

# Analysis of the execution of core tactical principles and technical efficiency of primary school futsal players

## *Análise da execução de princípios táticos fundamentais ofensivos e eficácia técnica de escolares praticantes de futsal*

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**Abstract** – The study aimed to analyze the core tactical offensive principles and technical efficiency of primary school futsal players. Thirty-three students from a school in Paraná participated in the study. The System of Tactical Assessment in Soccer (FUT-SAT) and the System of Notational Analysis in Small-sided Soccer Games were used for tactical-technical analysis. It was found that the tactical principle “offensive coverage” was most frequently executed by the primary school futsal players ( $p = 0.01$ ), followed by “width and length” without ball ( $p < 0.01$ ). Moderate and strong significant correlations were identified between the execution frequency of the core tactical principles “penetration”, “offensive coverage”, “width and length without ball”, “offensive unity” and efficiency in technical skills (from  $r = 0.43$  to  $r = 0.82$ ,  $p < 0.05$ ). It is concluded that there is a model of playing near the game center in the presented age group, and that the efficiency of executing technical skills is associated with tactical behavior in game situation.

**Key words:** Athletic performance; Youth sports; Performance tests.

**Resumo** – O estudo objetivou analisar os princípios táticos fundamentais ofensivos e a eficácia técnica de escolares praticantes de futsal. Participaram do estudo 33 alunos de uma escola no Paraná. Utilizou-se o Sistema de Avaliação Tática no Futebol (FUT-SAT) e o Sistema de Análise Notacional em Jogos Reduzidos de Futebol para análise tático-técnica. Constatou-se que o princípio tático “cobertura ofensiva” foi executado com mais frequência pelos escolares praticantes de futsal ( $p = 0,01$ ) seguido pelo princípio “espaço sem bola” ( $p < 0,01$ ). Correlações significativas moderadas e fortes foram identificadas entre a frequência de execução dos princípios táticos fundamentais “penetração”, “cobertura ofensiva”, “espaço com bola”, “unidade ofensiva” e a eficiência em habilidades técnicas (de  $r = 0,43$  a  $r = 0,82$ ,  $p < 0,05$ ). Conclui-se que no grupo etário avaliado, existe um modelo de jogar próximo ao centro de jogo e que a eficiência de execução técnica está associada com o comportamento tático em situação de jogo.

**Palavras-chave:** Desempenho esportivo; Esportes juvenis; Provas de rendimento.

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**Received:** May 16, 2019

**Accepted:** October 10, 2019

### How to cite this article

Ueda LSC, Menegassi VM, Avelar A, Rechenchosky L, Silva FLO, Borges PH. Analysis of the execution of core tactical principles and technical efficiency of primary school futsal players. Rev Bras Cineantropom Desempenho Hum 2020, 22:e65221. DOI: <http://dx.doi.org/10.1590/1980-0037.2020v22e65221>

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## INTRODUCTION

The collective dynamics of cooperation with teammates and opposition to rivals, coupled with unpredictable, random, and variable situations<sup>1</sup> give futsal a complex and systemic character, where the tactical, technical, physical, and psychological dimensions might be understood in symbiosis to obtain success<sup>2-5</sup>.

In this sense, the combination of an opposition scenario and the coordination of team members' collective and individual actions compose the basis for thinking about strategies, tactics, and technical development of a team and its members<sup>6</sup>. Therefore, players must identify the variables inherent to the game (players, ball, goalposts, referees, physical demarcations, and others) and seek to move functionally, from a collective tactical strategy and tactical organization<sup>7</sup>. The literature has been consistent in affirming that this perception is strictly related to players' cognitive processes, which, in turn, are crucial in "problem solving situations" presented in team sports<sup>8,9</sup>.

The tactical dimension in sports practice consists of several cognitive processes that mostly involve memory and attention, since in order to play tactically, the player needs to perceive and analyze the situation, mentally solve presented problems (tactical scenarios), and select a motor response (technique) that best adjusts to decision making<sup>9</sup>. To Greco<sup>8</sup>, tactical knowledge can be understood in two structural classes: Declarative Knowledge (DK) and Procedural Knowledge (PK), in which the first is related to the facts that can be stated from descriptions (verbalize the best decision making); and the second concerns the motor application (how to do it) that can be used in a specific context.

Protocols have been proposed for the evaluation of declarative tactical knowledge<sup>10,11</sup>, procedural knowledge<sup>6,12,13</sup>, and both<sup>14</sup>. Cardoso et al.<sup>15</sup> evidenced that these were associated to cognitive effort, since players with higher levels of tactical knowledge performed soccer tasks demanding less effort. Although, it is not clear in the literature if there is a relationship between the mental solution of the problems presented in the game (tactical scenario) and execution of appropriate motor responses (technical scenario). In some match situations, players can perform technical actions well but choose a wrong move, while tactical intent can be productive, but with ineffective technical execution, which motivates an investigation into the relationship between the tactical and technical dimensions.

A study published by Praça et al.<sup>16</sup>, evaluating specific motor actions (passing, dribbling and shooting on goal) and performance in core tactical principles of young soccer players, demonstrated that there is a weak association ( $r < 0.37$ ) between the tactical and technical indicators performance of young soccer players. However, the protocol applied to evaluate the technical abilities presents limited ecological validity as it is executed outside a match context, which reinforces the need to evaluate the relationship between the manifestation of the tactical and technical dimensions in a real match scenario.

There is a large amount of quality information related to team sports teaching-learning theories directed to initiation programs in educational and recreational contexts<sup>1,8,9</sup>. Considering the evaluation of this process, especially related to children and adolescent futsal players, few experimental studies have been conducted aiming to analyze the interaction between the tactical and technical dimensions and the implications related to how players behave in match situation. Reis et al.<sup>17</sup> compared the execution of specific motor skills among competitive categories (U-7, U-9, and U-11) and Travassos et al.<sup>4</sup> analyzed the manipulation of the number of targets in relation to different tactical behaviors in U9, U11, U15 and U17 categories. However, there is not enough evidence on how players at young ages tactically behave during game situation, especially considering core tactical principles execution. The lack of studies evaluating performance indicators<sup>18</sup> specially outside high competitive contexts, represents a substantial gap that needs to be filled in order to provide evidence on how youth players develop specific knowledge and motor abilities during the teaching-learning process of initiation programs in team sports.

Regarding the alluded context, the present study has the following purposes: a) to identify the offensive tactical principles most frequently performed by primary school futsal players; and b) to analyze the relationship between the execution of offensive tactical principles and technical efficiency of primary school futsal players. Considering that structural characteristics of futsal demand the execution of some offensive core tactical principles, instead of other most common in soccer (depth mobility and offensive unity, for example), it is hypothesized that differences in frequency of execution of the six core tactical principles are expected. Besides, when considering the multidimensional performance required in team sports, it is also expected that associations between technical and tactical demands will be evidenced.

## METHOD

### Subjects

The sample was selected intentionally. In total, 33 primary school futsal players, aged between 9 and 14 years old, from a private institution in Maringá, Paraná, Brazil, participated in the study, belonging to the U-10 (21 players), U-12 (6 players), and U-14 categories (6 players). The players participated in technical-tactical training sessions with a frequency of three times a week and competed in regional tournaments. The following inclusion criteria were adopted: (a) students enrolled at the present school; (b) participants in the school's futsal team; and (c) attending training sessions at least once a week. As exclusion criteria, the following were highlighted: (a) presenting muscular or skeletal lesions at the moment of data collection and (b) not presenting the Informed Consent Form (ICF) signed by the subjects and their guardians. No subjects were excluded from the study. The study was approved by the local ethics and research committee (Process number: 2.853.653).

## Procedures

Data were obtained through video recording of a tactical-technical futsal training session at the school's court. In each evaluated category (U-10, U-12, and U-14), the GK3-3GK test proposed by Costa et al.<sup>19</sup> was applied, with a four-minute duration. Each player participated of more than one match but was evaluated in a single match within the same category. Participants received numbered vests in order to facilitate their identification after filming. The teams were selected for convenience within each category of play, and each team consisted of a goalkeeper, a defender, a winger, and a forward. The players were allocated in teams according to coaches subjective evaluation. One team composed by three players in U-10 category performed two matches but the technical-tactical evaluation considered the first match analysis. The players executed one minute of a match to become familiar with the format and, at the end of that time, the test began.

The GK3-3GK test images were acquired with the use of a Canon PowerShot SX 510 HS digital camcorder. In order to reflect the dimensions commonly used by individuals, the GK3-3GK test was adapted from the procedures previously described by Muller et al.<sup>20</sup>, being applied in an area with dimensions of 26 meters in length by 15 meters in width.

## Measuring instruments

To analyze the tactical performance through video recordings, the System of Tactical Assessment in Soccer (FUT-SAT) was used. The instrument developed by Costa et al.<sup>6</sup>, is designed specifically for soccer during the stages of sports training but can also be used in futsal context<sup>21</sup>. The objective of the test is to assess the management of the playing space by considering the players' tactical actions regarding the ball, teammates, and opponents. All validation procedures (content, facial, construct, and reliability) were performed and supported by literature recommendations<sup>6</sup>. To perform this analysis, a trained and experienced evaluator, with a measuring reliability above 81% in relation to the original protocol, was selected. Also the Soccer View<sup>®</sup> software was used, specifically built to facilitate FUT-SAT analysis. Soccer View<sup>®</sup> inserts spatial references on the screen of the video recording, allowing rigorous evaluation of the positioning and movements of the players on the field/court<sup>6</sup>.

The use of the GK3-3GK test and the FUT-SAT system enabled evaluation of six core tactical offensive principles of the futsal match: penetration, offensive coverage, depth mobility, width and length (with ball), width and length (without ball) and offensive unity<sup>6,21</sup>. Since ball possession determines at which phase of the game the players are (offensive/defensive) and that futsal specific technical execution (passing, receiving, shooting) is mostly related to the motor actions performed with the ball, it was defined that only the offensive fundamental tactical principles would be assessed.

Regarding technical efficiency, the System for Notational Analysis in Small-sided Soccer Games proposed by Maarseveen et al.<sup>22</sup> was used for



**Figure 1.** Representation of video analysis using Soccer View® software.

video evaluation. This instrument, developed with the objective of defining indicators to quantify technical actions, considers three distinct functions of the evaluated player: attacker with ball, attacker without ball, and defender. All validation procedures (concurrent, construct, intra-observer and inter-observer reliability) were performed and supported by literature recommendations.

In the present study, the scores of the technical actions performed by the attacker with ball were evaluated, considering the categories shooting, passing, receiving, and during offensive 1:1 duel, using the definitions previously established by the notational system table as evaluation parameters<sup>22</sup>.

The video analysis in relation to technical actions was based on the use of Lince® software<sup>23</sup>. The main application of this software is to facilitate the observation of events and/or variables that occur in the video, through tools to create buttons that can be used to previously assign determined classifications and descriptions.

## Statistical analysis

Regarding the statistical analysis, the normality of the data was verified through the Shapiro-Wilk test. Subsequently, the Friedman test was applied followed by comparisons in pairs by the Wilcoxon test, in order to verify the tactical principles most executed by the primary school futsal players. Finally, Spearman's correlation coefficient was used to identify the degree of association between tactical and technical variables. In data analysis the software Statistical Package for the Social Sciences - SPSS (version 20.0) was used. The level of significance was 5%.

## RESULTS

Table 1 presents the characterization of the execution frequency of tactical principles and score in technical skills among the three categories.

**Table 1.** Characterization of the execution frequency of tactical principles and score in technical skills among the three categories.

	U-10 (n = 21)	U-12 (n = 6)	U-14 (n = 6)
	Md (Q1-Q3)	Md (Q1-Q3)	Md (Q1-Q3)
Penetration (freq.)	6.00 (1.00-8.50)	4.50 (2.25-8.50)	5.00 (3.00-7.50)
Width and length with ball (freq.)	3.00 (1.00-4.00)	3.50 (1.50-6.25)	5.00 (2.50-6.25)
Offensive coverage (freq.)	22.00 (14.00-24.00)	21.50 (16.75-26.25)	24.50 (19.50-31.25)
Width and length without ball (freq.)	12.00 (9.50-16.50)	12.00 (6.75-13.75)	20.50 (8.25-29.75)
Depth mobility(freq.)	1.00 (0.00-2.50)	2.50 (0.75-4.25)	1.50 (0.00-5.25)
Offensive unity (freq.)	5.00 (2.00-10.50)	10.50 (6.50-16.25)	5.00 (2.75-17.25)
Shooting (points)	21.00 (9.00-33.00)	18.00 (4.50-38.25)	19.50 (0.00-30.00)
Passing (points)	5.00 (3.00-9.00)	13.50 (10.25-15.25)	18.50 (13.50-22.50)*
1:1 Duel (points)	7.00 (3.00-15.00)	10.50 (2.75-36.50)	10.50 (7.75-31.75)
Receiving (points)	9.00 (6.00-14.50)	10.00 (8.00-14.25)	12.00 (7.50-16.00)

Note. \*Statistically different to U-10; Descriptive values presented by player/per match.

Table 2 presents the characterization and comparisons of frequency of execution of offensive core tactical principles. It was observed that the tactical principle “offensive coverage” was most frequently executed by the primary school futsal players ( $p = 0.01$ ), followed by “width and length” without ball ( $p < 0.01$ ).

**Table 2.** Characterization and comparisons of offensive core tactical principles performed by the sample (n = 33).

	Median	Q1	Q3	Overall actions
Tactical Principles				
Penetration	5.00*	1.50	8.00	174
Width and length (with ball)	3.00#	1.00	5.00	114
Offensive coverage	22.00§	16.50	25.50	706
Width and length (without ball)	12.00†	9.50	17.50	442
Depth mobility	1.00‡	0.00	3.00	67
Offensive unity	6.00*	3.00	13.00	227

Note. Different symbols represent a statistically significant difference ( $p < 0.01$ ); Equal symbols represent the absence of statistically significant differences ( $p > 0.05$ ); Descriptive values presented by player/per match.

It was also observed that “penetration” was significantly different from almost all offensive tactical actions ( $p < 0.01$ ), presenting a higher execution frequency than “depth mobility” and “width and length” with ball, while being less executed when compared to “offensive coverage” and “width and length” without ball. “Depth mobility” was the principle performed

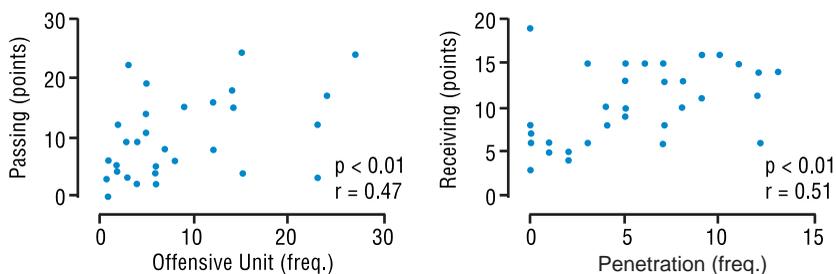
least by primary school futsal players, followed by the principle “width and length”, which was significantly different from all other variables ( $p < 0.01$ ).

**Table 3.** Correlation of the execution frequency of tactical principles and score in technical skills among the three categories ( $n = 33$ ).

		Receiving	Passing	1:1 Duel	Shooting
U-10 ( $n = 21$ )	Penetration	0.69**	-	-	0.43*
	Offensive Coverage	-	-	-	-0.60**
U-12 ( $n = 6$ )	Width and Length (without ball)	-	0.82*	-	-
U-14 ( $n = 6$ )	Width and Length (without ball)	-	-	0.81*	-

Note. \*Significant correlation ( $p < 0.05$ ); \*\*Significant correlation ( $p < 0.01$ ); Tactical principles are presented in frequency of execution; Technical skills are presented in score.

Table 3 presents significant correlations between the execution frequency of tactical principles and score in technical skills in each category. In U-10, the principle “penetration” was positively and moderately correlated to the action of receiving the ball ( $p < 0.05$ ) and “shooting” on goal. In contrast, the principle “offensive coverage” presented a negative moderate correlation with “shooting” score ( $p < 0.01$ ). In U-12, the principle “width and length” without ball was strongly correlated to the technical skill “passing” ( $p < 0.05$ ). Finally, in U-14 the principle “width and length” without ball presented a strong correlation to “1:1 Duel” score. The other correlations found were weak and without statistical significance.



**Figure 2.** Correlation between core tactical principles and score in technical skills performed during the game ( $n = 33$ ).

Finally, Figure 2 shows significant, moderate correlations between the tactical principle “offensive unity” and the technical skill “passing” ( $r = 0.47$  and  $p < 0.01$ ) for all players, as well as between “penetration” and “receiving” ( $r = 0.51$  and  $p < 0.01$ ). The other correlations found were weak and without statistical significance.

## DISCUSSION

The objectives of this article were: a) to identify the offensive tactical principles most frequently performed by primary school futsal players; and b) to analyze the relationship between the execution of offensive core tactical principles

and technical efficiency of primary school futsal players. The main findings suggest that the players perform the principle “offensive coverage” with greater prevalence, indicating that executing support movements to the player with the ball is the most required tactical action in youth futsal matches. In the correlation between tactical-technical indicators, moderate and strong, positive and negative associations were found when considering each category and the whole sample. Only the principles “width and length” with ball and “depth mobility” were not related to the scoring of any technical skill. The quality of passing the ball was associated with the maintenance of the team in a block during the offensive phase and the progression of the player with the ball towards the opposite goal and/or goal-line requires great ball “receiving”.

While studies related to soccer demonstrate that the most frequently executed action is “width and length”, even in different contexts and conditions<sup>24</sup>, Muller et al.<sup>20</sup> corroborate the idea that there seems to be a tendency towards the prevalence of “offensive coverage” (18.8% of the actions), followed by “width and length” (10.5%), in line with the results found in the present study.

The reduced game space of futsal compared to soccer favors the adoption of tactical behaviors to assist the player with ball possession, in order to benefit the progression of the team to the opposite court. Nevertheless, the literature is not yet consensual about the relationship between the dimensions of the playing space and the execution of core tactical principles. In fields with smaller dimensions there is apparently a higher execution frequency of the principle “width and length”<sup>6,7</sup>.

It is worth mentioning that the present study involved a sample that was, on average, younger than the previously published studies. While the present study involved subjects with a maximum age of 14 years, and the majority (64%) in the U-10 category (9-10 years), previous articles involved older players, aged up to 17 years<sup>25</sup> or up to 19 years<sup>24</sup>. Another important point to highlight is the difference in the evaluation instrument. While the present study used FUT-SAT, most studies employed different methods of evaluation, such as the KORA test<sup>25</sup>.

When analyzing the technique of the players from an ecological environment, whose main benefit is the presence of the opposition and cooperation inherent in team sports, the present study contributes to elucidate the relation of the technical and tactical dimensions in youth futsal players. In U-10, the “receiving” and “shooting” technical skills seem to be influenced by the execution frequency of “penetration”, showing that as the players increase the number of individual actions of carrying the ball towards opponent’s goal<sup>6</sup>, they increase also the participation in the game and the number of attempts to finish the offensive sequence by shooting. In contrast, the “shooting” score was negatively correlated to “offensive coverage” highlighting that the act of being near the ball, supporting the player with ball possession decreases the frequency of shooting towards opponent’s goal.

In U-12, the principle “width and length” without ball was directly associated to “passing” score, showing that when adopting this behavior

of horizontally and vertically increasing effective playing space<sup>6</sup> may end up requiring them to interact, by receiving and consequently passing the ball to another player, to continue the offensive construction. Furthermore, in U-14 category, the principle “width and length” without ball was also directly correlated to “1:1 Duel”, showing that this tactical action may increase the chances of promoting direct confrontations with an opponent.

When considering the relationship in all categories analyzed, the results showed correlations between “offensive unity” and the technical indicator “passing”. The principle “offensive unity” can be understood as the positioning behind the less offensive zone of the game center. Costa et al.<sup>6</sup> define this principle as the actions of a highly organized attack executed by one or more players, which support the attacking players, standing and acting behind them. According to Costa et al.<sup>19</sup> by executing this action, the team achieves a block structure, able to favor continuous circulation of the ball, with fluidity and effectiveness. Within the characteristic of allowing the team to attack in unity, it can be understood that by acting in the rear of the possession team, this player acts in a region of the court with less space-time constraints and risks of the opponent’s marking, allowing the execution of passes to teammates with higher refinement.

Regarding the relationship between the tactical principle “penetration” and the technical action of “receiving”, It is possible to understand that ball domain is a prerequisite for penetration, in this way, showing a direct association between obtaining control of a ball received and the act of advancing through game space by controlling the ball. This correlation can be understood by the fact that players with better scores in the technical action of controlling a received ball may have better conditions to progress through the playing court, while players who do not control the ball will have difficulty performing the function of “carrier” of the ball, to execute the tactical principle “penetration”.

As limitations of the present study, we highlight: a) the restricted number of participants that compose the sample, especially the older categories; b) the fact that only the execution frequency and not the efficiency of core tactical principles was evaluated; c) the adoption of a tactical evaluation instrument not designed specifically for futsal; and d) the low number of total offensive actions compared, evaluated, and correlated. These factors reduce the possibility of transferring these results to similar contexts. However, the combination of instruments chosen to assess the technical-tactical behaviors, starting from an environment with interactions and constant decision-making situations, added new information to the literature. As practical applications, the results found provide professionals with a theoretical rationale to think about the efficiency of tactical training, based on corrections of the technical actions correlated in the present study.

## CONCLUSIONS

After conducting this research, some conclusions about tactical-technical

performance of primary school futsal players can be made. Initially, a prevalence of tactical actions related to the support offered to the player with possession of the ball was observed, which indicates a model of playing near the game center in the presented age groups. It was also observed that technical efficiency was related to the offensive core tactical principles of youth futsal players, showing important associations when considering each category and the whole sample. Only the principles “width and length” with ball and “depth mobility” were not related to the scoring of any technical skill.

### **Acknowledgements**

We would like to thank the Coordination of Improvement of Higher Education Personnel (CAPES/Brazil) for the Master Scholarship conceded to V.M.M. A. A. is supported by a scholarship from Fundação Araucária (process: 085/2019-UEM/Fundação Araucária).

## **COMPLIANCE WITH ETHICAL STANDARDS**

### **Funding**

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. This study was funded by the authors.

### **Ethical approval**

Ethical approval was obtained from the Institutional Ethics Board of the Standing Committee on Ethics in Research with Humans of the State University of Maringá, Paraná, Brazil (Process number: 2.853.653), and the protocol was written in accordance with the standards established by the Declaration of Helsinki.

### **Conflict of interest statement**

The authors have no conflict of interests to declare.

### **Author Contributions**

Conception and design of the experiment: L.S.C.U., F.L.O.S., and P.H.B. Realization of the experiments: L.S.C.U., F.L.O.S., and P.H.B. Data analysis: L.S.C.U., V.M.M., F.L.O.S., and P.H.B. Contribution with reagents/research materials/analysis tools: L.S.C.U., F.L.O.S., and P.H.B. Article Writing: L.S.C.U., V.M.M., A.A., L.R., F.L.O.S., and P.H.B. All authors read and approved the final version of the manuscript.

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