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Triangle Training and Diamond Exercise on Passing Skills in Futsal Extra-Curricular Students at High School

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ABSTRACT

Passing accuracy is a crucial element in futsal, yet extracurricular students often fail to reach optimal skill levels due to limited variations in training methods. This study aims to evaluate: (1) the effect of triangle training on passing skills; (2) the effect of diamond training on passing skills; and (3) the difference in effectiveness between triangle and diamond training among futsal extracurricular students at High School 1, Toraja Utara. Methods: This quasi-experimental study employed a two-group pretest-posttest design. A total of 40 students were selected through total sampling and divided into two groups using the ordinal pairing technique. Data were collected via pretest, treatment, and posttest using a futsal passing skills test and analyzed using an independent sample t-test at a 0.05 significance level. The analysis revealed that both methods significantly improved technical skills ($p = 0.001 < 0.05$). However, the triangle training group recorded a more substantial average increase, from 4.50 to 9.30, compared to the diamond training group, which increased from 4.45 to 6.80. Triangle training is significantly more effective than diamond training in improving passing skills. This superiority is attributed to the dynamic and adaptive variations in angles, distances, and ball trajectories inherent in the triangle pattern, which more effectively hone students' accuracy and ball control. These findings provide a practical contribution for coaches in implementing more efficient training models for beginner futsal players.

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1. INTRODUCTION

Futsal is a large ball sport that is very popular among various groups, including high school students (Hudain et al., 2025; Usman et al., 2025). Terminologically, futsal is a ball game played by two teams, each consisting of five main players (Mappaompo et al., 2025). The main goal of the game is to score goals by kicking the ball into the other team's goal. Although often considered a miniature version of conventional football due to the similarity in their primary objective, to score more goals to achieve victory, futsal has unique characteristics that differentiate it tactically and technically (Ismail & Nunome, 2020; Villarejo-García et al., 2025).

Futsal is different from other sports because the field is much smaller and the game moves quickly. Such gameplay requires players to have a deep understanding of the basic elements (Agras et al., 2016; Spyrou et al., 2020). According to Suci et al. (2026), the basic elements of futsal are not significantly different from those of large-pitch soccer, but the limited space on a futsal field demands greater accuracy and speed in decision-making. Without a solid mastery of basic techniques, a player will struggle to contribute optimally to the team's game plan. In the dynamics of futsal, passing skills play a vital role as the backbone of team strategy (Da'is, 2025). Passing is not simply moving the ball from one player to another but rather a crucial instrument for collectively achieving the game's goals. A team's success depends heavily on the effectiveness of training that supports its players' performance (Setiawan et al., 2021).

Technically, the most dominant passing technique in futsal is the inside-foot pass. This technique is chosen because it provides stability and makes it easier for players to accurately direct the ball to teammates when in possession (Sudirman & Jaya, 2020). Given the small size of the pitch, accuracy is paramount; the ball must be precisely directed at a teammate's feet. A small error in the direction or power of a pass can easily result in the ball being intercepted by the opponent, which can then pose a potentially deadly counterattack.

Although the importance of basic techniques is widely recognized, the reality on the ground often shows a different outcome. One of the main factors hindering the emergence of talented futsal players is a lack of knowledge and poor mastery of the necessary basic techniques (Mendes et al., 2022; Oppici et al., 2019). This condition is clear in the performance of students participating in extracurricular futsal activities at High School 1 Toraja Utara. Based on initial observations, researchers found that most students still struggled to execute effective passes. These challenges included low accuracy, poor ball control when receiving passes, and an inability to maintain game rhythm under pressure from opponents. If we don't promptly address these challenges through appropriate training methods, students' competitive potential in inter-student tournaments will suffer. Therefore, a systematic training approach is necessary to transform their technical abilities.

Training is the primary foundation for improving an athlete's performance (Foster et al., 2017). According to Macedo et al. (2024), training is defined as a sporting activity carried out systematically and repeatedly over a long period of time and accompanied by a continuous increase in training load according to individual capacity. The primary focus of this process is to harmoniously shape and develop the athlete's physiological and psychological functions. Furthermore, Imbach et al. (2022) emphasizes that training is a conscious process to improve or mature an athlete's abilities to achieve maximum performance. This process involves regular, targeted, and repetitive physical and mental stress. The principle of repetition helps the athlete's body and mind adapt so they can do technical moves like passing automatically and correctly, even when the match is stressful.

The most appropriate scientific method for evaluating the efficacy of a training technique on skill enhancement is quantitative research. According to Almusaed et al.

(2025), experimental research is a branch of quantitative methods specifically designed to test the effectiveness of experimental variables. Although this method is more commonly used in the exact sciences, its application in sports science is crucial for empirically proving whether a training programme has a significant impact. Within the experimental realm, there is a distinction between pseudo-experimental and real-world experiments, both of which aim to draw valid conclusions regarding cause-and-effect relationships between variables.

In this study, researchers offer two specific training models deemed relevant for improving passing skills in real-world match situations: Triangle Training and Diamond Exercise. The Triangle Training model employs a triangular geometric configuration with varying angles (Setiawan, 2025), which, according to Hakim et al. (2022), encompasses a variety of trajectories, from diagonal passes to short passes with dynamic angles at an ideal distance of 5-10 metres to minimize the risk of the ball being stolen by the opponent. The advantage of this model lies not only in improving passing accuracy but also in strengthening players' ball control abilities when moving in confined spaces (Afrianto et al., 2024). Meanwhile, the second model is Diamond Exercise or Diamond Passing, where players position themselves in a diamond-shaped pattern to speed up ball circulation and train players to avoid losing the ball easily to opponents (Kegelaers & Oudejans, 2024). This diamond pattern provides more varied passing options (to the right, left, and forward), thus more accurately representing real-world situations on the futsal field.

The uniqueness of this study lies in the comparison and integration of Triangle Training and Diamond Exercise, specifically applied to a population of high school students. While many previous studies have focused solely on general passing techniques or a single type of exercise, this study explores how two different geometric patterns—triangles for angular accuracy and diamonds for rapid circulation—can be combined to address specific issues at High School 1 Toraja Utara. Through a literature review and in-depth observations, this study aims to develop a methodological guide for coaches and sports teachers in developing student talent. It is hoped that the use of this experimental method can provide concrete evidence that interventions through triangle and diamond exercises are effective solutions in improving students' passing quality, which ultimately will increase the competitiveness of extracurricular futsal teams at a higher level.

2. METHOD

This study used a quantitative approach with a quasi-experimental design. The design employed was a Two-Group Pretest-Posttest Design, in which two experimental groups were both given a pretest before treatment and a posttest after completing a series of training programs. This design aims to compare the effectiveness of two independent variables on a single dependent variable. The population in this study included all students who participated in futsal extracurricular activities at High School 1 Toraja Utara, with a sampling technique using total sampling so that all 40 students were

involved as research subjects. To maintain objectivity and ensure balance of initial abilities between groups, the sample was divided into two groups of 20 students each using the Ordinal Pairing technique. This procedure was carried out by detailing the students' pre-test scores from highest to lowest, then distributing them systematically into Group 1 which received the Triangle Training treatment and Group 2 which received the Diamond Exercise treatment.

The data collection procedure in this study was carried out using a Futsal Passing Skills Test instrument specifically designed to measure students' accuracy and ball control within a predetermined duration or target. The data collection stages included three main phases, beginning with a pre-test to map the initial abilities of respondents in both groups before being given the intervention. Next, the treatment phase was carried out through a routine training program with a standardized frequency and duration, where the first group implemented a triangle formation (triangle training) and the second group implemented a diamond formation (diamond exercise). This series of procedures concluded with a post-test that served as a final measuring tool to evaluate the significance of improvements in students' passing skills after receiving treatment in each group.

The intervention or treatment in this study applied two geometric-based training models specifically designed to improve students' technical competence: Triangle Training and Diamond Exercise. The Triangle Training model focused on developing angular accuracy through short and diagonal passing trajectories in a triangle formation with a distance of 5 to 10 meters, while the Diamond Exercise emphasized fast ball circulation in a diamond formation to hone passing speed and positioning accuracy.

The collected data were systematically processed using descriptive and inferential statistics, where before hypothesis testing was carried out, the data first went through prerequisite tests in the form of normality tests and homogeneity tests. Hypothesis testing was carried out using a t-test at a significance level of alpha = 0.05, which included a Paired Sample T-test to evaluate the significance of increased ability in each group through a comparison of pre-test and post-test scores. In addition, an Independent Sample T-test was also used to determine statistically significant differences in effectiveness between the final results (post-test) of the Triangle Training group and the Diamond Exercise group, as the Passing Test instrument model used in this study is presented in Figure 1.

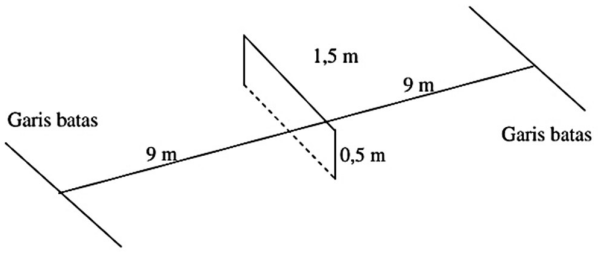

Figure 1. Passing Test

3. RESULTS AND DISCUSSION

Results

The descriptive data analysis in this study provides a comprehensive overview of the distribution of passing skill scores in the triangle training and diamond training groups. In the initial phase (pretest), both groups demonstrated relatively equal levels of ability. The triangle group recorded the highest score of 7 and a lowest of 2, with an average of 4.50, while the diamond group achieved the highest score of 7 and a lowest of 1, with an average of 4.45. The median and mode scores for both groups also showed significant similarities, at 4.50 and 4, respectively, indicating that participants' starting points for passing accuracy were in a similar category before the treatment.

After implementing the training program, posttest results showed improved performance in both methods, albeit with quite stark differences in effectiveness. The triangle training group experienced significant improvement, with a highest score reaching 10 and a mean jumping to 8.75, with a dominant mode score of 9. Conversely, the diamond training group showed more moderate improvement, with the highest score of 8 and a final mean of 6.55. Overall, these data show that the triangle training method makes a greater contribution to improving passing accuracy compared to the rhombus training method, as detailed in the data presented in Table 1.

Table 1. Descriptive Data of Passing Skills (Triangle vs Diamond Training)

Training Group	Test Types	Highest Score	Lowest Score	Mean	Median	Modus
Triangle Training	Pretest	7	2	4.5	4.5	4
	Posttest	10	7	8.75	9	9
Diamond Training	Pretest	7	1	4.45	4.5	4
	Posttest	8	3	6.55	7	7

A normality test was conducted as a primary requirement to determine data distribution, with a significance level (sig) of >0.05. The analysis showed that the data in the triangle and diamond training groups were normally distributed, thus meeting the assumptions for parametric statistical testing. Based on the results of the Paired Sample T-Test in the first pair (the triangle training group), a 2-tailed Sig. value of 0.001 was obtained, which is less than the 0.05 significance level. This result indicates a real and significant difference in the average passing skills of futsal extracurricular students at High School 1 Toraja Utara before and after the triangle training treatment.

A similar condition was found in the second pair (the diamond training group), where the pre-test and post-test data analysis yielded a 2-tailed Sig. value of 0.001 <0.05. This demonstrates a significant difference in students' passing accuracy after participating in the diamond training program. Collectively, the results of this study conclude that both triangle training and diamond training interventions have a significant positive impact on improving students' technical skills. Thus, the null hypothesis (H_0) is rejected, and the working hypothesis (H_a) is accepted, as detailed in the data presented in Table 2.

Table 2. Paired Sample T Test Results

Pair	t	df	Sig.(2-tailed)
Triangle Exercise Pre-test and Post-test	-22,342	19	0,001
Diamond Exercise Pre-test and Post-test	-11,020	19	0,001

A homogeneity test was conducted to ensure that the data variance between the triangle and diamond training groups was equal, with a significance value (Based on Mean) > 0.05 as the criterion. The analysis showed a significance value of 0.594, significantly exceeding the 0.05 threshold. This finding provides a strong statistical basis for concluding that the variance of the post-test data across the two training groups is homogeneous. The fulfillment of this homogeneity assumption, supported by the data's normality test, allowed the analysis to proceed to the comparative testing stage using parametric statistics.

As a final hypothesis testing step, an Independent Sample t-Test was conducted on the post-test data to compare the effectiveness of the triangle training and diamond training methods. This test aimed to determine whether there was a statistically significant difference in the average scores between the two interventions on improving the passing skills of extracurricular futsal students at High School 1 Toraja Utara. This procedure is crucial in determining which training model provides the most optimal impact on athletes' technical development. Details of the results of this difference analysis are presented in full in Table 3.

Table 3. Independent Sample t-test results

		t	df	Sig. (2-tailed)
Passing skills	Equal variances assumed	6.145	38	0.001
	Equal variances not assumed	6.145	36.691	0.001

The data analysis results presented in Table 3, a significance value (Sig. 2-tailed) of 0.001 was obtained. Considering that this value is much lower than the threshold of 0.05, it can be statistically concluded that there is a real and significant difference in passing skills between the triangle training group and the diamond training group. This finding indicates that the choice of training model has a distinct effect on the mastery of basic futsal techniques among extracurricular students at High School 1 Toraja Utara.

This significant difference indicates that one training method is more effective in improving students' passing accuracy and consistency. By rejecting the null hypothesis (H_0), this study successfully demonstrated that specific interventions using triangle and diamond training patterns do not produce identical results, but rather produce substantially different technical competency outcomes. These test results provide a strong basis for recommending the most optimal training model for developing futsal training programs at the secondary school level.

Discussion

The results of this study indicate that the implementation of triangle training significantly improved passing skills in futsal extracurricular students. Empirical data showed a substantial increase in the average score, from 4.50 in the pre-test to 9.30 in the post-test. Theoretically, this effectiveness stems from the characteristics of triangle training, which not only focuses on ball-touching techniques but also integrates a variety of off-the-ball movements and dynamic teamwork. This training pattern forces players to consistently create precise passing lanes and maintain distance between players, thus indirectly honing ball distribution accuracy in game situations that mimic real-life match conditions.

This finding aligns with a previous study by Majid and Zaenal (2021), which also found a significant effect of triangle training on passing skills in high school students. The validity of these findings is supported by the results of the hypothesis test, which showed a Sig. (2-tailed) 0.000 < 0.05 and the comparison of the calculated t_value of 13.147 is greater than the t_table of 2.145. The alignment of the results of this study with previous studies strengthens the theory that geometric pattern-based training such as triangles is a very effective method for improving technical competence as well as tactical awareness of students in futsal (Liping, 2017; Zhu et al., 2025).

The results of this study demonstrate that the diamond training method positively contributes to improving the passing ability of extracurricular futsal students, as indicated by an increase in the average score from 4.45 in the pre-test to 6.80 in the post-test. Conceptually, diamond training is a variation of a diamond- or rectangular-shaped training formation designed to simulate the spatial density of futsal (Pramudia et al., 2025; Syaehan & Hariadi, 2025). Through this pattern, students are not only trained to deliver accurate passes but also challenged to understand the rhythm of off-the-ball movements and coordination between players. This geometric training structure is highly effective in developing students' spatial understanding, enabling them to find the right position to receive and distribute the ball sustainably.

These findings reinforce previous research by Nurmaharani et al. (2025), who concluded through a t-test analysis that diamond passing training has a significant impact on the passing skills of extracurricular high school students. The alignment between these results and previous studies confirms that diamond training is a valid pedagogical tool for improving the technical competence of novice athletes (Ikhsan et al., 2025). By combining technical aspects and teamwork in one training scheme, diamond training has proven to be an effective strategy for developing the efficiency of play in the limited space that is characteristic of futsal.

Furthermore, the results of the Independent Sample T-Test analysis of this study provide strong empirical evidence to accept the author's proposition. A significance value of 0.001 (<0.05) indicates a significant difference between the triangle training and diamond training methods on the passing skills of futsal extracurricular students at High School 1, Toraja Utara. The superiority of triangle training in this study is believed to be closely related to the characteristics of its training design, which involves varying trajectory shapes, sharper passing angles, and varying distance manipulation. These

elements simultaneously demand more complex motor adaptations from students, resulting in more optimal effectiveness in improving accuracy and ball control compared to other training patterns.

This finding aligns with research conducted by Agustin and Nur (2024), which also confirmed a significant difference in effectiveness between diamond and triangle passing training. Consistent with this study, the triangle passing training model was shown to have a more dominant and significant effect on improving ball distribution skills. This is supported by sports pedagogical theory, which states that training with a more dynamic geometric scheme can stimulate players' spatial awareness and decision-making (Backes et al., 2023; Larsson et al., 2024). Thus, the integration of triangle training into the sports curricular programme is highly recommended to accelerate the mastery of basic futsal techniques at the intermediate level.

This research makes significant theoretical and practical contributions to the field of sports pedagogy, particularly in futsal. It expands the literature on the effectiveness of geometric-based training models in improving basic futsal technical skills. The findings provide empirical validation that manipulation of trajectory shape, angles, and distances in triangle training has a stronger positive correlation with increased passing accuracy than diamond training. Furthermore, the results of this study support motor learning theory, which states that training variations that require dynamic spatial adaptation can accelerate the mastery of complex motor skills in beginner or student athletes.

Additionally, the results of this study can serve as practical guidance in developing more efficient extracurricular training programs. Coaches are advised to prioritize triangle training as the primary instrument for improving students' passing accuracy and positional awareness in a relatively short period of time. This research provides evidence-based data that can be used to evaluate and develop extracurricular sports curriculums to achieve more optimal performance targets. This study serves as an important reference for further research related to other non-physical variables, such as the influence of students' spatial intelligence or adversity quotient on their response to different tactical training models.

4. CONCLUSION

Both triangle training and diamond training significantly improved the technical skills of students at High School 1 Toraja Utara, but with varying degrees of effectiveness. Although both methods showed a significance value of $0.001 < 0.05$, the triangle training group recorded a more substantial average increase, from 4.50 to 9.30, compared to the diamond training group, which increased from 4.45 to 6.80. Independent Sample T-Test results confirmed that triangle training had a superior effect on honing students' accuracy and ball control due to its training characteristics, which involve a more dynamic and adaptive variation in angles, distances, and ball trajectories than the diamond training pattern.

The researchers recommend that coaches and extracurricular instructors integrate the triangle training model as a primary instrument in basic passing technique development programs, modifying the intensity and complexity of the distances to maintain the

progressiveness of the students' training. Furthermore, students are expected to execute this training in a disciplined manner, with a particular focus on detailed off-the-ball movements, which are crucial for successful ball circulation in real-life match situations. In addition, school support in providing adequate facilities and infrastructure is very necessary to support a more structured and achievement-oriented innovative training model, while for future researchers, it is recommended to expand the scope of the study by involving additional variables such as the level of eye-foot coordination, Adversity Quotient, or implementation in different age groups to test the consistency of the effectiveness of this method in a broader context.

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