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Behavioral Sciences

The Influence of 25 Training Sessions on the Decision-Making Skill of U-12 Soccer Players

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ABSTRACT – The aim of this study was to verify the influence of 25 training sessions on the decision-making skill of U-12 soccer players. The sample was comprised of 25 U-12 soccer players from a first division Brazilian club. Decision making was assessed through the TacticUP® online platform. The 25 training sessions were organized based on the core tactical principles of soccer. There was a positive correlation (r=.413, p=.040) between the performance variation of decision-making and the training time for the offensive principles outside the center of play. It was concluded that training improved the decision-making skill of U-12 soccer players with respect to the tactical principles of width and length without the ball, mobility, and offensive unity.

KEYWORDS: tactical knowledge; game reading; child development; talent; perceptual-cognitive skills.

A Influência de 25 Sessões de Treino na Capacidade de Tomada de Decisão de Jogadores de Futebol Sub-12

RESUMO – O objetivo deste estudo foi verificar a influência de 25 sessões de treino na capacidade de tomada de decisão de jogadores de futebol sub-12. A amostra contou com 25 jogadores de futebol sub-12 de um clube de primeira divisão do Brasil. Avaliou-se a tomada de decisão através da plataforma online TacticUP®. As 25 sessões de treino foram organizadas baseadas nos princípios táticos fundamentais do futebol. Verificou-se correlação positiva (r=0,413, p=0,040) entre a variação do desempenho da tomada de decisão e o tempo de treino para os princípios ofensivos fora do centro de jogo. Conclui-se que o treino melhorou a capacidade de tomada de decisão de jogadores de futebol sub-12, para os princípios de espaço sem bola, mobilidade e unidade ofensiva.

PALAVRAS-CHAVE: conhecimento tático; leitura de jogo; desenvolvimento infantil; talento; habilidades perceptivo-cognitivas.

Making efficient decisions is an essential feature for athletes to achieve superior performance in sports (Fortes et al., 2019; Grehaigne et al., 2001). Therefore, decision-making can be defined as the process of selection of the more appropriate response (e.g., moving towards an empty space to receive the ball) or functional action (e.g., passing or shooting the ball) among several options, with the purpose of achieving a specific goal in the game (Abernethy, 1996; Hastie, 2001). The decision-making skill is also based on players' game reading skill, which can be defined in soccer as the players' ability to notice and integrate the moving information on the field, including the ball, teammates, opponents, as well as the actions they perform (Hartigh et al., 2018; Teoldo et al., 2022; Williams & Reilly, 2000). In the context of soccer, the game reading and decision-making skills seem to be associated to players' sport development, as well as to the achievement of high competitive levels (Keller et al., 2018; Williams & Reilly, 2000).

A recent study carried out with U-18 Australian soccer players competing at the national level (participating in the major league of Australia) indicated that those players were able to make better decisions compared to players competing at the state level (competing in the league of their state) (Keller et al., 2018). Moreover, Cardoso et al. (2020) showed

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that youth soccer players (age 16.7 ± 3.1 years) who were faster decision-makers had better game reading skills compared to their colleagues slower on decision-making skills. In addition, those players with faster decisions possessed more efficient visual search strategies and had less cognitive effort to make decisions than their colleagues. In the study carried out by O'Connor, Larkin, and Williams (2016), decision-making skill was the most important among 11 perceptual-cognitive (decision-making, anticipation, situational probability, pattern recognition, combined perceptual-cognitive performance) and developmental variables (accumulated hours on match-play, coach-led practice, individual practice, peer-led play, indirect involvement, number of other sports participated) for distinguishing selected and non-selected U-15 players for an elite club (players from a major league in Australia). Findings indicated that selected players displayed better decision-making skills than the non-selected ones. In light of these studies, it is possible to confirm the importance of the decision-making skill for athletes' development in soccer.

Regarding the development of the decision-making skill, literature highlights the importance of athletes experiencing a great amount of structured sport practice (e.g., team training) throughout their development process (Berry et al., 2008). Besides, it is necessary that much of this time focused on structured practice includes activities that enable the interaction of perceptual-cognitive and technical skills, as through the utilization of small-sided games, which provides a rich environment to foster the players' game reading and decision-making skills (Machado et al., 2017; Machado et al., 2019; O'Connor & Larkin, 2016). Another characteristic of this component is its straight connection to the tactical dimension of soccer, since every action in the game has a tactical purpose (Garganta, 2009). A recent study showed that activities in coach-led practice based on small-sided and conditioned games, which seek to develop both group tactics (2x2 up to 4x4) and collective tactics (5x5 up to higher structures), were the main activities that developed both offensive and defensive decision-making skills in youth soccer players, among other activities in practice, such as, individual, peers and drills (Machado et al., 2020).

Hence, it is important to develop players' decision-making skill according to the tactical contents recommended for each stage during their sport pathways (González-Víllora et al., 2015). Literature indicates that from age 11 onwards it is necessary to develop tactical content related to the core tactical principles, particularly those related to behaviors outside the center of play (Teoldo et al., 2022). Besides, the development of this type of content should be aligned with the process of continuous evaluation (Badari et al., 2021; Barquero-Ruiz et al., 2019). Thus, it is necessary to resort to instruments that enable the assessment of players' decision-making skill based on the core tactical principles, so as to ensure the coherence of the processes of teaching and training.

In this context, previous studies focused on evaluating the effectiveness of interventions in soccer, by aligning teaching contents and tactical assessments, based on the core tactical principles of the game (Lima et al., 2015; Souza et al., 2014). In both studies, authors sought to verify the effectiveness of training organization based on the core tactical principles on the tactical performance of U-13 and U-14 players. They observed that training organization led to an overall improvement of the tactical performance of players from both age groups.

Although these studies indicated that training organization based on this content can improve players' tactical performance, none of them addressed the assessment of the quality of decision-making. Therefore, it is necessary to verify whether the decision-making skill might be influenced by a similar training organization. Another aspect to be taken into account refers to the fact that their structuring takes into consideration the athletes' individual needs of improvement, and not only the collective needs of the team, as occurred in the aforementioned studies. Despite the fact that soccer is a team sport, there is the need to individualize training according to the needs of each athlete, so as to optimize time and potentialize players' development (Andrade et al., 2021).

Consequently, a study that seeks to investigate the effectiveness of training systematization on players' decision-making skill, through a process of individualization of players' training according to their needs, can support coaches' work and provide a new perspective for a more individualized approach for the teaching of team games. Thus, the aim of this study is to verify the influence of 25 training sessions on the decision-making skill of U-12 soccer players.

METHOD

Sample

In the present study, 25 U-12 male soccer players (aged 12.0 ± 0.2 years), participating in national/international competition, from a Brazilian Serie A club were evaluated. The athletes had training experience in soccer of 5.4 ± 1.9 years and trained in the club for 1.9 ± 1.1 years. In order to be included in the sample, participants had to be a regular academy player, training four times a week, two hours per session.

Data collection was performed with previous authorization from club's representatives and players' legal guardians. The study was approved by the Ethics Committee for Research with Human Beings of the Universidade Federal de Viçosa (CAAE: 2.312.402) and is in accordance with the norms

established by the World Medical Association Declaration of Helsinki (2013) for research with human beings. An informed consent was signed by participants' legal guardians.

Instruments

The instrument used to assess players' decision-making skills was the TacticUP® online platform (Machado & Teoldo, 2020) - www.tacticup.com.br. This platform enables the assessment of players' decision-making skills based on the core offensive and defensive tactical principles of soccer (see Figure 1) (Teoldo et al., 2022). These principles allow players to find effective solutions for game situations through the management of playing space, and were proposed because they display central aspects of the process of teaching tactical skills. Besides, these principles provide objective measures of players' movements, with respect to the management of playing space.

The TacticUP® video test comprises video sequences (scenes) of offensive and defensive 11vs.11 actions, obtained from official soccer matches. Each scene has duration from 5 to 7 seconds. The videos are displayed from a panoramic perspective, which is an elevated view of an object from above. This perspective enables players to visualize the offensive and defensive core tactical principles, near or far from the ball. The test includes scenes of each of the core tactical principles, in both offensive and defensive phases of play. In each scene, four possibilities of solution for the respective situation are shown. Participants should select the more appropriate solution for each scene. Prior to the start of the test, the online platform provides participants with instructions about the test structure and assessment procedures, in addition to three trial scenes, for familiarization with the task. These three scenes include: two offensive sequences (one scene showing the observed player in possession of the ball, and another scene with the observed player without possession); and a defensive sequence (the observed player is in the defensive phase). These three conditions allow participants to familiarize with the different kinds of video sequences they will be shown subsequently.

Procedures

TacticUP® Assessment

The assessment through TacticUP® occurred in two steps: i) diagnostic evaluation of players' decision-making skills prior to the start of the systematic training intervention (May 2019); ii) evaluation immediately following the end of the training intervention (July 2019). The first assessment was performed immediately after the first competition of the age group in the 2019 year, whereas the second took place on the two days following the end of the 25 training sessions.

The athletes evaluated were divided in groups of five for taking the test. Each athlete had access to a computer with internet availability, in order to access the platform and take the test individually. All available computers were DELL Optiplex 3020 with i5 4570 processor – 4GB RAM and DELL screen, 18.5 inches, and were located in a single room. The test was carried out by the main researcher and each group of five players took approximately 25 minutes to finish the test. All athletes were assessed in two consecutive days, always prior to the start of the training session.

Organization of the 25 Training Sessions

Following the first athletes' assessment, 25 training sessions were designed based on the individual needs of improvement or maintenance of decision-making skill, related to the core tactical principles of soccer. These sessions were weekly planned (four sessions a week) taking into account players' development in previous training sessions and competitions, as observed by the coaching staff. Players were ranked and sorted in 3 performance groups, according to each tactical principle, which were categorized as: i) high; ii) regular; and iii) low.

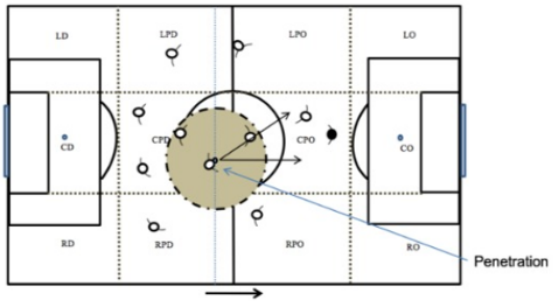
Throughout the 25 training sessions designed by the coaching staff, the first activity was focused on the core tactical principles of soccer, with the purpose of improving players' decision making. These activities had average duration of 36.7 ± 7.6 minutes (minimum time = 28 minutes; maximum time = 50 minutes) per session.

The coaching staff discussed the aims of the training sessions in planning meetings held at the start of each week, in which they selected the coaches responsible for supervising each activity, and also defined the feedbacks to be provided to the players, with respect to the performance indicators related to the tactical principles on which the activities were focused in each training sessions (Figure 2). Feedbacks occurred during training (without a break), post-training (group talk showing the tactical board) and also on the day after training, individually, in case of need.

The interactions within the activities were organized according to the athletes' performance levels (e.g., an athlete with high performance in relation to principle X, against an athlete with high performance in relation to principle Y). These interactions could be modified according to the context of a given proposed activity (Figure 2).

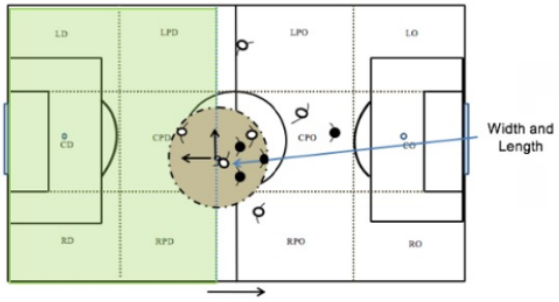
At the end of each training session, coaches and the technical coordinators held meetings to provide feedback about how each group performed the exercises, in addition to perform adjustments regarding the structure of the activities proposed for the next training sessions.

a) Offensive Principles



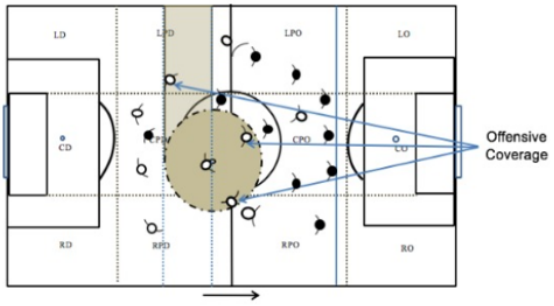
Penetration

Action to advance with the ball to the opponent's goal line, that is, to decrease the distance between the player in possession of the ball and the opponent's goal.



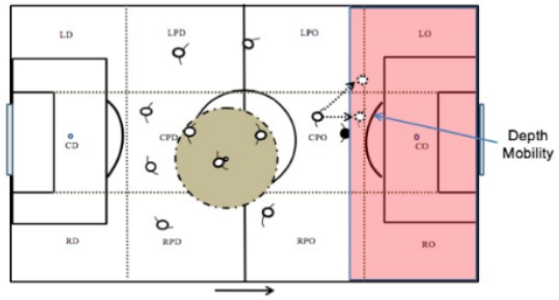
Width and Length with the Ball

Movements of the player in possession of the ball towards the own team's goal line or either touch line, in order to gain space and time for a better subsequent action.



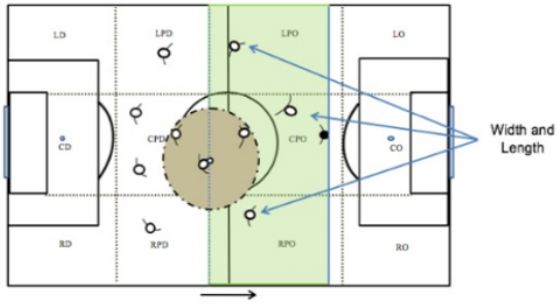
Offensive Coverage

Actions of approaching or distancing of the player in possession of the ball, to ensure safe passing line/zones and increase the speed and rhythm of play (inside the center of play).



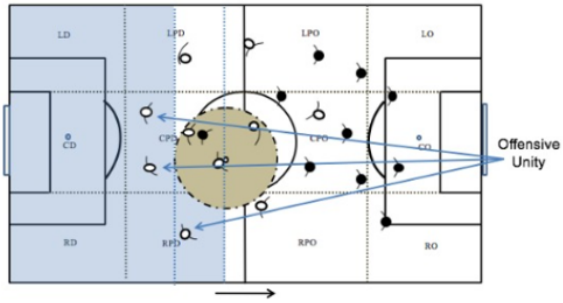
Depth Mobility

Movements performed by the players without the ball behind the back of the last line of defenders.



Width and Length without the Ball

Movements of the players without the ball performed ahead of the line of the ball (outside the center of play), in order to allow longer and deep passes.

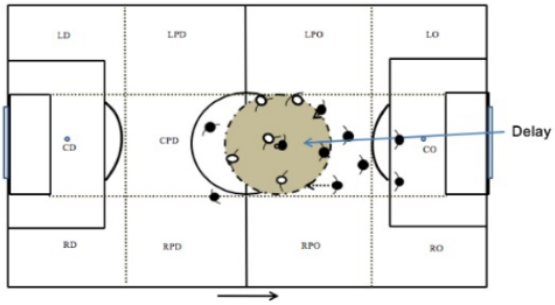


Offensive Unity

Action of organization of the attacking lines in order to maintain teams' unity and allow a more collective play.

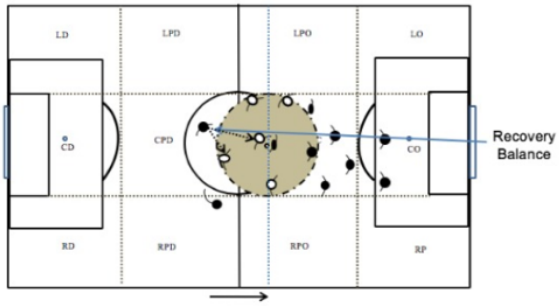
Figure 1. Description of the core tactical principles of soccer: a) offensive; and b) defensive (Source: Teoldo, Guilherme & Garganta 2022).

b) Defensive Principles



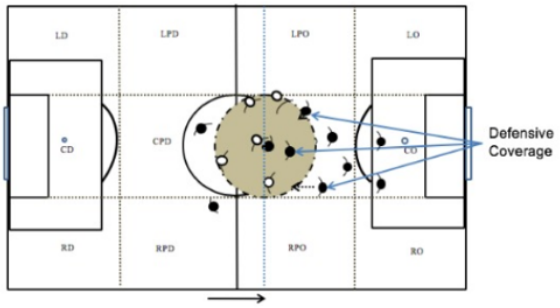
Delay

Actions to delay the player in possession of the ball to move towards the goal.



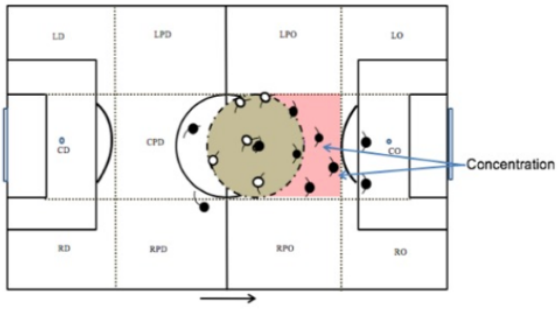
Recovery Balance

Movements of defensive players performed in the less offensive half of the center of play to increase pressure on the player in possession of the ball, in order to recover the ball or reduce passing lines behind the ball line.



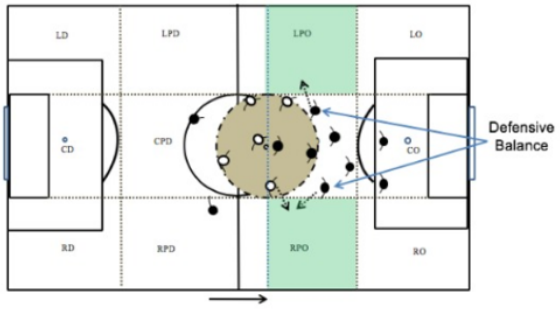
Defensive Coverage

Actions to ensure support to the first defender who is performing delay to the player in possession of the ball.



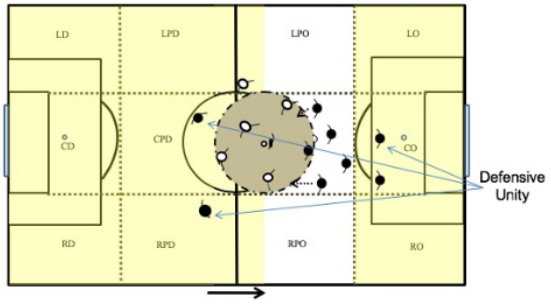
Concentration

Movements of the defensive players performed to increase protection of the goal and force the opponent's attacking actions towards the sides of the field.



Defensive Balance

Movements performed in zones of play to ensure defensive stability for the team (allow better defensive balance).



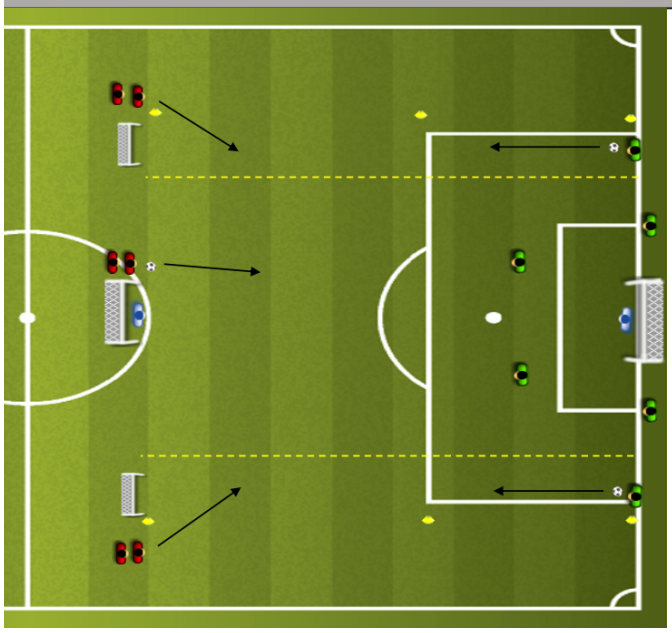
Defensive Unity

Actions to ensure the organization of the defensive lines to allow the team to defend as a unity or block and obtain more defensive protection.

Figure 1. Cont.

CONTENTS AND PURPOSES			
Type of Principle	**Principle 1**	**Principle 2**	**Principle 3**
Principle	Penetration	Delay	-
Performance Indicator	Enable shot or dribbling	Prevent progression and shot at goal	-
Purpose	Directly attack the opponent or the goal	Limit the space of the player in possession for offensive actions	-

ACTIVITY 1



Number of Players	14 (in each area)
Time (min)	30
Dimensions	Length: 50m / Width: 40m
Series x Duration	2 x 15
Description	The aim of the attacking players (in red) is to quickly progress throughout the opponent's area, with the purpose of shooting at goal, thus taking advantage of numerical superiority. After the end of each bout, the athletes near the side corridors have to quickly change their attitude and perform a delay action towards the opposing players who will be in possession of the ball, performing the principle of penetration.
Variations	-
	-
	-

ORGANIZATION OF ACTIVITY INTERACTIONS
Part 1 (Athletes with high performance in penetration x athletes with high performance in delay). Part 2 (Athletes with regular performance in penetration x athletes with regular performance in delay). Part 3 (Athletes with low performance in penetration x athletes with low performance in delay).

PLAYERS FEEDBACK			
Performance Group	**High Performance**	**Regular Performance**	**Low Performance**
Feedback	Adjustments, for both high and regular performance groups, on the utilization of the arms to provide support when challenging an opponent; stimuli to encourage agressiveness and speed when performing penetrations were also provided.	Adjustments, for both high and regular performance groups, on the utilization of the arms to provide support when challenging an opponent; stimuli to encourage agressiveness and speed when performing penetrations were also provided.	In this group, some athletes had difficulties in defensive actions of limiting the space of the player in possession. Adjustments were made in this respect.

Figure 2. Exemplar planning and organization of a training activity based on the core tactical principles.

The average training time per player for the tactical principles are displayed in Table 1.

Time control regarding the training contents taught during the 25 training sessions was carried out according to the groups of tactical principles, which were categorized as follows: i) offensive principles inside the center of play (OICP) (penetration, offensive coverage and width and length with the ball); ii) offensive principles outside the center of play (OOCP) (width and length without the ball, mobility and offensive unity); iii) defensive principles inside the center of play (DICP) (delay, defensive coverage and recovery balance); and iv) defensive principles outside the center of play (DOCP) (defensive balance, concentration and defensive unity). This categorization was performed due to the spatial relations between these principles and the center of play, as well as their hierarchical relation within the teaching-learning process. The tactical principles performed inside the center of play display less complexity regarding their execution, when compared to those performed outside the center of play.

Table 1. *Means and standard deviation of training time of the core tactical principles, considering the 25 players within the squad.*

Principles	Time (min)
Offensive	
Inside the center of play	478.6 ± 140.4
Outside the center of play	223.5 ± 76.8
Defensive	
Inside the center of play	630.7 ± 192.3
Outside the center of play	190.6 ± 83.8

According to Teoldo et al. (2022), the center of play is a dynamic spatial reference employed to characterize where the game is played more intensely/quickly. Its radius is 9.15 meters from the epicenter of play. With respect to this space, it is assumed that ball transmission between teammates is facilitated when they are located inside the center of play and/or when opponents are located farther than the distance of the radius and the player in possession needs to pass the ball to a teammate outside the center of play. In the case of the players located inside the center of play, ball transmission is facilitated, as the distance between the player in possession and the potential receiver is lower, thus allowing for more efficient technical actions and increased ball transmission speed.

As the activities and their interactions are planned according to the players' individual needs, the amount of training time for each principle was not similar for all players, taking the 25 training sessions into account. The training time of each player, for each tactical principle, is displayed in Table 2.

Also, the contents taught in each training session are displayed in Table 3.

Statistical Analysis

Statistical analysis of data initially included the calculation of players' performance variation, considering the assessment carried out before the start of the intervention, as well as after it ended. The calculation was performed through the following formula (([post-intervention result] – [pre-intervention result]) / [pre-intervention result]), and results were described as percentages. For each player, values generated following this calculation could be positive, if there was an increase in decision-making skill, or negative, if decision-making skill decreased. This calculation was performed for each group of principles, categorized as OICP, OOCP, DICP and DOCP.

After obtaining these results, data distribution was verified through the Shapiro-Wilk test. The relation between performance variation and training time accumulated in the 25 sessions was calculated through Pearson's correlation. Significance level was set at $p < 0.05$. Effect sizes (r) followed the interpretation proposed by Cohen (1988, 1992) and were categorized as: small (0.01 – 0.29); medium (0.30 – 0.49) and large (0.50 – 1.00). Statistical procedures were performed through IBM SPSS®, version 22.0

RESULTS

Table 4 displays the results of the correlation between performance variation in decision-making skill and training time across the 25 sessions, accounting for the groups of core tactical principles, categorized as offensive principles inside the center of play (OICP), offensive principles outside the center of play (OOCP), defensive principles inside the center of play (DICP) and defensive principles outside the center of play (DOCP).

Results indicated a positive and moderate correlation between performance variation related to the offensive tactical principles outside the center of play and training time ($r = 0.413$; $p = 0.040$) dedicated to such principles (OOCP). In other words, this means that the more time dedicated to training these principles, the higher the positive performance variation of decision making for these principles.

DISCUSSION

This study aimed to verify the influence of 25 training sessions on the decision-making skill of U-12 soccer players. Results showed a positive correlation between performance variation of decision-making skills and training time dedicated to tactical principles performed outside the center of play (width and length without the ball, mobility and offensive unity). These principles are related to offensive actions performed more distant from the ball, such as: i) organization of attacking lines behind the ball line (offensive unity); ii) movements ahead of the ball line that enable longer wide and/or deep passes (width and length without the ball); iii) movements performed behind the back of the last line of defense (mobility).

Table 2. *Individual training time for each principle.*

Principles	Players – time for each principle (minutes)																								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Offensive																									
Penetration	146	166	166	166	146	166	166	146	166	166	166	166	166	166	146	166	166	146	146	146	166	146	146	166	146
Offensive coverage	301	301	349	301	265	265	301	301	265	265	265	349	313	301	301	301	265	265	313	301	265	265	301	301	301
Width and length with the ball	66	66	66	66	66	66	66	68	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66
Width and length without the ball	168	158	138	168	98	168	128	168	153	98	98	138	138	113	168	98	128	128	138	168	168	138	98	153	128
Mobility	68	158	68	158	68	68	68	40	85	68	40	68	68	158	68	68	40	113	40	130	40	40	40	85	113
Offensive unity	45	0	45	0	45	0	45	0	0	45	45	45	45	0	45	45	45	0	45	0	45	0	0	0	45
Offensive principles inside the center of play	513	533	581	533	477	497	533	513	497	497	497	581	545	533	513	533	497	477	525	513	497	477	513	533	513
Offensive principles outside the center of play	281	316	251	326	211	236	241	208	238	211	183	251	251	271	281	211	213	241	223	298	253	178	138	238	286
Defensive																									
Delay	398	418	408	378	468	378	418	426	406	448	476	408	408	448	398	448	446	438	456	426	406	456	496	406	466
Defensive coverage	210	210	210	210	294	294	210	210	254	246	246	210	246	294	258	258	294	246	246	218	206	254	180	140	228
Recovery balance	0	0	0	0	0	0	85	0	0	45	0	0	0	0	40	0	85	0	0	0	45	45	0	0	85
Defensive balance	76	116	266	116	261	121	116	76	116	171	306	221	251	116	76	291	116	116	161	116	116	161	236	116	116
Concentration	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28
Defensive unity	0	45	0	45	0	45	0	45	45	0	0	0	0	45	0	0	0	45	0	45	0	45	45	45	0
Defensive principles inside the center of play	608	628	618	588	762	672	713	636	660	739	722	618	654	742	696	706	825	684	702	644	657	755	676	546	779
Defensive principles outside the center of play	104	189	294	189	289	194	144	149	189	199	334	249	279	189	104	319	144	189	189	189	144	234	309	189	144

Table 3. *Tactical principles taught, and training time per session.*

Session	Tactical principles taught	Time (min)
1	Penetration; Delay	48
2	Mobility; Delay	28
3	Defensive Coverage; Offensive Coverage	36
4	Width and length without the ball; Defensive Balance	36
5	Width and length without the ball; Defensive Balance	36
6	Mobility; Delay; Defensive Balance	40
7	Defensive Balance, Width and length without the ball; Delay	40
8	Offensive Coverage; Delay	50
9	Defensive Coverage; Delay	48
10	Defensive Balance; Recovery Balance	40
11	Defensive Unity; Offensive Unity	45
12	Defensive Balance, Delay; Width and length without the ball	30
13	Offensive Coverage; Delay; Defensive Coverage	30
14	Offensive Coverage; Delay; Defensive Coverage	40
15	Mobility; Defensive Balance; Recovery Balance	45
16	Width and length without the ball; Defensive Coverage; Width and length with the ball	30
17	Width and length without the ball; Penetration; Concentration	28
18	Width and length without the ball; Offensive Coverage; Defensive Coverage	40
19	Penetration; Width and length with the ball; Delay	30
20	Offensive Coverage; Delay	40
21	Offensive Coverage; Delay	40
22	Offensive Coverage; Mobility; Defensive Balance	45
23	Penetration; Delay	30
24	Defensive Coverage; Delay; Penetration	30
25	Defensive Coverage; Width and length without the ball; Delay	40

Table 4. *Correlation between performance variation of decision making and training time accumulated throughout the 25 sessions.*

Performance Variation	Training time			
	OICP	OOCP	DICP	DOCP
Offensive principles inside the center of play	0.009	-	-	-
Offensive principles outside the center of play*	-	0.413	-	-
Defensive principles inside the center of play	-	-	0.035	-
Defensive principles outside the center of play	-	-	-	0.138

* $p < 0.05$. OICP = Offensive principles inside the center of play; OOCP = Offensive principles outside the center of play; DICP = Defensive principles inside the center of play; and DOCP = Defensive principles outside the center of play.

These results show the importance of individualizing the stimuli provided through the training process, with respect to players' individual needs, as structured in the present study (Teoldo & Machado, 2022). This individualization must be in accordance with the content proposed for the athletes' development phase, which, in the case of an U-12 team, is related to the core tactical principles of soccer, regarding the tactical component (Teoldo et al., 2022). In addition, these results indicate that players from this age group are already able to develop their decision-making skill related to the principles outside the center of play, as has already been suggested by literature (Américo et al., 2016).

Teoldo et al. (2022) highlight that the core tactical principles of soccer demand abstract thinking and hypothesis

testing to enable space occupation and movement throughout the playing field. Therefore, it is suggested that they should be the target of the training of the tactical component by around 11 or 12 years of age, particularly the principles performed outside the center of play, when the child's cognitive development stage is already (or close to becoming) fully mature (Gallahue et al., 2013; Piaget, 1964).

Another aspect to be taken into account is that this development stage must be exploited by the coach to encourage the decentralization of players in relation to the ball, such as in actions performed outside the center of play (González-Víllora et al. 2012). Results of this study endorse this recommendation through empirical data, thus reinforcing the importance of teaching contents related to actions more distant from the ball (outside the center of play) in training sessions, early in this stage, since players already possess the skills necessary to assimilate these principles (González-Víllora et al. 2012).

Hence, the systematic application of these tactical contents may contribute positively to the performance of athletes from this age group, especially to their collective organization (Lima et al. 2015). Thus, the systematization of contents and the interactions between players during the activities with the purpose of solving tactical problems, seeking to comprehend the spaces of play and stimulating the decision-making skill fosters significant improvements for the learning of tactical skills by players within the initial development stages. This contributes to the development of players capable of quickly and effectively solving problems that arise from the game (Aquino et al. 2015).

The results regarding the non-significant correlations between performance variation of decision-making skill and training time include the offensive and defensive principles inside the center of play, as well as the defensive principles outside the center of play. The results regarding the principles performed inside the center of play may be related to the higher performance level expected for the principles inside the center of play, when compared to those performed outside the center of play, for this age group (Teoldo et al., 2010). This occurs because most stimuli near the ball (i.e., inside the center of play) are performed in training since the early years (e.g., from 4 and 5 years of age) of sports development (Teoldo et al., 2010).

Besides, research emphasizes that during this development period (i.e., approximately up to 12 years of age) players want to be protagonists of the game, to frequently have the ball, thus being likely to put more effort to learning the technique aspect of the game ("me and the ball"), without considering the solutions for the problems that arise distant from the ball (González-Víllora et al., 2010; González-Víllora et al., 2011; González-Víllora et al., 2012). It can also be noted that, during this period, players respond more efficiently to the actions of the game when they act in direct relation with the ball (González-Víllora et al., 2010). This characteristic is likely associated to the longer teaching time mainly focused on this type of content (i.e., actions near the ball). Thus, the longer time of stimuli they experienced throughout their development leads to an accumulation of knowledge about these actions.

Therefore, it is possible to observe the tendency of players to display more developed levels of knowledge and performance with respect to actions near the ball, when compared to those distant from the ball (González-Víllora et al., 2010). As the execution of these actions near the ball are more consolidated, it may be necessary longer time of training stimuli, in order to allow their evolution regarding this component (Mesquita et al., 2012). This may explain the fact that no significant correlation was observed between training time and performance variation of the decision-making skill for the (offensive and defensive) principles inside the center of play.

As for the non-significant results regarding the correlation between training time of the defensive principles outside the center of play and performance variation of the decision-making skill, some factors may be involved. We can draw attention to the fact that this group of principles was the one least stimulated during the training sessions, among all four categories of principles (see Table 1). Also, the focus of training interventions was mainly directed to the offensive phase of play, whereas the defensive phase was a secondary target. Another possible explanation may be related to the decision-making skill in the defensive phase, which, apparently, displays slower development when compared to the offensive phase, as described in several studies (González-Víllora et al., 2010; González-Víllora et al., 2011; González-Víllora et al., 2013).

One limitation of the study is the fact that a pedagogical progression of contents was not carried out, as training sessions did not progress from the less (core tactical principles inside the center of play) through the more complex contents (core tactical principles outside the center of play). Such a strategy could be accounted for in future studies. In addition, we suggest that further research increases the duration of the activities and the number of training sessions based on the core tactical principles, between the period of tests. Activities with tactical (particularly defensive) contents outside the center of play could also be emphasized, with the purpose of investigating the effect of a greater volume of stimuli of these contents on this age group. Lastly, we suggest that a similar intervention protocol be developed in other age groups or competitive levels (e.g., soccer schools), as well as different team sports.

Practical Implications

Overall, in light of these findings, it is possible to verify that the design of training activities taking into account the core tactical principles of soccer for the U-12 age group enables the improvement of athletes' decision-making skill, especially for the offensive actions outside the center of play. This improvement seems to be related to players'

knowledge acquisition and increased ability to read the game (Hartigh et al., 2018; O'Connor et al., 2017). Apparently, it is possible to achieve these results, given that training contents are organized and practiced based on objective information about players' individual characteristics and improvement needs (Teoldo et al., 2021). These findings may encourage coordinators and coaches of team-sports teaching programs to resort to an approach based on participants' individual needs.

Thus, this study shows the effectiveness of the systematization of training sessions (based on the core tactical principles of soccer) to improve the decision making of U-12 soccer players. In addition, the study indicates that players between 11 and 12 years old are already able to learn soccer contents whose operationalization demands abstract thinking. Literature suggests, through theoretical studies (Teoldo et al., 2022; Teoldo et al., 2009), that players from this age (i.e., 11 and 12 years old) are able to start learning the contents (core tactical principles of soccer) addressed in this study. However, for all we know, this is the first empirical study, carried out with players from this age group, which tested the theoretical assumption that learning of such contents at this age is possible and, thus, contributes to the scientific literature by supporting this teaching guideline.

Regarding the competitive context, this type of intervention can contribute to greater understanding and game reading capacity of individual and collective actions of the game by athletes. It also allows to positively collaborate towards greater organization and distribution of the team in the game space and greater perception, interpretation, and more efficient decisions to solve tactical problems near and far from the ball presented during the game.

In summary, we verified that U-12 elite players (participating in national/international competitions) are already able to learn contents related to the offensive tactical principles outside the center of play (width and length without the ball, mobility and offensive unity). Furthermore, the use of this kind of systematization enables the optimization of training time for players, as the activities account for the players' needs of individual development, based on objective assessments of their decision-making skill. This subsidizes the utilization of such a methodology by coordinators and coaches of team-sports training programs. As training design is focused on players' individual needs, there is a greater need for planning activities and training goals, as well as for a greater integration of the coaching staff, in order to operationalize this proposal.

CONCLUSION

It is concluded that 25 training sessions based on the core tactical principles of the game improved the decision-making skill of U-12 soccer players, with respect to their movements outside the center of play. This improvement is mainly associated to the decision-making skill related to the core offensive tactical principles performed outside the center of play (width and length without the ball, mobility and offensive unity).

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