The Effect of Dribbling Training Methods, Speed, and Leg Length on Players Dribbling Skills at the UPG 1945 NTT Futsal Club: A SEM-PLS Analysis

El efecto de los métodos de entrenamiento del regate, la velocidad y la longitud de las piernas en las habilidades de regate de los jugadores del club de fútbol sala UPG 1945 NTT: un análisis SEM-PLS

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Abstract

Introduction
Research Method, A quantitative approach using partial least squares structural equation modeling (SEM-PLS) is employed to analyze the influence of dribbling and speed drills on the dribbling skills of players on the UPG 1945 NTT futsal team.
The research results, show that the "Dribbling Drills" variable does not have a significant effect on players' dribbling ability, with a path coefficient of -0.057, a t-statistic of 0.247, and a p-value of 0.805. In contrast, the variable "Speed Drills" has a positive and significant influence on dribbling ability, with a path coefficient of 0.378, a t-statistic of 2.433, and a p-value of 0.015. The R-squared value of 0.130 indicates that both variables together explain only 13% of the players' dribbling ability.
Research analysis, This demonstrates that speed drills contribute most significantly to improving dribbling ability, as they help increase players' acceleration, motor coordination, and agility while carrying the ball.
Research conclusion, This demonstrates that speed drills are the factor that most influences the improvement of futsal players' dribbling skills; therefore, they should form the core of the UPG 1945 NTT futsal team's training program.

Keywords

Dribbling training, Speed drills, Stride length, Dribbling techniques, SEM-PLS.

Resumen

Método de investigación, se ha empleado un enfoque cuantitativo basado en el modelo de ecuaciones estructurales con mínimos cuadrados parciales (SEM-PLS) para analizar la influencia de los ejercicios de regate y velocidad en las habilidades de regate de los jugadores del equipo de fútbol sala UPG 1945 NTT.
Los resultados, de la investigación muestran que la variable «Ejercicios de regate» no tiene un efecto significativo en la capacidad de regate de los jugadores, con un coeficiente de ruta de -0,057, una estadística t de 0,247 y un valor p de 0,805. Por el contrario, la variable «Ejercicios de velocidad» tiene una influencia positiva y significativa en la capacidad de regate, con un coeficiente de ruta de 0,378, una estadística t de 2,433 y un valor p de 0,015. El valor R cuadrado de 0,130 indica que ambas variables juntas explican solo el 13 % de la capacidad de regate de los jugadores.
Análisis de la investigación, Esto demuestra que los ejercicios de velocidad son los que más contribuyen a mejorar la capacidad de regate, ya que ayudan a aumentar la aceleración, la coordinación motora y la agilidad de los jugadores mientras llevan el balón.
Conclusión de la investigación, Esto demuestra que los ejercicios de velocidad son el factor que más influye en la mejora de las habilidades de regate de los jugadores de fútbol sala; por lo tanto, deberían constituir el núcleo del programa de entrenamiento del equipo de fútbol sala UPG 1945 NTT.

Palabras clave

Entrenamiento de regate, Ejercicios de velocidad, Longitud de la zancada, Técnicas de regate, SEM-PLS.

Introduction

Futsal is a rapidly growing sport in Indonesia. It's enjoyed by a wide range of people, from children and teenagers to college students.(Villarejo Garcia et al., 2025)Futsal is characterized by a fast tempo, limited playing space, and the need for excellent individual technical skills. Therefore, every futsal player is required to possess optimal basic skills to be able to play effectively in matches.(Souza et al., 2025)One of the most important basic skills in futsal is dribbling. Dribbling is the ability to dribble the ball using the feet while moving to maintain possession and pass opponents.(Barreira et al., 2025)Good dribbling skills allow players to create attacking opportunities, open up space, and maintain possession under pressure. In modern futsal, dribbling ability is one indicator of a player's technical quality. Dribbling skills are influenced not only by technical mastery but also by a player's physical condition.(Gomes et al., 2025)A player who is in good physical condition will find it easier to dribble the ball quickly and in a controlled manner.(Majid et al., 2025),Conversely, players with less than optimal physical condition tend to experience difficulties in maintaining balance, coordination, and ball control while moving. In the process of developing futsal sports, training is a major factor in determining the improvement of player abilities. A systematically designed training program can help players improve their technical skills, physical abilities, and understanding of game tactics. One important form of training given to players is dribbling practice.(Arif Kustiawan et al., 2024)The right dribbling training method is essential for improving a player's dribbling skills. Coaches must be able to choose training methods that suit the player's needs and characteristics to optimally achieve training goals.(Méndez-Dominguez et al., 2022),Variations in training methods can provide different movement experiences so that players can more easily develop their dribbling technique skills effectively.(Apriady et al., 2025)Monotonous dribbling training methods often make players feel bored and less motivated to participate in training.(Aizava et al., 2023)This condition can lead to less than optimal development of a player's abilities. Therefore, the use of varied and engaging training methods is crucial in the futsal development process. In addition to training methods, speed also significantly influences a futsal player's dribbling skills.(Choi, 2023)Speed is a person's ability to perform movements in the shortest possible time. In futsal, players are required to move quickly while maintaining control of the ball to effectively pass opponents.(Fernández-Galván et al., 2024)Players with high speed tend to penetrate the opponent's defense more easily. Speed also helps players transition from defense to attack and vice versa. Therefore, speed is a crucial physical component in modern futsal.(Ginanjar et al., 2023)Good dribbling skills require a combination of speed and ball control. Players who can dribble quickly and maintain possession will be more difficult for opponents to stop. Conversely, players who lack speed often lose the ball easily when faced with pressure.(Fahrudin et al., 2024)In addition to speed, leg length is also thought to be related to a futsal player's dribbling skills. Leg length is related to stride length and the body's biomechanical capabilities during movement.(Djaba et al., 2024)Players with specific leg lengths can have an advantage in dribbling quickly and efficiently. Leg length can affect body balance and the effectiveness of dribbling. In futsal, which requires rapid changes of direction, body balance is crucial for players to maintain effective ball control. Therefore, leg length is an interesting anthropometric aspect to study in futsal.(Albalad-Aiguabella et al., 2025)Anthropometric factors such as leg length are often a concern in the selection and development of athletes. Each sport has specific physical characteristics that support athlete performance. In futsal, leg length is thought to contribute to the effectiveness of a player's movements when dribbling and moving without the ball. The UPG 1945 NTT Futsal Student Activity Unit (UKM Futsal) is a student sports organization that actively fosters and develops student talent in futsal.

Method

Participants

This study employed a quantitative approach with an explanatory research design, aiming to examine causal relationships between independent and dependent variables through statistical analysis. A quantitative approach was selected because it allows researchers to measure variables objectively using numerical data, thereby enabling empirical analysis of relationships among variables and producing scientifically verifiable conclusions. According to Montaser and Shah (2024), explanatory research focuses on hypothesis testing to explain the effect of one variable on another. In this study, the independent variables consist of dribbling training methods, speed, and leg length, while the dependent variable is the dribbling skill of players in the Student Activity Unit (UKM) Futsal at Universitas Persatuan Guru (UPG) 1945 East Nusa Tenggara (NTT). The purpose of this study is to analyze the extent to which these three independent variables influence players' dribbling performance in futsal.

Data analysis was conducted using Partial Least Squares Structural Equation Modeling (PLS-SEM) with the assistance of SmartPLS software. PLS-SEM was chosen because it is a variance-based multivariate analysis technique capable of simultaneously testing relationships among multiple variables within a research model, while also offering strong predictive capabilities. In addition, this method is suitable for studies with relatively small sample sizes, non-normally distributed data, and models involving multiple constructs and causal relationships. Unlike Covariance-Based Structural Equation Modeling (CB-SEM), which primarily focuses on model fit and goodness-of-fit evaluation, PLS-SEM emphasizes the model's ability to explain and predict endogenous variables through the estimation of path coefficients and the coefficient of determination (R^2). Therefore, PLS-SEM is widely applied in social sciences, education, and sports research where the primary objective is the development of predictive models rather than strict model fit confirmation.

Population and Sample

The population in this study was all active players of the UPG 1945 NTT Futsal Student Activity Unit who participated in futsal training and matches. The population was heterogeneous, consisting of players of varying ages, playing experience, technical abilities, and physical conditions.(Gasparyan et al., 2026)Therefore, certain criteria are needed in determining the sample so that the data obtained is in accordance with the research objectives.(Balfour et al., 2026)The sampling technique used purposive sampling with the following criteria: (1) active players of UKM Futsal UPG 1945 NTT, (2) regularly attending training for the last 6 months, and (3) willing to be research respondents. The number of samples was determined based on the PLS-SEM method with a general rule (rule of thumb), namely 5–10 times the number of research indicators. With 16 indicators, the minimum sample required is between 80–160 respondents. This number is considered sufficient to produce stable and accurate estimates in the PLS-SEM analysis.

Operational Definition of Variables

Table 1 Operational Definition of Variables

No	Variables	Component	Code
1	Dribbling Training Method (X1)	T-Cone Dribbling Drill	X1.1
		Half Box Agility Drill	X1.2
		Intensity of dribbling training	X1.3
		Frequency of dribbling practice	X1.4
2	Speed Training (X2)	Sprint on the beach	X2.1
		Sprint on the grass	X2.2
		Acceleration speed	X2.3
		Movement speed	X2.4
3	Leg Length (X3)	Long leg length	X3.1
		Short leg length	X3.2
		Step range	X3.3
		Balance of movement	X3.4
4	Dribbling Skill (Y)	Ball control	Y1.1
		Dribbling speed	Y1.2
		Dribbling agility	Y1.3
		Dribbling effectiveness	Y1.4

In Table 1, the operational definition of the variables is an explanation of the research variables measured based on certain indicators to facilitate the process of data collection and analysis. In this study, there are four main variables, namely Dribbling Drills (X1), Speed Drills (X2), Leg Length (X3), and Dribbling Skills (Y). Each variable is measured using several indicators that are adjusted to the research objectives using the SEM-PLS method. The Dribbling Drills variable (X1) is defined as a form of dribbling technique training carried out by players to improve their ball control skills when playing futsal. This variable is measured through the T-Cone Dribbling Drill (X1.1), Half Box Agility Drill (X1.2), dribbling training intensity (X1.3), and dribbling training frequency (X1.4). The better the dribbling training done by players, the better their dribbling skills are expected to be. The Speed Drills variable (X2) is defined as a form of speed training that aims to improve the acceleration and movement abilities of players when dribbling the ball. This variable is measured through indicators of beach sprints (X2.1), grass sprints (X2.2), acceleration speed (X2.3), and movement speed (X2.4). Speed training is an important factor in futsal because it helps players move quickly and effectively when dribbling. Furthermore, the Leg Length variable (X3) is defined as the length of a player's leg which affects the range of steps and balance of movement when dribbling. This variable is measured through indicators of long leg length (X3.1), short leg length (X3.2), range of steps (X3.3), and balance of movement (X3.4). Leg length is estimated to contribute to a player's ability to control and dribble the ball. The Dribbling Skills variable (Y) is defined as a player's ability to dribble the ball quickly, in a controlled, and effective manner in futsal. This variable is measured through indicators of ball control (Y1.1), dribbling speed (Y1.2), dribbling agility (Y1.3), and dribbling effectiveness (Y1.4). The better a player's dribbling skills, the greater their ability to get past opponents and maintain possession of the ball during the match.

Reliability Test

Reliability testing is used to determine the level of consistency of research instruments in measuring research variables. A variable is considered reliable if it has a Cronbach's Alpha value of ≥ 0.70 and a Composite Reliability value of ≥ 0.70.(Xu & Potimu, 2026)This value shows that the indicators used in the research are able to produce consistent and reliable data.(Cheng et al., 2026)The higher the reliability value, the better the instrument's consistency in measuring the construct being studied. Conversely, if the reliability value is below 0.70, the indicator needs to be improved or eliminated.

Cronbach's Alpha

Cronbach's Alpha is a measure used to test the reliability or internal consistency of a research instrument.(Henseler et al., 2025)The Cronbach's Alpha value indicates the extent to which indicators in a variable correlate with each other and are able to measure the same construct. A variable is declared reliable if it has a Cronbach's Alpha value ≥ 0.70.(Zia et al., 2025)The higher the Cronbach's Alpha value, the better the consistency of the research instrument. In the analysis using SmartPLS, Composite Reliability is used in conjunction with Cronbach's Alpha to ensure that the research instrument has a good level of reliability. If both values are ≥ 0.70, the construct is declared reliable and suitable for further analysis.

Table 2 Cronbach's Alpha

Alpha Value	Criteria
≥ 0.90	Very Reliable
0.70 – 0.89	Reliable
0.60 – 0.69	Quite Reliable
< 0.60	Not Reliable

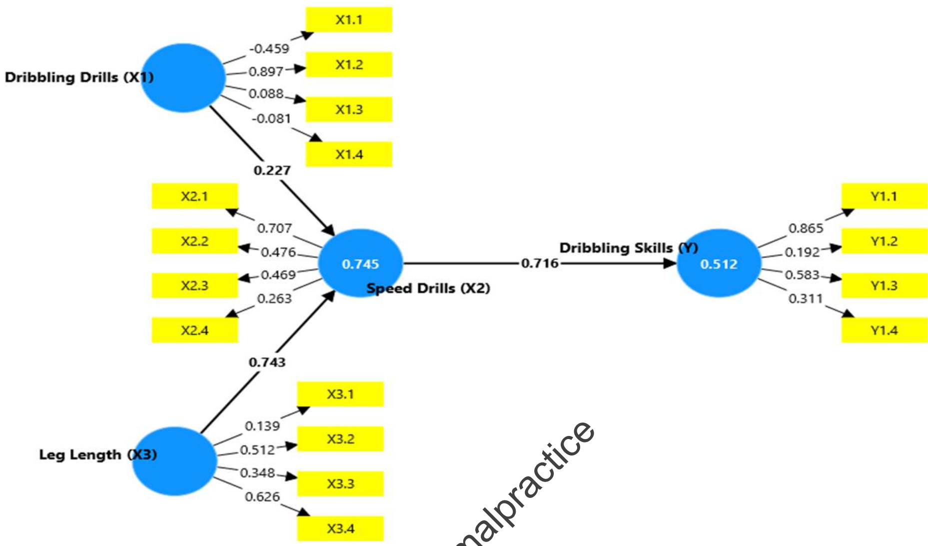
Composite Reliability

Composite Reliability is a measure of reliability in the PLS-SEM model which is used to assess the internal consistency of indicators in a latent variable.(Zia et al., 2025)This test was conducted using SmartPLS. A construct is considered reliable if its Composite Reliability value is ≥ 0.70. This value indicates that the indicators used are able to measure the variables consistently and reliably. The higher the Composite Reliability value, the better the level of internal consistency of the construct in the study.

Results

Outer Model

Figure 2 Outer Model SEM-PLS



The results of the first-stage outer model analysis using Structural Equation Modeling–Partial Least Squares (SEM-PLS) indicate that not all indicators included in the study met the criteria for convergent validity. Convergent validity was assessed by examining the outer loading (loading factor) values of each indicator using SmartPLS software. An indicator is considered valid if it has an outer loading value of ≥ 0.70, as this threshold indicates that the indicator is capable of explaining more than 50% of the variance of its associated latent construct. Conversely, indicators with outer loading values below 0.70 are considered insufficient in representing the construct and should be considered for removal from the measurement model.

For the Dribbling Training Methods variable (X1), the results show that only indicator X1.2 meets the criteria for convergent validity, with an outer loading value of 0.897. This value indicates a strong relationship between X1.2 and the Dribbling Training Methods construct, suggesting that it serves as a valid representation of the variable. According to Hair et al. (2022), outer loading values above 0.70 indicate high indicator reliability and a strong ability to explain a substantial proportion of variance in the latent construct. In contrast, indicators X1.1, X1.3, and X1.4 did not meet the convergent validity requirements, as their outer loading values were below the minimum threshold of 0.70. In addition, some indicators exhibited negative loading values, indicating an inverse relationship between the indicators and the latent construct. Negative loadings may occur due to data coding errors, the presence of reverse-coded items that have not been properly recoded, or because the indicators are conceptually inconsistent with the construct being measured.

Therefore, these indicators were deemed invalid and were removed from the model in order to avoid reducing measurement quality and to ensure the accuracy of the structural model estimation. The detailed outer loading values for each indicator of the Dribbling Training Methods variable are presented in Table 2.

Table 2 outer model analysis stage 1

Variables	Dribbling Drills (X1)	Speed Drills (X2)	Leg Length (X3)	Dribbling Skills (Y)	Information
X1.1	-0.459				Invalid
X1.2	0.897				Valid
X1.3	0.088				Invalid
X1.4	-0.081				Invalid
X2.1		0.707			Valid
X2.2		0.476			Invalid
X2.3		0.469			Invalid
X2.4		0.263			Invalid

X3.1	0.139		Invalid
X3.2	0.512		Invalid
X3.3	0.348		Invalid
X3.4	0.626		Invalid
Y1.1		0.865	Valid
Y1.2		0.192	Invalid
Y1.3		0.583	Invalid
Y1.4		0.311	Invalid

The results of the first-stage outer model assessment presented in Table 2 indicate that not all indicators in the research model met the criteria for convergent validity. The evaluation was conducted based on outer loading (loading factor) values, with a commonly accepted threshold of ≥ 0.70 as recommended by Hair et al. (2022). Indicators with values below this threshold are considered insufficient in representing their respective latent constructs and should therefore be considered for removal from the measurement model.

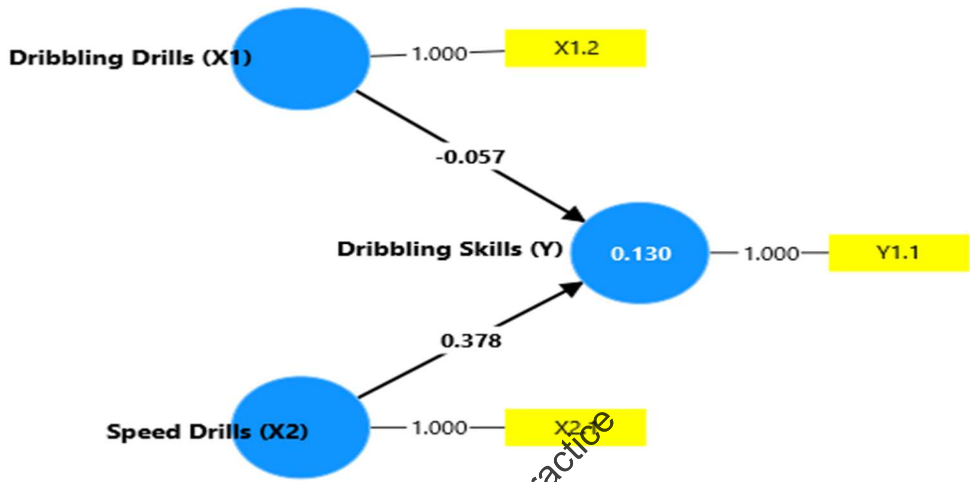
For the Dribbling Training Methods construct (X1), only indicator X1.2 met the criteria for convergent validity, with an outer loading value of 0.897. This value indicates a strong relationship between X1.2 and the Dribbling Training Methods construct, suggesting that it serves as a robust and appropriate indicator for measuring the variable. In contrast, indicators X1.1 (−0.459), X1.3 (0.088), and X1.4 (−0.081) did not meet the required threshold. The presence of negative outer loading values for X1.1 and X1.4 indicates an inverse relationship between the indicators and the latent construct. This may suggest issues such as data coding errors, the presence of reverse-coded items that were not properly recoded, or conceptual misalignment between the indicators and the construct being measured. Consequently, these indicators were deemed invalid and excluded from the model. Regarding the Speed Training construct (X2), only indicator X2.1 met the convergent validity requirement with an outer loading value of 0.707. This value is marginally above the recommended threshold, indicating that the indicator is acceptable but represents the construct at a moderate level. In contrast, indicators X2.2 (0.476), X2.3 (0.469), and X2.4 (0.263) fell below the required threshold, indicating weak relationships with the latent construct. These results suggest that the indicators are not sufficiently capable of measuring the Speed Training construct and therefore fail to meet convergent validity criteria.

For the Leg Length construct (X3), all indicators failed to meet the convergent validity criteria, with outer loading values ranging from 0.139 to 0.626. Although indicator X3.4 showed the highest loading among the items, its value remains below the minimum threshold of 0.70. This finding indicates that all indicators for this construct are inadequate in representing the latent variable. From a conceptual perspective, this result is particularly important. Leg length is an anthropometric variable that is objective in nature and is typically measured directly using physical units such as centimeters. Therefore, it is more appropriately treated as an observed variable rather than a latent construct measured by multiple indicators. Accordingly, the use of multiple indicators for this variable should be reconsidered, as it may not align with its conceptual characteristics.

Finally, for the Dribbling Skill construct (Y), only indicator Y1.1 met the convergent validity criteria, with an outer loading value of 0.865. This indicates a strong relationship between the indicator and the construct, suggesting that it is a valid measure of dribbling skill. In contrast, indicators Y1.2 (0.192), Y1.3 (0.583), and Y1.4 (0.311) did not meet the required threshold. These low loading values indicate weak relationships with the latent construct, meaning that they are not adequate in explaining the variance of dribbling skill. Therefore, these indicators were excluded from the measurement model to ensure that subsequent analyses are based on indicators with stronger construct representation.

SEM PLS inner model test analysis

Figure 3 Analysis of the inner model test of SEM PLS



The results of the inner model analysis using Structural Equation Modeling–Partial Least Squares (SEM-PLS), as presented in Figure 3, indicate that the coefficient of determination (R^2) for the Dribbling Skill variable (Y) is 0.130. This value suggests that the independent variables, namely Dribbling Training Methods (X1) and Speed Training (X2), jointly explain 13% of the variance in players' dribbling skills. The remaining 87% of the variance is explained by other factors not included in the research model. According to Hair et al. (2022), an R^2 value of 0.130 is classified as weak, indicating that the model has relatively low predictive power for the endogenous variable. This finding suggests that additional variables may significantly contribute to dribbling skill, such as agility, coordination, balance, lower limb muscle strength, playing experience, training frequency, motivation, as well as technical and tactical aspects that were not examined in this study.

The path coefficient analysis reveals that the Dribbling Training Methods variable (X1) has a coefficient of −0.057 on Dribbling Skill (Y). The negative coefficient indicates an inverse relationship between the two variables, while the magnitude close to zero suggests that the effect is very weak. Substantively, this result indicates that the implemented dribbling training methods do not meaningfully contribute to improvements in players' dribbling skills within the tested model. However, a negative coefficient does not necessarily imply statistical significance. To determine whether this relationship is statistically significant, bootstrapping results are required, particularly the t-statistic and p-value. If the p-value is greater than 0.05, the relationship is considered statistically insignificant, even if the coefficient is negative. In contrast, the Speed Training variable (X2) shows a positive path coefficient of 0.378, indicating a positive relationship with dribbling skill. This suggests that improvements in speed training are associated with better dribbling performance. Theoretically, this finding can be explained by the fact that speed is a fundamental component of physical conditioning in futsal. Players with higher levels of speed are generally better able to maintain ball control while moving, evade opponents, preserve balance while dribbling, and execute rapid directional changes without losing possession of the ball. Therefore, speed training contributes more substantially to improving dribbling skill compared to the dribbling training methods applied in this study.

Table 3 Analysis of SEM PLS inner model test

Variabel	Dribbling Drills (X1)	Speed Drills (X2)	Dribbling Skills (Y)	Keterangan
X1.2	88			Valid
X2.1		89		Valid
Y1.1			90	Valid

The results of the second-stage outer model analysis presented in Table 3 indicate that all constructs in this study are represented by a single indicator each, with loading values ranging from 0.88 to 0.90. In

Partial Least Squares Structural Equation Modeling (PLS-SEM), outer loading values are commonly used to assess convergent validity, which refers to the extent to which an indicator is capable of explaining its associated latent construct. In general, loading values of ≥ 0.70 are considered acceptable, as they indicate that more than 50% of the variance in the indicator is explained by the latent construct (Hair et al., 2022).

However, in this study, each construct—namely Dribbling Training Methods (X1), Speed Training (X2), and Dribbling Skill (Y)—is measured by only one indicator, specifically X1.2, X2.1, and Y1.1. This condition fundamentally changes the nature of the outer model evaluation, as the constructs are no longer specified as multi-indicator latent variables. As a result, the outer loading values no longer reflect internal consistency among multiple indicators within a construct, but instead represent a direct correspondence between a single observed indicator and its latent construct. In other words, the constructs function as single-item constructs. In the context of single-item constructs, high loading values (0.88–0.90) should not be interpreted as evidence of convergence among multiple indicators, but rather as an indication that the observed variable is being used as the sole operational representation of the construct. Therefore, convergent validity in the traditional PLS-SEM sense cannot be fully assessed, since there is no internal indicator comparison within each construct. Nevertheless, high outer loading values still suggest that each indicator has a strong empirical association with its corresponding latent construct. However, from a methodological standpoint, the use of single-item constructs introduces limitations, particularly in evaluating construct reliability (e.g., composite reliability) and discriminant validity, as both require multiple indicators to be meaningfully assessed. Compared with the initial stage of analysis, the second-stage measurement model reflects a simplified structural form resulting from the elimination of indicators that did not meet validity criteria. This simplification improves model parsimony and emphasizes the most representative indicators; however, it simultaneously reduces the model's capacity to capture the multidimensional nature of the constructs. Therefore, the results of this outer model should be interpreted with caution, especially within the context of PLS-SEM measurement model evaluation, as the constructs are simplified and entirely dependent on a single indicator.

Table 4 Results of SEM PLS Hypothesis Test Analysis

Variables	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values	Information
Dribbling Drills (X1) -> Dribbling Skills (Y)	-0.057	-0.076	0.231	0.247	0.805	No Significant Correlation
Speed Drills (X2) -> Dribbling Skills (Y)	0.378	0.395	0.156	2,433	0.015	Significant Correlation

The results of the second-stage outer model analysis presented in Table 3 indicate that all constructs in this study are represented by a single indicator each, with loading values ranging from 0.88 to 0.90. In Partial Least Squares Structural Equation Modeling (PLS-SEM), outer loading values are used to assess convergent validity, which refers to the extent to which an indicator is able to represent its associated latent construct. In general, loading values of ≥ 0.70 are considered acceptable, as they indicate that more than 50% of the variance in the indicator is explained by the latent construct (Hair et al., 2022). However, in this study, each construct—namely Dribbling Training Methods (X1), Speed Training (X2), and Dribbling Skill (Y)—is measured by only one indicator, specifically X1.2, X2.1, and Y1.1. This condition fundamentally changes the nature of the outer model evaluation, as the constructs are no longer modeled as multi-indicator latent variables. As a result, the outer loading values no longer reflect inter-indicator consistency within a construct but instead represent a direct correspondence between the indicator and the latent construct. In other words, the constructs function as single-item constructs.

In the context of single-item constructs, high loading values (0.88–0.90) do not represent convergence among multiple indicators but rather indicate that the observed variable is being used as a sole operational representation of the construct. Therefore, convergent validity in the traditional PLS-SEM sense cannot be fully assessed, as there is no internal comparison among multiple indicators within the same construct.

Nevertheless, high loading values still suggest that each indicator has a strong empirical association with its respective latent construct. However, from a methodological perspective, the use of single-item constructs introduces limitations, particularly in assessing construct reliability (e.g., composite reliability) and discriminant validity, as these assessments generally require multiple indicators per construct. Compared to the initial stage of analysis, the second-stage measurement model reflects a simplified structure resulting from the elimination of indicators that did not meet validity criteria. This simplification improves the focus on the most representative indicators; however, it simultaneously reduces the model's ability to capture the multidimensional nature of the constructs. Therefore, the results of this outer model should be interpreted with caution, particularly within the context of PLS-SEM measurement model evaluation, as the constructs are simplified and entirely dependent on a single indicator.

Discussion

The results of the outer model analysis using Structural Equation Modeling–Partial Least Squares (SEM-PLS) indicate that, in the initial stage of testing, not all indicators in the research model met the criteria for convergent validity. Convergent validity in the PLS-SEM approach is assessed through outer loading values, which represent the strength of the relationship between an indicator and its associated latent construct. According to Hair et al. (2022), an indicator is considered to have satisfactory convergent validity when its outer loading is ≥ 0.70, indicating that it explains more than 50% of the variance in the latent construct.

Conceptually, high outer loading values reflect that an indicator contributes strongly and consistently to the measurement of its construct. In contrast, indicators with outer loading values below 0.70 indicate weak contributions and insufficient representation of the latent construct. In SEM-PLS, such conditions not only affect measurement validity but may also influence the accuracy of structural model estimation. For the Dribbling Training Methods construct (X1), the results show that only indicator X1.2 meets the convergent validity criteria, with an outer loading value of 0.897. This value is substantially above the recommended threshold, indicating that X1.2 has a strong empirical contribution in representing the construct and can be considered the most stable indicator for X1. However, indicators X1.1, X1.3, and X1.4 do not meet the convergent validity criteria due to low outer loading values, including negative values. Negative outer loadings indicate an inverse relationship between the indicator and the latent construct. Methodologically, this condition may reflect serious measurement issues, such as data coding errors, the presence of reverse-worded items that have not been properly reverse-coded, or conceptual inconsistency between the indicators and the construct being measured.

For the Speed Training construct (X2), only indicator X2.1 meets the convergent validity criterion, with an outer loading value of 0.707. This value is at the minimum acceptable threshold in PLS-SEM, indicating that the indicator is statistically acceptable but only moderately representative of the construct. In contrast, indicators X2.2, X2.3, and X2.4 show low outer loading values of 0.476, 0.469, and 0.263, respectively. These results indicate weak contributions in explaining the variance of the Speed Training construct, suggesting that these indicators are not sufficiently representative and should be removed from the measurement model. For the Dribbling Skill construct (Y), only indicator Y1.1 meets the convergent validity requirement, with an outer loading value of 0.865. This indicates a strong relationship between the indicator and the construct, suggesting that it is an adequate measure of dribbling skill. Conversely, indicators Y1.2, Y1.3, and Y1.4 exhibit low outer loading values of 0.192, 0.583, and 0.311, respectively. These results indicate weak empirical relationships with the latent construct, demonstrating that these indicators are not consistent in representing dribbling skill and should therefore be excluded from the model.

For the Leg Length construct (X3), all indicators fail to meet the convergent validity criterion, with outer loading values ranging from 0.139 to 0.626. Although X3.4 shows the highest loading among the indicators, it still falls below the minimum threshold of 0.70. This finding indicates that none of the indicators adequately represent the construct in the measurement model. From a conceptual perspective, this result is important. Leg length is an anthropometric variable that is objective in nature and can be measured directly using physical units such as centimeters. Therefore, it is more appropriately treated as an observed variable rather than a latent construct measured by multiple indicators. Accordingly, the use of multiple indicators for this variable should be reconsidered, as conceptual misalignment may explain the consistently low outer loading values.

After eliminating indicators that did not meet convergent validity criteria, the second-stage outer model results show that each construct is represented by a single indicator: X1.2 for Dribbling Training Methods, X2.1 for Speed Training, and Y1.1 for Dribbling Skill, with loading values of 0.88, 0.89, and 0.90, respectively. In the context of SEM-PLS, this condition indicates that the model has become a single-item construct model. Under this structure, outer loading no longer reflects convergent validity among multiple indicators but instead represents the direct relationship between an observed indicator and its corresponding latent construct. Although high loading values indicate strong empirical relationships, interpretation must be conducted with caution. Single-item constructs do not allow for comprehensive assessment of internal consistency reliability (e.g., composite reliability) or discriminant validity, as these require multiple indicators per construct. Furthermore, the structural model results show that the coefficient of determination (R^2) for Dribbling Skill (Y) is 0.130. This indicates that Dribbling Training Methods (X1) and Speed Training (X2) jointly explain only 13% of the variance in dribbling skill. According to Hair et al. (2022), this R^2 value is categorized as low, indicating limited predictive power of the model. Thus, 87% of the variance in dribbling skill is explained by other factors not included in the model.

The path coefficient results show that Dribbling Training Methods (X1) have a negative effect of −0.057 on Dribbling Skill (Y). This indicates a very weak and practically negligible relationship between the two variables. The bootstrapping results further confirm that this effect is not statistically significant, leading to the rejection of the first hypothesis. Substantively, this finding suggests that the dribbling training methods applied in this study were not effective in improving players' dribbling skills. In contrast, Speed Training (X2) shows a positive and statistically significant effect of 0.378 on Dribbling Skill (Y). This finding indicates that improvements in speed training contribute meaningfully to enhancements in dribbling performance. Theoretically, speed is a fundamental biomotor component in futsal that supports ball control, rapid directional changes, acceleration in tight spaces, and the ability to bypass opponents in dynamic game situations. Overall, the findings indicate that Speed Training is a more dominant factor influencing dribbling skill compared to Dribbling Training Methods. However, the relatively low coefficient of determination suggests that the model still has limited explanatory power.

Conclusions

In conclusion, Speed training has a positive and significant effect on improving the dribbling skills of the players on the UPG 1945 NTT Futsal Club. Meanwhile, dribbling practice did not show a significant effect on the players' dribbling ability. SEM-PLS analysis also revealed that the research model could only explain 13% of the variance in dribbling skills, indicating that many other factors outside the model contribute to the players' performance. Therefore, speed training should be a primary focus in futsal training programs to improve players' agility, acceleration, and ball control during matches.

Conflict of Interest Statement

The authors declare no conflict of interest related to this article.

Data Availability Statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request. The data is not publicly available due to the potential for respondent-identifying information and due to ethical considerations. However, all data used in the analysis have been validated and are available for academic purposes, research replication, or verification of results with the author's consent.

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