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Original Article

TACTICAL BEHAVIOR IN SOCCER SMALL-SIDED GAMES: INFLUENCE OF TACTICAL KNOWLEDGE AND NUMERICAL SUPERIORITY

COMPORTAMENTO TÁTICO EM PEQUENOS JOGOS NO FUTEBOL: INFLUÊNCIA DO CONHECIMENTO TÁTICO E DA SUPERIORIDADE NUMÉRICA

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RESUMO

Este estudo investigou a influência do conhecimento tático processual (CTP) e da superioridade numérica no comportamento tático de jogadores de futebol durante pequenos jogos. Dezoito atletas de futebol do sexo masculino configuraram seis equipes de três jogadores cada, três delas compostas pelos atletas com maior desempenho no teste de CTP e as outras três equipes constituídas pelos jogadores com menor desempenho. Realizaram-se seis dias de coleta, totalizando 24 séries de jogos de 4 minutos de pequenos jogos. Utilizou-se ANOVA Two-way (grupo x jogo) para análise dos dados. Resultados apontaram ausência de interação entre fatores grupo e jogo, sendo estes analisados isoladamente. No fator grupo observou-se diferença significativa no parâmetro “espaço sem bola”, realizado com maior frequência no grupo com menor conhecimento tático. No fator jogo, a configuração 3vs.3 apresentou maior incidência de penetrações, enquanto a configuração 4vs.3 apresentou maior incidência de unidade (ofensiva e defensiva), cobertura defensiva e equilíbrio de recuperação. Conclui-se haver diferenças nas configurações de jogo, cabendo às comissões técnicas adequá-las à intencionalidade da sessão de treino.
Palavras-chave: Futebol. Pequenos Jogos. Avaliação tática. FUT-SAT.

ABSTRACT

This study investigated the influence of procedural tactical knowledge (PTK) and numerical superiority on the tactical behavior of soccer players during small-sided games. Eighteen male soccer players were divided into six teams, of which three showed higher PTK, and three lower PTK. Data was collected over six days, with two 4-minute sets of small-sided games held by group. Tactical behavior was assessed through FUT-SAT. Two-way ANOVA (group x game) was used for data analysis. In the group factor, only width and length principles showed difference, being more frequent in the lower PTK group. As for game factor, 3x3 SSG presented higher penetration incidence, while in the 4x3 SSG players performed more actions of unity (offensive and defensive), defensive coverage and balance. It is concluded that PTK levels have lower influence on tactical behavior than on game situation.
Keywords: Soccer. Small-sided games. Tactical performance. FUT-SAT.

Introduction

Soccer is an invasion team sports game (TS) played within a common space and with simultaneous actions between attack and defense[1]. Just as other invasion sports, soccer has remarkable characteristics such as variability and unpredictability of game situations[2]. This poses problem situations to be solved through resorting to different solutions. This diversity of actions happens in a non-linear way, outside of a sequential logic; therefore, an efficient action depends not only on the mastering of techniques, but concomitantly requires the mastering of tactical principles, since without the application of those principles technique becomes meaningless[3]. In this way, it is understood that level of tactical knowledge has a direct influence on a player’s tactical behavior, because in the game information flow is constantly changing, which demands, beyond the good execution of game actions, the ability to make decisions about them[4]. Thus, a player can only perform a certain behavior efficiently by resorting to the knowledge he has of the game[5]. This information is founded on previous studies, which show a greater capacity of predicting precisely the opponent's actions in a certain situation by experienced players[6,7]. In the literature, tactical knowledge level can be measured based on two constructs: declarative and procedural knowledge[8], which manifests in sports as "knowing what to do" – declarative tactical knowledge (DTK) – and "knowing how to do" – procedural tactical knowledge (PTK)[9].

In TS teaching, small-sided games are means able to bring training content close to game real conditions[10]. In this context, studies conducted with soccer players investigated small-sided games and the behavior of technical[11], physiological[12] and tactical[13] variables, arguing that changes in game structure, understood as "task constraints"[14], should be imposed taking into consideration individual performance levels (i.e. experience and level of tactical knowledge)[15] and objectives (technical, tactical and/or physical conditioning) to be achieved. However, in experimental designs of most studies the handling of "task constraints" does not take into account individual differences related to PTK. Considering that PTK levels may have an influence on tactical behavior response, the possibility of extrapolation of some studies results is limited. In this way, lack of knowledge about the influence of PTK levels of athletes on the handling of small-sided games stands as a methodological gap, since specific knowledge of the game is regarded as a basic aspect for decision making[16] through the action-perception[17] cycle, thus guiding behavior during the game.

When it comes specifically to tactical aspects, small-sided games enable a diversity of game situations that require from participants constant decision making determined by the tactical objectives of the game in each specific situation, frequently occurring under pressure and time limitation[6,18]. Costa et al[13] investigated the influence of a game field's dimensions on tactical actions of sub-15 players according to 10 fundamental tactical principals of soccer and pointed greater differences in defensive aspects favorable to smaller-sided pitches.

Previous studies investigated small-sided games involving settings with numerical equality[13]. However, in those games the attacking team sought to keep the ball while creating situations of numerical superiority that contribute to achieving the opponent's goal and the definition of the action. This creation of numerical superiority is a common situation in the game context and generally has an influence on game results[19]. Although numerical superiority is a frequent condition in the game context[20], there are few data available concerning its influence on the behavior of players during small-sided soccer games. The impact of numerical superiority on tactical behavior response, considering different PTK levels of teams, can provide information for a better understanding of the prescription of small-sided games, just as for a better training planning through a better organization of activities and of possible responses expected in different training situations. Therefore, the present study aims to investigate the influence of tactical knowledge levels and presence of numerical superiority on the tactical behavior of young soccer players.

Methods

Sample

Eighteen young athletes participated in this study (6 defenders, 6 midfielders and 6 forwards 16.4 ± 0.7 years old) of a soccer team from the city of Belo Horizonte that participates in national competitions and perform on average seven weekly training sessions. Both athletes and legal guardians were notified on the research procedures and signed an informed consent form. The study was approved by the Federal University of Minas Gerais Research Ethics Committee, registered under No 29215814.8.0000.5149.

Procedures

First, athletes were divided into two groups, being one with greater procedural tactical knowledge (G1) and the other with less knowledge (G2). For such a purpose, the Procedural Tactical Knowledge Test was used (PTKT)[21]. In this stratification process from the PTKT, the 18 athletes were divided into 3 groups of 6 athletes of equal positional status, i.e. 6 defenders, 6 midfielders and 6 forwards. Each group was composed of two teams with 3 athletes of equal positional status; each athlete was allocated into one of the teams randomly. Thus, these two teams played two games against each other, which were filmed with a JVC HD *Everio* GZ-HD520 digital camera for further PTK analysis. PTKT results led to a performance ranking of the athletes within each positional status. By doing so, it was possible to divide the sample into two groups: Group 01 – G1; composed of the three athletes with the greatest performance in PTKP of each positional status, N=9; Group 2 – G2; composed of the three athletes with poorer performance in PTKT of each positional status, N=9. Subsequently, each group was divided into 3 teams (A, B and C) with 3 athletes; each team counted with one defender, one midfielder and one forward. Finally, another criterion adopted for the composition of each team was that a certain team could not have two athletes at the same level in the performance ranking so the teams were kept even. The criteria above reported determined the allocation of athletes within each team. Chart 1 shows in a schematic manner the composition of the teams. The athletes of group 1 (G1) showed a significantly higher number of tactical actions during the PTKT (χ^2=3.64 p=0.05) compared to the athletes of group 2 (G2)

Group 1 (G1)			
Team A1	D^{1*}	M^3	F^2
Team B1	D^2	M^1	F^3
Team C1	D^3	M^2	F^1
Group 2 (G2)			
Team A2	D^4	M^6	F^5
Team B2	D^5	M^4	F^6
Team C2	D^6	M^5	F^4

Figure 1. Systematization adopted for team composition considering performance level in PTKT and positional status.

Legend: G1 – Athletes with better performance in PTKT and; G2 – Athletes with worse performance in PTKT; D - Defender; M – Midfielder; A - Forward.

* The superscripted number indicates PTKT performance ranking – with 1 being the best and 6 the worst in the ranking of each positional status.

Source: The authors

After teams were composed, tactical behavior was assessed based on the System of Tactical Assessment in Soccer – FUT-SAT[3]. For the application of FUT-SAT, it was defined that G1 teams would not play against G2 teams, aiming to reduce the influence of the opponent's level on observed behaviors. FUT-SAT was used for assessment in two game settings: 3x3 (goalkeeper plus three outfield players for each team – numerical equality) and 4x3 (goalkeeper plus three outfield players for each team and an additional player, playing for the attacking team – numerical superiority). In this numerical superiority setting, the additional player, distinguished with a shirt of different color, participated only in the offensive process. This player was allowed to perform all actions of the offensive process, including finishings and corners. When a team lost possession, the additional player automatically joined the other team with the ball and performed offensive actions for the new team. Data collection sessions involving small-sided games were balanced out so all teams from the same group played equal number of games against each other in the proposed settings.

All games were played at the same hour each day so as to standardize the influences of circadian rhythms. The game area used was 36 x 27 meters for representing a relative area per athlete similar to the reality of the formal game; goals measuring 6 x 2 meters were used[3]. Four auxiliary balls were placed at the sides of the pitch. All formal soccer game's rules were used, including the offside rule. Two coaches stood at the sides of the pitch and provided constant external encouragement[22]. Familiarization with small-sided games occurred during two consecutive sessions separated by 48 hours. Each familiarization session lasted 30 minutes, in which players were subjected to the two proposed settings (3x3 and 4x3). At the beginning of each data collection session, a 4-minute standard preparatory activity was carried out. Data collection sessions were done through the protocol with 2 series of 4 minutes each – enough time for soccer game tactical principles manifested according to[3] – and 4 minutes for passive recovery between series[23-25]. With the aim of preventing fatigue effects on the observed behavior, both data collection sessions for each team (i.e., Team A1 x B1 and A1 x C1) were held on alternate days, with a minimum of 48 hours between sessions.

Instruments

Procedural Tactical Knowledge Test (PTKT)

The PKPT consists of a game between two teams with the 3x3 setting within a 9x9 game area, in which the objective of the team with ball possession (attacking team) is to pass as much as possible in the course of the four (4) minutes of test[21]. In the present study, the TPKP was performed 3 times, that is, three games between teams composed of athletes of equal positional status (i.e., 3 forwards against 3 forwards). There was a 4-minute interval between each game. All games were filmed with a JVC HD *Everio* GZ-HD520 camera placed diagonally in relation to the game field, and a 5-meter tripod above the game plane. Two PTKT-expert assessors classified the athletes into procedural tactical knowledge levels based on the frequency these five actions were performed: 1. "Moves trying to receive the ball" (Player without ball in the attack), 2. "Passes the ball to a teammate who is not being marked and adopts a receiving position" (Player with ball in the attack), related to attacking situations, 2. "Supports teammates in the defense (cover) when overcome by the opponent" (Marks a player who is without the ball", 4. "Supports a teammate in the defense when the player with the ball has trouble controlling it" (Marks a player who is without the ball) and 5. "Puts pressure on the opponent, leading him towards the corners of the game field" (Marks the player who has the ball). Cohen's Kappa coefficient was calculated, presenting intra-observer agreement value of 0.844 and inter-observer agreement value of 0.806, indicating satisfactory reliability of observations. For the calculation of Cohen's Kappa coefficient, 21.2% of the athletes were reassessed[26], with a 21-day interval between observations[27]. The study by Greco et al. (2014) provides greater details on the TPKT.

System of Tactical Assessment in Soccer (FUT-SAT)

Tactical behavior was assessed through FUT-SAT[3]. In this protocol, the tactical behavior of athletes is assessed from ten tactical principles, being five related to the offensive phase – penetration, offensive coverage, width and lenght (with ball and without ball), depth mobility and offensive unity – and five to the defensive phase – delay, defensive coverage, balance, concentration and defensive unity, as displayed in figure 1. In addition, the place in the game field where the action is performed and the result of the action are analyzed based on videos of small-Sided games planned situations (see Figure 2). More details on fundamental tactical principles can be found in studies in the literature[28, 29].

TACTICAL PRINCIPLES	ACTION LOCATION IN THE GAME FIELD	ACTION RESULT
Offensive	**Offensive Midfielder**	**Offensive**
Penetration	Offensive tactical actions	Finishing towards the goal
Offensive Coverage	Defensive tactical actions	Keeping ball possession
Width and Length	**Defensive midfielder**	Suffering a foul, being entitled to a throw-in or corner
Depth Mobility	Offensive tactical actions	Committing a foul, giving a throw-in or corner
Offensive Unity	Defensive tactical actions	Lose ball possession
Defensive		**Defensive**
Delay		Recovering ball possession
Defensive Coverage		Suffering a foul, being entitled to a throw in or corner
Balance		Suffering a foul, giving a throw-in or a corner
Concentration		Continuing without ball possession
Defensive Unity		Suffering a finish towards the goal

Figure 2. Structure of the Observation, Analysis and Assessment of Soccer Tactical Performance

The assessment of items that compose the FUT-SAT Observation Macro-Category (offensive and defensive tactical principles, place in the game field where the action is performed, and action result) is carried out from the analysis of videos made with the JVC HD *Everio* GZ-HD520 digital camera, and through the Soccer Analyser® software, which allows for the placement of a "field diagram" over the video and the definition of the center game and the ball line, references adopted for tactical principles. All data were organized and tabulated on Microsoft Excel 2010®. The present study verified the intra and inter-observer reliability for the measuring of the variables related to individual tactical behavior, obtained from FUT-SAT protocol. In this sense, of the 24 games registered during data collection sessions, four (16.7%) were reassessed as recommended in the literature[26]. The second analysis of the games occurred after 21 days, minimizing the familiarity of the assessors with the assessed scenes[27]. Cohen's Kappa coefficient – agreement measure – and standard deviation – used to estimate the confidence interval of observations – were calculated for the following variables: tactical principles, action location in the game field and action result (see Table 1). Results indicated satisfactory reliability for intra and inter-observer analysis.

Table 1. Intra and inter-observer reliability calculation using FUT-SAT.

	Intra-observer		Inter-observer	
	Kappa	Standard Deviation	Kappa	Standard Deviation
Tactical Principles	0.934	0.006	0.977	0.004
Action location	0.998	0.001	0.997	0.002
Action Result	1	0	0.998	0.001

Source: The authors

Statistical analysis

Data referring to individual tactical behavior, obtained through FUT-SAT, were initially analyzed based on descriptive statistics. Inferential analysis was done by means of two-way analysis of variance (ANOVA) (Group Factor: G1 and G2 and Setting Factor: 3x3 and 4x3) with repeated measures in the second factor. In case of significant differences, the *post hoc* of LSD was used for identification of differences. Finally, the effect size was calculated, which reflects the magnitude of differences between treatments (small = 0.01; medium = 0.06; and big = 0.14)[30]. All calculations were done on SAS 9.0 statistical package. The adopted level of significance was 0.05.

Results

Table 2 shows the means and standard deviations of the frequency of the tactical principles performed in 3x3 and 4x3 settings for groups G1 and G2, and the results of the analysis of variance.

Two-way ANOVA showed no significant interaction effect between Group x Setting factors in most tactical principles, except for the width and length (with the ball) principle ($F = 5.397$; $p = 0.023$; $\eta^2 = 0.17$) (TABLE 2). The *post hoc* test pointed that, differently from the group with less tactical knowledge (G2), the group with greater tactical knowledge (G1) showed higher incidence of width and length (without the ball) actions in the game when it comes to numerical superiority than in the game with numerical equality ($p = 0.044$). Results referring to the Group main effect (G1 and G2) show similar tactical behavior of both groups in most of the assessed tactical principles in FUT-SAT. The ANOVA pointed main effect of the Group factor only for the concentration tactical principle ($F = 7{,}837$ $p = 0{,}006$ $\eta^2 = 0{,}34$) (see TABLE 2); the group with less tactical knowledge (G2) obtained higher mean (4.1 ± 2.1; grouped mean) than the group with greater tactical knowledge (G1) (G1) (2.8 ± 1.8; grouped mean) as to that principle (p=0.006)

Table 2. Means and standard deviations of the frequency of tactical principles in 3x3 and 4x3 settings for G1 and G2.

	Group 1		Group 2		*Interaction effect (p)*	*Group main effect (p)*	*Setting main effect (p)*
	3x3	4x3	3x3	4x3			
Offensive							
Penetration	8.0±2.6	6.4±1.3	7.3±2.3	6.1± 2.5	0.697	0.294	0.006*
Offensive coverage	6.1±2.6	6.5±4.6	6.6±4.1	6.7±2.8	0.836	0.678	0.782
Width and length (with the ball)	10.8±4.0	13.7±5.1	13.4±4.6	11.0±5.0	0.023*	0.941	0.826
Width and length (without the ball)	2.6±1.3	2.0±1.5	2.0±1.6	1.7±1.5	0.637	0.159	0.210
Depth Mobility	1.8±1.4	3.4±2.8	2.7±2.1	3.2±2.8	0.346	0.585	0.069
Offensive unity	10.7±3.8	12.6±4.2	10.3±4.5	14.7±6.6	0.193	0.389	0.002*
Defensive							
Delay	5.2±3.1	4.6±2.2	4.6±1.8	3.72±2.6	0.815	0.21	0.179
Defensive coverage	7.0±4.0	8.4±4.6	6.5±3.5	9.6±5.1	0.308	0.633	0.006*
Defensive balance	6.8±3.3	7.7±4.2	8.7±4.4	7.6±3.2	0.277	0.335	0.925
Recovery balance	1.3±1.5	2.5±1.9	1.6±2.0	2.4±2.3	0.718	0.809	0.044*
Concentration	2.7±1.9	2.8±1.7	4.1±2.1	4.0±2.1	0.808	0.006*	0.903
Defensive unity	11.9±4.8	15.6±4.5	13.3±5.0	14.6±3.8	0.288	0.862	0.030*

* Significant differences ($p<0.05$); G1 – Athletes with better performance in PTKT; G2 -Athletes with worse performance in PTKT.
Source: The authors

Concerning the comparison of tactical principles in 3x3 and 4x3 settings, the analysis of variance detected significant differences in 5 of the 12 analyzed variables. About offensive tactical principles, the participants' tactical behaviors differed as to "penetration" and "offensive unity"; in "penetration, the 3x3 setting showed higher mean than the 3x3 3 ($F = 8.037$; $p = 0.006$; $\eta^2 = 0.30$). On the other hand, the 4x3 setting allowed for higher frequency of "offensive unity" tactical actions than the setting with numerical equality (3x3) ($F = 9.987$; $p = 0.002$; $\eta^2 = 0.31$).

In defensive tactical principles, the analysis of variance pointed significant differences as to "defensive coverage" tactical principles ($F = 7.885$; $p = 0.006$; $\eta^2 = 0.26$), "recovery balance” ” (F = 4.219 p = 0.044 η^2 = 0.26) and “defensive unity” (F = 4.908; p = 0.030; η^2 = 0.27); all cases showed higher mean frequencies for the setting with numerical superiority.

Discussion

This study aimed to investigate whether procedural tactical knowledge and numerical superiority change the offensive and defensive tactical behavior of soccer players during small-sided games. Broadly speaking, the results of the present study showed that the 4x3 setting (numerical superiority) in a small-sided game changes the offensive and defensive tactical behavior of athletes, and that the level of tactical knowledge of these athletes does not change that response. The present study observed that the 4x3 setting changed the tactical behavior of players in 5 of the 12 tactical analyzed principles in comparison with the 3x3 setting (numerical equality). There were differences between settings (3x3 and 4x3) as to the following offensive principles: “Penetration” and “Offensive unity”, and as to the following defensive principles: “Defensive coverage”, “Recovery balance” and “Defensive unity”.

The frequency of actions of the “Penetration” offensive tactical principle was higher for the 3x3 setting compared to the 4x3 setting. A possible explanation for this result relates to the expectation that the 3x3 setting requires more 1x1 actions for ball progression within the game field, whereas the game with offensive numerical superiority allows attack with constant presence of a free player, facilitating progression in the game field and ball possession primarily through passes[31]. This difference in possible game dynamics would justify the result found.

In addition, the 4x3 setting showed higher mean in tactical actions that take into account the “Offensive unity” principle. The fact that there was an extra player in one of the teams to support the attack allows the last offensive line to advance in response to the retreat of the defensive line of the numerically inferior team. According to Travassos et al.[20], the interpersonal coordination pattern between soccer players changes with the presence of numerical superiority during small-sided games. The authors analyzed the space reduction between athletes and the occupation of the place nearest to the goal – defensive line retreat – as a response to the offensive numerical superiority. Such findings reinforce the explanation for the result observed about the “Offensive unity” principle. Moreover, because the 4x3 setting has an extra player in the attack, positioning happens in a more compact way with greater proximity for passes.

As for defensive tactical principles, there was higher incidence of the “Defensive coverage” principle in the small-sided game with numerical superiority. This response is justified by the fact that the defense does not have numerical advantage in the 4x3 setting, which leads to a greater defensive demand, especially regarding positioning with the aim of blocking the opponent’s pass lines. This rationale is reinforced by results of the study by Evangelos et al.[19], which compared tactical-technical actions in games with numerical equality and superiority and found greater amount of passes in favor of the 4x3 setting compared to the 3x3. In the defense, face the impossibility of 1x1 individual marking so as to stop the attack progression due to the offensive numerical superiority, defensive cover situations are useful for the creation of numerical equality in regions that are more dangerous in relation to the goal, namely the game center. About the “Recovery balance” and “Defensive unity” tactical principles the 4x3 setting also showed higher frequency of actions in comparison with the 3x3. In this case, players in the 4x3 setting are at a disadvantage in the defense and are more pressured due to the presence of the fourth player, so they tend to organize themselves more quickly to protect zones where it is easier to score. In addition, after possession is lost, the athletes need to reposition in the defense in a way that is more dynamic than the numerical equality situation.

These differences previously reported in the response of the tactical principles investigated in the present study show that the different game settings have a direct influence on the players' tactical behavior, corroborating with other studies that show the influence of manipulating a task's characteristic as an effective strategy to enable certain game behaviors[15,32].

In the present study it was expected that the level of tactical behavior of the athletes had an influence on tactical behavior. This expectation was based on an inherent characteristic of the game, which is the constant change of information flow, which, in addition to performing well the game actions, requires ability to properly decide on them[4]. Considering this context, a player can perform a certain behavior efficiently by resorting to the knowledge he has of the game[5]. Furthermore, in sports, the concept of bidirectionality between perception and action[17] considers the simultaneity between bottom up and top down processes during decision making[33].

Decision making, in turn, results from the interaction of heuristic attention and anticipation processes, based on processes supported on specific knowledge about the modality, that is, tactical knowledge. In this context, studies point that expert individuals are capable of coming up with more options[6,18] and better apply them in the game context[35]. However, contrarily to this expectation, results indicated a significant interaction effect between the level of tactical knowledge (group factor) and different game settings (Setting Factor) in only 1 ("Space without ball") of the 12 analyzed tactical principles. Besides, when the group factor was analyzed, groups G1 and G2 also showed difference in only 1 ("Concentration") of the 12 tactical principles. These results evidence that the level of tactical knowledge had little effect on the athletes' tactical behavior, regardless of the game setting (3x3 or 4x3).

A possible explanation for this unexpected result relates to the performance measure in the PTKT. In it, the incidence of certain tactical principles is the measure that allows differing the athletes' level of procedural tactical knowledge. Despite the ability to generate options being a relevant aspect in the game context, it is possible that this measure is not enough to differ players with homogenous characteristics, as in the present study. The investigated athletes show participation, over few years, in similar teaching-learning-training processes, the same age group and the same level of competition, factors that interfere with expertise development[16]. It is possible that differences in the "quality" of tactical actions represent an additional aspect to be considered concerning the matter of amount of actions in the characterization of the performance level related to the procedural tactical behavior. However, this argument presents itself only as a speculation, and its confirmation demands additional investigations.

One of the study's limitations refers to the use of a sample composed of young soccer players with specific characteristics (competition level, age group). This characteristic limits the possibilities of extrapolating results to other populations such as professional adult soccer players, young players of other age groups and young players of equal age group, but belonging to other clubs with the same competitive level, which can respond differently to the conditions of the present experiment.

Conclusion

Offensive and defensive tactical behavior is influenced by a numerically superior game setting. Unlike game setting manipulation, the level of procedural tactical knowledge little changed tactical behavior, only in one of the twelve analyzed principles.

The results of this investigation allow coaches and physical trainers to adjust training content by adapting small-sided games to the intentions of the game model construction for the team. If, on one hand, a numerically equal game setting favors the emergence of confrontations, being potential useful for the experiencing of content associated with dribbling and ball conduction, on the other hand, numerically superior settings represent an important for the construction of game models based on an organized attack and on the development of principles related to an offensive construction.

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