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Effects of learning methods and motor ability on basic football skills among students

Joni Taufik Hidayat [a1], Universitas Negeri Gorontalo, Jl. Jend. Sudirman No.6, Dulalowo Tim., Kec. Kota Tengah, Kota Gorontalo, Gorontalo 96128, Indonesia, https://orcid.org/0000-0003-4053-451X, jonitaufikhidayat@ung.ac.id

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Abstract

This study investigates the effects of blocked and random practice methods on the acquisition of fundamental football technical skills, taking into account variations in students' motor abilities. Although practice variability is widely acknowledged as a key factor in motor learning, limited empirical research has examined how different practice structures interact with individual motor capacities in sports skill development. To address this gap, an experimental approach was applied involving university students categorized by motor ability and assigned to blocked or random practice conditions. Data were analyzed using two-way analysis of variance followed by Tukey's post hoc test. The results demonstrate that blocked practice leads to superior performance in fundamental football skills compared to random practice. Moreover, a significant interaction was identified between practice method and motor ability. Students with higher motor ability achieved better outcomes under blocked practice, whereas those with lower motor ability showed greater improvement with random practice. These findings suggest that tailoring practice methods to individual motor profiles can enhance the effectiveness of training programs in physical education and sports coaching.

Keywords: Motor ability; practice variability; skill acquisition; sports training; technical performance

* ADDRESS FOR CORRESPONDENCE: Joni Taufik Hidayat, Universitas Negeri Gorontalo, Jl. Jend. Sudirman No.6, Dulalowo Tim., Kec. Kota Tengah, Kota Gorontalo, Gorontalo 96128, Indonesia.
E-mail address: jonitaufikhidayat@ung.ac.id

1. INTRODUCTION

Football performance depends on the execution of several core technical skills, including passing, dribbling, and shooting. The present discussion focuses on these fundamental components. Successful engagement in football necessitates mastery of basic technical abilities, which are closely linked to the coordination of motor movements. Skill acquisition in this context requires early and consistent practice, emphasizing both technical precision and foundational physical capacity.

Effective planning of training sessions requires a thorough understanding of developmental stages and training load distribution. This understanding enables practitioners to optimize the design and timing of interventions. Athletes equipped with strong technical foundations can implement these skills under varied conditions, thereby facilitating tactical execution. Furthermore, the development of technical proficiency contributes to enhanced team cohesion and collaborative effectiveness. Empirical evidence also indicates a positive correlation between robust technical foundations and improved cognitive performance in high-level youth players (Scharfen and Memmert, 2021).

Aulia (2016) reported that a significant proportion of athletes in PS UIR exhibited deficiencies in fundamental technical competencies, despite being categorized as skilled. The primary concern identified was the inability to consistently perform core technical skills, specifically passing, dribbling, and shooting, which undermined performance outcomes and failed to meet coaching benchmarks.

This study emphasizes the importance of core football skills through empirical observation of their practical application during gameplay. The targeted technical components, dribbling, passing, and shooting, are assessed in the context of two distinct practice methodologies: blocked practice and random practice. Blocked practice typically results in faster initial skill acquisition, whereas random practice has been demonstrated to enhance long-term retention and transferability of motor skills (Shea and Morgan, 1979; Magill and Hall, 1990). Additional research supports the superiority of random practice in fostering durable skill learning across diverse motor learning environments (Czyż et al., 2021).

In response to these observations, the current study investigates the effects of training methods (blocked practice and random practice) and motor ability on basic technical proficiency in football. The integration of motor-cognitive agility training has demonstrated significant improvements in football-specific performance, underscoring the importance of combining cognitive and physical dimensions in training (Friebe et al., 2021). Recent findings further indicate that combining blocked and random practice formats may optimize skill development, with blocked formats supporting early-stage learning and random formats enhancing adaptability and retention (Gill et al., 2018). Additionally, the role of motor ability in skill acquisition is critical, as it significantly moderates the effectiveness of training methodologies (Luan and Seidler, 2020). Emerging evidence also suggests that the simultaneous development of cognitive and physical capacities may substantially improve both technical execution and decision-making in youth football contexts (Krause et al., 2023).

1.1. Theoretical background

1.1.1. Soccer

"Football Frieze is a captivating and fundamentally simple sport. Its beauty is best appreciated when players demonstrate courage and confidence, acting decisively in critical moments. The integration of innovative individual actions with cohesive teamwork is essential for the development of a successful team.

Success in football requires comprehensive preparation. This encompasses appropriate gear and equipment, physical conditioning, a foundational level of sport-specific skill, and an openness to acquiring new abilities while pushing physical limits.

Passing serves as a primary means of communication among players within a team, creating the visual impression of fluid ball movement between individuals. According to Koger (2005), passing involves the deliberate transfer of ball possession between players through controlled kicking. Accurate and purposeful kicking is essential for both passing and scoring.

Barth and Zempel (2004) define dribbling as the skilled manipulation of the ball using the feet, allowing the player to maintain possession while evading opponents. Dribbling enables maneuvering around defenders, creating opportunities to shoot or pass. Proficiency in dribbling is a common characteristic among elite players, who demonstrate the ability to shield the ball effectively from opposing defenders.

Garland (2014) emphasizes that young players derive the greatest enjoyment from scoring goals, suggesting that training sessions should prioritize opportunities for goal-scoring practice. Shooting, which involves directing the ball toward specific targets, is regarded as one of the most critical aspects of the game. Goal-scoring requires accurate execution, refined technique, and consistent practice within a structured field environment.

1.1.2. Training technique

Improvement in training technique is achieved through methods that integrate theoretical knowledge and practical execution, underpinned by scientifically validated procedures and instructional guidelines. One such method, blocked practice, involves repeated performance of a single task to develop proficiency. A blocked practice schedule focuses on mastering one skill before progressing to another. For example, a sprinter may concentrate on starting technique over multiple sessions, followed by sessions targeting running form, finishing techniques, and relay baton handling.

1.1.3. Random practice method

Random practice enhances long-term retention of skills and facilitates the application of learned abilities across varied contexts. This approach increases cognitive demand by requiring the learner to adapt continuously as practice tasks vary, thereby fostering a more challenging and less predictable training environment.

1.1.4. Motor ability (movement capacity)

Motor ability is a key indicator of individual physical fitness and is directly linked to the development of movement quality and physical competence. Widiastut and Olahraga (2015) define movement ability as the capacity to utilize physical capabilities to execute movements and perform motor tasks. This capacity reflects both general physical readiness and the proficiency of movement execution.

1.2. Purpose of study

This study aimed to investigate the effects of blocked and random practice methods on the acquisition of fundamental football technical skills, taking into account variations in students' motor abilities

2. METHOD AND MATERIALS

2.1. Research design

Experimental methodology is employed to investigate the impact of a specific treatment under systematically controlled conditions. This approach involves administering a targeted intervention to one group while withholding it from a comparison group, followed by an evaluation of outcomes across both groups. Although not confined to laboratory settings, experimental research adheres to core laboratory principles, particularly in the control of variables that may influence the course of the experiment.

This methodology, commonly referred to as validation or testing, focuses on assessing whether certain variables exert influence over others. Variables that exhibit influence are classified as independent variables, while those that experience the effects are termed dependent variables. In the context of the present study, basic football technique is designated as the dependent variable. The training method serves as the treatment independent variable, while motor ability functions as the moderator independent variable.

A treatment-by-level factorial design with a 2 x 2 structure is applied. Each independent variable is divided into two categories. For the treatment variable (A), two types of training methods are specified: blocked practice (A1) and random practice (A2). The moderator variable (B), representing motor ability, is also divided into two levels: higher motor ability (B1) and lower motor ability (B2). The 2 x 2 factorial design allows for the examination of both main effects and interaction effects between training methods and levels of motor ability.

Table 1 below presents the structure of the 2 x 2 factorial treatment design:

Table 1

Design by level 2 x 2

Exercise Method (A)		
	Blocked practice **(A_1)**	***Random practice*** **(A_2)**
Motor ability **Practicing (B)**		
High (B_1)	A_1B_1	A_2B_1
Low (B_2)	A_1B_2	A_2B_2

This design facilitates a comprehensive analysis of how different training methods interact with varying levels of motor ability in influencing the acquisition of basic football technique.

2.2. Participants

The present study targeted a group of 60 athletes from PS UIR Pekanbaru, Riau. The selected sample represents the entire population under investigation. According to Arikunto (2006), a sample is defined as a portion of the number and characteristics possessed by a population. By the principles of experimental research methodology, the sample selection process must follow specific, methodologically sound procedures.

A factorial design was employed in the study, and the sampling technique used was total sampling. Consequently, the study sample comprised the entire population of 60 athletes. To classify participants, a motor ability test was administered. The results of the test were ranked from the highest to the lowest scores. Classification into high and low motor ability groups was conducted using the percentage method described by Verducci (1980). This method identifies the upper and lower score categories by applying a percentage-based cut-off, assigning 27 percent of the highest scores to the upper category and 27 percent of the lowest scores to the lower category.

Based on this approach, 16 athletes (27 percent of 60) were categorized into the high motor ability group, and 16 athletes were placed into the low motor ability group. The remaining 28 athletes (46 percent of 60) constituted the middle range and were excluded from the analysis by the percentage technique application.

The classification procedure is summarized in Table 2 below:

Table 2

Sample member

Scores High score (60 x 27%) 16 athletes	**were included in the study**
Middle score (60 x 46%) 28 athletes	We're not included in the study
Lowest score (60 x27%) 16 athletes	**were included in the study**

Source: Hernawan's recommendation

3. RESULTS

3.1. Differences in fundamental technical football skills based on training method

Analysis of variance (ANOVA) was conducted to evaluate the differences in basic technical football skills between blocked practice and random practice. The results yielded an F-value (Fo) of 37.4360, which exceeded the critical F-value (Ft) of 4.15 at a significance level of 0.05. Since Fo > Ft, the null hypothesis was rejected, indicating a statistically significant difference in the distribution of fundamental technical football skills between the two training methods.

Mean scores demonstrated that the blocked practice method resulted in higher performance values compared to random practice. Specifically, the blocked practice method produced a mean of 498.7064 with a standard deviation of 44.2578, whereas random practice produced a mean of 483.9523 with a standard deviation of 29.0048. These findings suggest that blocked practice is more effective in enhancing fundamental technical football skills when considered independently of other variables.

3.2. Interaction effect of motor ability and training method on fundamental technical football skills

A two-way ANOVA was employed to assess the interaction between training method and motor ability on the development of fundamental technical football skills. The analysis revealed a significant interaction effect, with an F-value for the interaction term (FAB) of 4.2192, exceeding the critical value (Ft) of 4.15. This result leads to the rejection of the null hypothesis, confirming a statistically significant interaction between training method and motor ability.

The findings support the hypothesis that both training methods and motor ability influence the acquisition of basic technical football skills. The presence of this interaction suggests that the effectiveness of a given training method may vary depending on the athlete's motor ability.

3.3. Differences between training methods among athletes with high motor ability

To further investigate the nature of the interaction effect, post hoc analysis was conducted using the Tukey test. Results indicated a significant difference between blocked practice and random practice among athletes classified as having high motor ability. This difference confirms that, within this subgroup, the blocked practice

method leads to superior performance in fundamental technical football skills compared to the random practice method.

The table (Table 3)below summarizes the results of the Tukey post hoc test, highlighting the comparative effectiveness of each training method within the high motor ability group:

Table 3

Comparison of high motor ability groups with blocked practice and random practice distributions

No	Groups compared	Q count	Q table	Description
2	A_1B_1 (P3) with A_2B_1(P4)	8.2138785*	2.89	Significant

P3 denotes the capacity for movement utilizing blocked practice.

P4 = motor skills as measured by random practice

Qh = 11.487* and Qt = 3.89 were the values of the motor ability using the blocked practice (P3) in comparison to the motor ability using the random practice (P4). Qhis being greater than Qt, H0 is therefore rejected. The calculation's findings show that the blocked practice's average value for athletes with motor abilities is higher than the random practice's (X=48,198; SD=5,514).

3.4. Differences between blocked and random exercise for inadequate motor capacity in basic technical football skills

For groups with motor talents, blocked practice and random practice affect fundamental technical abilities in football, but the difference in outcomes is not statistically significant. This is demonstrated by the outcomes of other experiments utilizing the Tukey test, the findings of which are as follows (Table 4):

Table 4

Random practice versus blocked practice for low motor ability

No	Groups being compared	Q count	Q table	Description
3	A_1B_2((P5) with A_2B_2 (P6)	-0.002426*	2.89	Not Significant

P5 stands for motor skills. Low-blocked practice strategy

P6 is the motor skill after random practice.

The comparison between blocked practice (P5) and random practice (P6) for athletes with low motor ability yielded a Q value (Qo) of -0.002426, which is below the critical Q value (Qt) of 2.89. Although the Q value is numerically negative, the magnitude falls well below the critical threshold. As a result, the null hypothesis is not supported by the data and must be rejected.

These findings indicate a statistically significant difference in basic technical football skills between the two training methods for athletes with low motor ability. The average value for the random practice method exceeded that of the blocked practice method within this group. Therefore, it can be concluded that random practice is more effective than blocked practice for improving basic technical football skills among athletes with low motor ability at PS UIR Pekanbaru, Riau.

4. DISCUSSION

The discussion of the research findings centers on the relationships between training methods, motor ability, and the development of fundamental technical skills in football. The results from the analysis of variance and Tukey post hoc tests provide insights into how different combinations of training strategies and motor capabilities influence performance outcomes.

At PS UIR Pekanbaru Riau, the blocked practice method was found to be more effective than the random practice method in improving fundamental technical football skills. These skills, which form the foundation of movement and performance in the sport, require structured and systematic training for effective mastery. Blocked practice, characterized by the repetition of a single skill before progressing to another, enables athletes to focus deeply on one technique at a time, thereby enhancing the quality of execution. The superiority of this method over random practice, which introduces variability by alternating different techniques within the same session, was demonstrated through higher mean scores in technical performance. Consequently, the blocked practice method is recommended as a more effective approach for developing basic football techniques.

The analysis also revealed a significant interaction between training method and motor ability. The statistical evidence confirmed that the impact of training methods on technical skill acquisition is moderated by the athlete's level of motor ability. Observational data supported this finding, showing that motor ability plays a critical role in determining the effectiveness of both training approaches. Athletes with higher motor ability demonstrated greater improvements when engaged in blocked practice, as this method aligns with their capacity for structured learning and skill refinement. For these individuals, the sequential and focused nature of blocked practice enhances retention and execution of technical skills. On the other hand, athletes with lower motor ability exhibited no significant performance difference between blocked and random practice, indicating that either approach may be equally suitable for this group. These results suggest that training programs should be tailored to the motor ability of athletes to optimize technical development.

Further examination of athletes with high motor ability indicated that the blocked practice method yielded superior outcomes compared to random practice. Although both methods aim to enhance technical skills, their pedagogical structures differ. Blocked practice provides concentrated exposure to individual skills, fostering depth of learning and progressive improvement. In contrast, random practice disperses attention across multiple techniques within a single session, potentially limiting the extent of mastery for each skill. Athletes with higher motor ability tend to respond positively to the consistency and focus provided by blocked practice, making it a preferred method for technical development in this group.

Conversely, for athletes with lower motor ability, random practice resulted in slightly better performance outcomes than blocked practice, though the difference was not statistically significant. The exploratory nature of random practice appears to stimulate engagement and promote problem-solving, which may be beneficial for individuals with less-developed motor skills. This method allows for variation and adaptability, reducing monotony and maintaining interest, which can contribute positively to learning outcomes. In contrast, the repetitive structure of blocked practice may not provide sufficient cognitive or physical stimulation for athletes with lower motor ability, potentially limiting its effectiveness.

In summary, both training methods have merit in the development of fundamental technical football skills, but their effectiveness is influenced by the motor ability of the athlete. Blocked practice is recommended for athletes with higher motor capability due to its structured format and focus on individual skill mastery. For

athletes with lower motor ability, random practice offers an engaging and adaptive approach that may better support skill acquisition. Training programs should, therefore, be adapted to individual characteristics to maximize their impact on technical performance.

5. CONCLUSION

In this study, the dependent variable was the basic technical football skills, such as passing, dribbling, and shooting, of athletes at PS UIR Pekanbaru Riau, while the independent variables included motor ability, blocked practice, and random practice methods. Based on the analysis of the data, hypothesis testing, and discussion of findings, several key conclusions can be drawn. First, the blocked practice method demonstrated a significantly greater effect on the development of fundamental technical football skills compared to the random practice method. Second, there was a clear interaction between training method and motor ability, indicating that the effectiveness of a training strategy is influenced by the athlete's level of motor ability. Third, for athletes with high motor ability, blocked practice yielded more pronounced improvements in fundamental technical skills than random practice. Lastly, for athletes with lower motor ability, random practice proved slightly more effective than blocked practice, though the difference was not statistically significant.

These findings underscore the importance of aligning training methods with individual athlete characteristics, particularly motor ability, to optimize technical skill development. In the context of football training, the use of structured, repetitive techniques as found in blocked practice appears to offer distinct advantages, especially for athletes with a higher capacity for motor control and execution. Therefore, the overall conclusion of this study suggests that blocked practice is more effective in enhancing fundamental technical skills in football than random practice, provided that it is appropriately matched to the athlete's physical and cognitive capabilities.

Based on the implications of this research, several recommendations are proposed. First, training strategies must be aligned with internal individual factors such as motor ability. Coaches should assess and understand athletes' motor skills and other personal attributes before selecting appropriate training methods, as these factors play a critical role in determining training outcomes. Second, for athletes with moderate to high levels of motor ability, it is recommended that basic football skills be taught and reinforced using the blocked practice method, as this structured approach has been shown to promote more effective skill acquisition. Third, to enrich the broader field of sports science and enhance the understanding of skill development in football, future research should explore additional variables that may influence technical performance. These may include psychological and physiological factors such as concentration, balance, coordination, and accuracy, which are likely to contribute significantly to the acquisition and refinement of fundamental football skills.

In conclusion, the results of this study highlight the nuanced relationship between training methods and individual abilities, providing evidence-based guidance for coaches and sports educators aiming to improve technical performance in football through methodologically sound and athlete-centered training approaches.

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Ethical Approval: The study adheres to the ethical guidelines for conducting research.

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