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Development a Geometric Training Model in Basic Football Techniques

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Abstract

This study aims to produce a geometric-based training model for basic football techniques that is valid, practical, and effective for foster athletes. The research method used is Research and Development (R&D) by adopting the Borg and Gall model development procedures which include the stages of analysis, design, development, implementation, and evaluation. The research subjects involved 30 football athletes in the adolescent age category who were undergoing an intensive technical development program. Data collection instruments used feasibility assessment questionnaires for material experts and basic technique skill test instruments (passing, control, and dribbling) to measure achievements in athletes' motor performance before and after intervention. The data analysis technique applied combined qualitative descriptive analysis and quantitative analysis through t-test (paired sample t-test). Research findings from the sports academic material expert validity team showed a feasibility percentage of 88.50% and from the football coach practitioner expert of 91.20%, both of which fell into the very feasible criteria. The results of the effectiveness test through statistical difference tests showed a significant increase in average scores on passing skill tests from 64.50 to 82.20, control skills from 66.20 to 84.10, and dribbling skills from 61.80 to 80.50. The conclusion of this study is that the integration of geometric concepts designed through the brog and gall structure is proven to be highly valid and effective in optimizing the performance of basic football skills in young athletes.

***Keywords**: Training Model, Geometric, Basic Techniques, Football.*

INTRODUCTION

Modern football demands that players possess high technical skills simultaneously integrated with spatial intelligence to effectively exploit space on the field. The rapidly evolving dynamics of the contemporary game require motor skills that go beyond mere physical strength. Players are required to be able to read teammates' movements, predict open spaces, and calculate opponents' positions in a matter of seconds. The ideal condition for an athlete at the initial development level is mastery of basic techniques, grounded in an understanding of angles and distances, to ensure more precise ball movement and make it difficult for opponents to predict. Mature positional awareness fosters high movement efficiency, allowing every ball manipulation to make a tangible tactical contribution to the team's overall strategy. The theoretical foundations of modern coaching emphasize that technical maturity coupled with spatial intelligence are key pillars in developing competitive football performance.

Empirical evidence on the field often demonstrates a significant gap between this ideal condition and the reality of daily training. Basic technique training at most football schools and youth clubs is still conducted in a static, linear, and repetitive manner, without providing a clear visual representation of the field's geometric structure. Conventional training models tend to separate gross motor skill development from cognitive stimulation. This weakness often leads to players experiencing severe positional disorientation when faced with dynamic, real-world match situations, where mastery of basic techniques is not accompanied by efficient spatial movement. Young athletes are accustomed to passing or dribbling in pressure-free spaces, so their technical capacity immediately declines drastically when subjected to tight marking from the opposing team. This limited variety of monotonous training menus also triggers physical and mental boredom, which hinders the long-term optimization of the subjects' motor skills.

In response to these issues, several experts and recent research in the fields of coaching and sports psychology strongly emphasize that integrating cognitive-spatial aspects into motor training can accelerate players' decision-making processes on the field. According to Prasetyo et al. (2021), motor stimulation provided in conjunction with an understanding of spatial orientation has been shown to effectively sharpen the accuracy of ball-holding techniques (control) because athletes consciously organize their surrounding area before executing the movement. This opinion is reinforced by Arifin (2022), who stated that mastering precise passing angles is crucial for winning game transitions and breaking down tight defenses. This ability can only be developed through familiarization with structured imaginary passing paths from a young age. Through a planned scheme, training models that incorporate visualizations of geometric shapes such as triangles, diamonds, and other dynamic polygons are considered capable of simulating much more complex real-life match situations. The alignment of spatial elements and the mathematical shape of the field indirectly forces the central nervous system to organize movement patterns more systematically. In line with this premise, Susanto

(2023) emphasized that variations of dynamic circuit training models based on spatial structures are much more effective in modification dribbling agility and minimizing the level of physical saturation of athletes compared to traditional static linear repetition methods.

The innovation of this research lies in the development of a geometric training model specifically designed to hone the three main basic technical components: passing, control, and dribbling, through a comprehensive approach of mathematical visualization of the field. This innovative program integrates the placement of field markers (cones) combined with a variety of dynamic circulation routes to form a solid positional anchor for athletes. The benefits of this innovation provide coaches with a more scientific, structured, and applicable training framework to improve the playing intelligence (football sense) of young players in a more measurable way. This training curriculum is designed using the systemic stages of the brog and gall model to ensure the quality of the material is safe and relevant to the characteristics of adolescent motor development. This research aims to produce a geometric training model that is valid, practical, and effective to optimize the basic technical skills of soccer for athletes.

METHOD

This study employed Research and Development (R&D) to produce a product in the form of a basic soccer technique training model based on a geometric approach. The development procedure adopted the brog and gall model, which consists of 10 systematic stages: Research and Information Collecting, Develop Preliminary Form of Product, Preliminary Field Testing, Main Product Revision, Main Field Testing, Operational Product Revision, Operational Field Testing, Final Product Revision, Dissemination and Implementation.

The subjects in this study were adolescent soccer athletes undergoing an intensive technique training program, serving as the primary population and sample.

The first stage, Research and Information Gathering (Research and Information Gathering) The initial stage involves identifying the needs of athletes and coaches through literature reviews, observations, interviews, and needs analysis related to basic soccer technique training. Planning (Planning) Developing a geometric training model plan that includes training objectives, materials, geometric pattern shapes, and research instruments to be used. Initial Product Development (Developing the Initial Product Form) The initial product is a geometric training model containing a variety of basic soccer technique drills such as passing, dribbling, control, and shooting. Small Group Trial (Initial Field Trial) The product is tested on a small number of athletes to determine its feasibility and ease of use, and to obtain initial user feedback. Initial Product Revision (Main Product Revision) Making improvements to the training model based on the evaluation results and feedback from the small group trial. Large Group Trial (Main Field Trial) The revised model is tested on a larger group of athletes to determine its effectiveness in improving basic soccer technique skills. Operational Product Revision (Operational Product Revision) Refines the training model based on the results of large-group trials to better suit user needs. Operational Testing (Field Operational Testing) The model is applied in actual training situations to test its practicality and effectiveness for broader use. Final Product Revision (Final Product Revision) Makes final refinements to the training model based on all evaluation results obtained during the development process. Dissemination and Implementation (Dissemination and Implementation) The final product is disseminated through scientific publications, seminars, coach training, and implementation at soccer schools or relevant sports institutions.

Researchers measured the product's functionality by comparing pre- and post-intervention skill data and conducting a final reflection on the success of integrating cognitive-spatial aspects into the motor training. Data collection in this study utilized non-test instruments in the form of evaluation sheets or feasibility assessment questionnaires for subject matter experts and coaches.

The developed geometry training model was then validated by three experts: a soccer subject matter expert, a sports coaching expert, and a media/learning design expert. Validation was conducted to assess the suitability of the material, clarity of the training steps, training safety, effectiveness of the use of geometric patterns, and the appearance and systematics of the guidebook. The validation results showed that the geometry training model achieved an average score of 89.3%, which falls into the "Very Valid" category and is suitable for field testing with some minor revisions, The results of expert validation can be seen in table 1.1

Table 1. Expert Validation Results

No	Rated aspect	Percentage (%)	Category
1	Suitability of Basic Football Technique Material	92 %	Very Valid
2	Suitability of Geometric Exercise Model	90 %	Very Valid
3	Clarity of Implementation Instructions	88 %	Very Valid
4	Safety and Feasibility of Exercise	91 %	Very Valid
5	Appearance and Systematics of the Guide	86 %	Very Valid

The test instrument, a series of basic soccer technique skills tests, was used to measure athletes' motor performance before and after the intervention. The field experiment was supported by the use of tools with measurable standard specifications to maintain the precision of the geometric patterns. The main equipment included 30 cm high, contrasting-colored cones as corner markers for the field, a size 5 soccer ball with standard air pressure, a digital stopwatch, and a tape measure to ensure the accuracy of the distance of each movement unit. The data analysis technique used combined qualitative descriptive analysis to summarize suggestions for improvement from expert validators and quantitative analysis. Quantitative statistical analysis using a t-test (difference test) was applied to analyze the skills test data to demonstrate significant improvements in the basic soccer technique abilities of the research subjects.

RESULTS AND DISCUSSION

The results of this research on the development of a geometric training model for basic soccer techniques are presented in quantitative and qualitative descriptive forms. The process of collecting data on product effectiveness was conducted

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through a basic soccer technique skills test on 30 athletes trained before (pre-test) and after (post-test) being given an brog and gall curriculum-based training model intervention. This testing step was taken to ensure that the developed training program updates had a strong empirical basis and could be scientifically justified. The results of the recapitulation of assessment data from the expert validity testing team and a detailed comparison of the average scores of the athletes' motor skills are shown in Figure 1 and Figure 2 attachment.

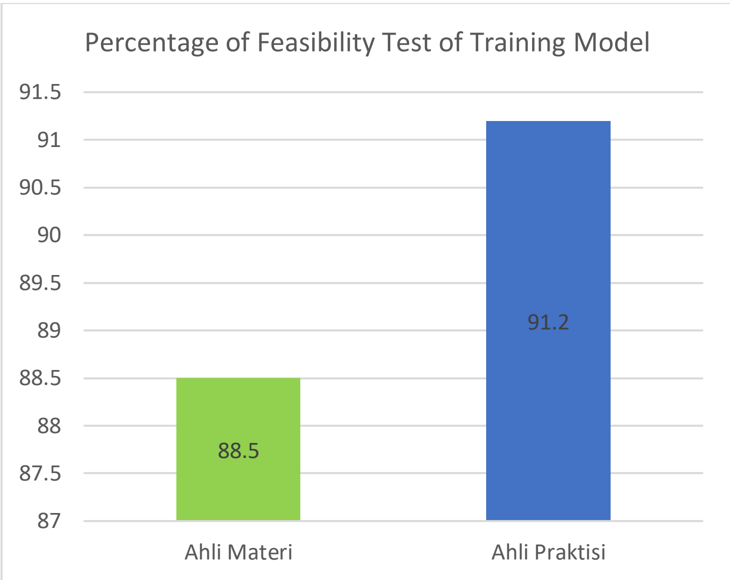

Figure 1. Expert Validation

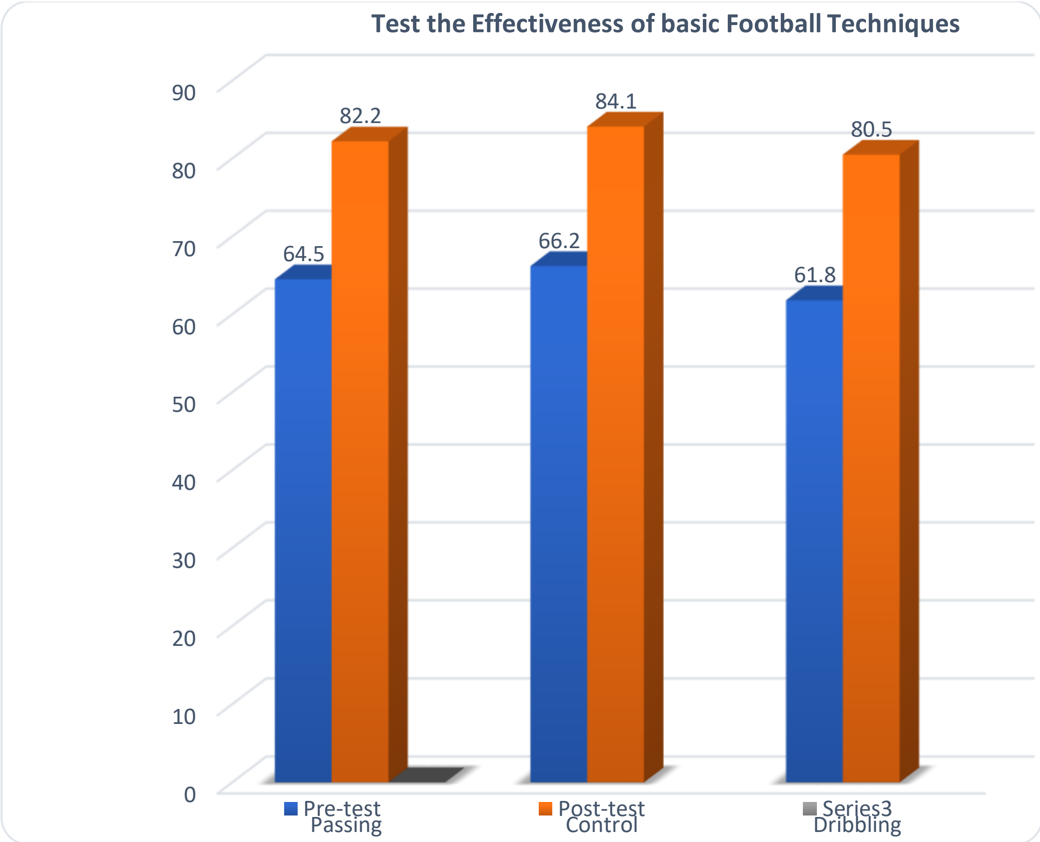

Figure 2. Summary of Expert Eligibility Scores and Athlete Basic Technical Ability Scores

Quantitative data analysis to test the significance of improvements in athletes' basic technical performance was conducted using a paired sample t-test. The formula for calculating the comparative value of the pre-action and post-action drafts is described in Equation 1.

$$t = \frac{\Sigma D}{\sqrt{\frac{N \cdot \Sigma D^2 - (\Sigma D)^2}{N-1}}}$$

Where t is the calculated t-value coefficient of the statistical comparison of athlete performance, and α is the total accumulated difference in scores between the pre-test and post-test, is the sum of the squares of the differences in movement scores, and is the total number of athlete samples participating in this development research.

A discussion of the data presented in Table 1 shows that the application of the geometric training model significantly improved athletes' passing, control, and dribbling abilities. The most striking increase in scores occurred in ball control ability, from an initial average of 66.20 to 84.10 after the intervention. This demonstrates that training forms that adopt geometric triangle and diamond patterns force athletes to actively position themselves facing the incoming ball with precise holding angles. This structured spatial movement pattern directly stimulates athletes' positional awareness, making it difficult for opponents to easily dispossess the ball. The spatial understanding gained by athletes during training fosters sharp visual perception in calculating the speed of the ball entering their control space.

This improvement in ball control skills confirms the importance of establishing a link between motor actions and the athlete's positional field orientation. Conventional soccer training often neglects the habituation of the ball's angle of arrival, making it difficult for athletes to stop the ball under the pressure of a real game. Layout of the movement area based on mathematical spatial figures helps athletes establish a solid positional anchor before receiving a pass. This empirical finding is reinforced by a recent study, which found that the efficiency of ball-holding techniques is closely correlated with an athlete's cognitive ability to organize the surrounding space (Prasetyo et al., 2021). The successful transfer of motor skills from training sessions to actual match situations is determined by how well this spatial habituation system is instilled early on.

The increase in passing ability, from 64.50 to 82.40, confirms that mathematical visualization of the field using geometric cone markings can sharpen the accuracy of players' through passes. Athletes no longer simply pass the ball randomly, but rather calculate the ideal release angle and distance to ensure the ball rolls precisely to their teammates' targets. This finding indicates that the integration of cognitive elements regarding spatial understanding with foot manipulative skills is crucial to the success of ball distribution in contemporary soccer tactics. Aligning spatial aspects of motor stimuli has been shown to significantly accelerate the formation of motor muscle memory and improve tactical decision-making accuracy on the field. The constant movement of the ball within geometric shapes trains the athlete's sense of touch, allowing for precise weighting of passes within the target's distance.

Accurate through passes are a key pillar in building an effective attack in modern football. A major obstacle often encountered by development-age athletes is low passing accuracy due to a failure to read the space in the opponent's defense. The geometric training model mitigates this weakness by providing structured imaginary passing paths through the placement of field markers. Athletes become accustomed to seeing ball circulation options that form an ideal network of passing angles. The results of this analysis align with scientific publications over the past ten years, which confirm that mastering precise passing angles is crucial for winning transitions and breaking down tight defenses (Arifin, 2022).

Dribbling skills also showed positive growth, rising from an average score of 61.80 to 80.50 after completing the brog and gall training program. The dynamic geometric trajectory pattern requires athletes to dribble the ball in a meandering manner with high control in tight areas. The characteristics of these movement units present unique challenges to athletes' agility compared to conventional training models, which tend to be monotonous and unidirectional. The dynamic circulation route variation conditioning in this new model has proven effective in revolutionizing the subjects' motor performance while minimizing physical fatigue during the training program. Sudden changes in dribbling direction based on geometric angles simultaneously train the athlete's ankle flexibility and body balance.

Effective dribbling requires good synchronization between running speed and control of the ball's proximity to the feet. Athletes who rely solely on physical aspects without spatial intelligence will easily lose momentum when blocked by defenders. The geometric model trains athletes to always keep the ball within a safe radius from the opponent's reach while also looking for gaps for penetration. Exploring varied trajectories stimulates the athlete's movement creativity, making it unpredictable for the opposing defense. This phenomenon is supported by contemporary sports studies, which prove that variations in dynamic circuit training models based on spatial shapes are far more effective in improving dribbling agility than static linear repetition methods (Susanto, 2023).

The functionality of the draft guidebook product designed using the brogg and gall structure is strengthened by the high level of practicality and feasibility values from validators, material experts and practitioners. Quantitative statistical proof through the calculation results of Equation 1 produced a significant t-test coefficient below the five percent error threshold, meaning the intervention has real implications for players' technical capacity. The integration of the geometric shape of the field and mastery of basic soccer techniques creates a positive synergy in the form of a more measurable increase in playing intelligence (football sense) of young athletes. The theoretical basis of modern coaching also emphasizes that training program innovation must be directed at meeting the needs of simulating complex real-life match situations so that movement learning outcomes can be optimally transferred into real-life playing competencies. The arrangement of the five systemic stages of brog and gall ensures that any product deficiencies in the draft phase are revised based on empirical input in the field so that the resulting output is safe and applicable for long-term coaching.

CONCLUSION

This development research successfully produced an innovative product in the form of a basic soccer technique training model based on a geometric approach constructed through teen systematic stages of the brog and gall model. The assessment by the validator team confirmed that the developed training model guidebook was highly feasible, both from a theoretical and academic perspective and from a practical operational coaching perspective on the field. This feasibility is based on the accurate visualization of the field space using measurable geometric patterns, which can reduce the weaknesses of conventional training programs that tend to be monotonous. The structured arrangement of movement units ensures safety and ease of implementation for coaches in the development age group of athletes.

This geometric training model has been proven to significantly improve athletes' basic technical performance, including passing, control, and dribbling. The significant increase in motor scores between the pre- and post-training phases confirms that the integration of spatial cognitive elements, such as spatial understanding, effectively accelerates the formation of athletes' muscle memory structures. The new idea underlying the research findings emphasizes that passing accuracy and ball retention efficiency are not solely determined by physical capacity but are highly dependent on a player's sensitivity to field orientation. The implementation of this dynamic mathematical geometry-based training curriculum is worthy of recommendation as a new reference standard in the modern football development system, aimed at producing tactically intelligent and technically mature athletes.

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