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Section III – Sports Training

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Tactical Behaviour of Youth Soccer Players: Differences Depending on Task Constraint Modification, Age and Skill Level

by

João Cláudio Machado[1,2], Daniel Barreira[3], Israel Teoldo[4], Jaime Serra-Olivares[5], Alberto Góes[1], Alcides José Scaglia[2,6]

This study aimed to investigate: i) how Small-Sided and Conditioned Games based on different representation and exaggeration modification strategies, from the Teaching Games for Understanding pedagogical principles, affected team performance and exploratory behaviour; and ii) how teams and players of different ages and skill levels were affected by the use of these different modification strategies. In total, forty-eight youth male soccer players participated in the study (U15, n = 24 mean age = 13.06 ± 1.53 years; U17, n = 24 mean age = 16.89 ± 0.11 years). In both categories, players were organized into three groups according to their tactical efficiency level (Group 01 = High Skilled Players (HSP), Group 02 = Intermediate Skilled Players (ISP), and Group 03 = Low Skilled Players (LSP)). The HSP and LSP groups performed two types of Gk+4vs4+Gk Small-Sided and Conditioned Games (SSCGs) based on different representation and exaggeration modification strategies. The first type of SSCGs was modified by structural constraints (Structural SSCG) and the second type was modified by rule manipulation (Manipulation SSCG). Team performance and exploratory behaviour were analysed through the Offensive Sequences Characterization System and Lag Sequential Analysis, respectively. SSCG modification strategies affected differently tactical performance and exploratory behaviour of teams composed of players of different skill levels. It was found that SSCG modification strategy through rule manipulation provided players and teams with a higher level of difficulty, compromising their performance and inhibiting exploratory behaviour. This information is crucial to practitioners wishing to apply more appropriate pedagogical strategies to improve a specific tactical problem using a player-centred and game-based approach.

Key words: *nonlinear pedagogy, pedagogical principles, tactical skills, performance level, complexity.*

Introduction

Small-Sided and Conditioned Games (SSCGs) are representative training tasks widely used by practitioners to enhance player and team performance in soccer. Understanding the important role of SSCGs for pedagogical purposes, in recent years sports scientists have sought to investigate how game modification might contribute to skill learning and development (Clemente et al., 2012; Ometto et al., 2018; Serra-Olivares and Garcia-Rubio, 2017). Despite the large production of scientific research that has investigated how game modification affects physical, technical, and tactical performance (Aquino et al., 2017; Hill-Haas et al., 2011; Ometto et al., 2018), there is still a lack of information about how a representative task design could enhance tactical learning and skill

[1] - *Human Performance Laboratory (LEDEHU), Faculty of Physical Education and Physiotherapy, Federal University of Amazonas, Manaus, Brazil.*
[2] - *Faculty of Physical Education, State University of Campinas, Campinas/SP, Brazil.*
[3] - *Centre of Research, Education, Innovation and Intervention in Sport (CIFI2D), Faculty of Sport, University of Porto, Porto, Portugal.*
[4] - *Department of Physical Education, Centre of Research and Studies in Football, Universidade Federal de Viçosa, Viçosa, Brazil.*
[5] - *Pedagogía en Educación Física, Facultad de Educación, Universidad Católica de Temuco, Chile.*
[6] - *Laboratory of Sport Pedagogy (LEPE), School of Applied Sciences (FCA), State University of Campinas, Limeira/SP, Brazil.*

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acquisition depending on the age and skill level of learners (Serra-Olivares al., 2016a; Serra-Olivares and Garcia-Rubio, 2017; Tan et al., 2012).

On the topic of representative task design, one of the best known teaching models is Teaching Games for Understanding (TGfU) (Bunker and Thorpe, 1982). From a tactical learning point of view, game modification in accordance with the TGfU follows four pedagogical principles: sampling, tactical complexity, representation, and exaggeration (Serra-Olivares et al., 2016a; Serra-Olivares and Garcia-Rubio, 2017; Thorpe and Bunker, 1989; Thorpe et al., 1986). The first two pedagogical principles refer to the existence of training tasks that have similar tactical dynamics and present appropriate difficulty and complexity levels. Thus, practitioners are given recommendations on enhancing learner behaviour transference between games with similar tactical problems (sampling), and the necessity of designing representative and adapted tasks according to player skill levels (tactical complexity) (Serra-Olivares and Garcia-Rubio, 2017; Tan et al., 2012). In turn, representation and exaggeration support the need to modify games in order to simulate the performance environment, stimulating player attunement and adaptation to relevant sources of information, by emphasizing both the tactical problems and skills to be acquired (Clemente, 2012; Serra-Olivares and Garcia-Rubio, 2017; Tan et al., 2012).

Regarding the representative task design, Serra-Olivares and colleagues performed research attempting to investigate how different game modification strategies affected tactical constraints and game performance in different contexts of SSCGs (Serra-Olivares et al., 2016b; Serra-Olivares et al., 2015a, 2015b). The authors observed that SSCGs modified by the representation principle presented lower tactical complexity than SSCGs modified by both representation and exaggeration principles (Serra-Olivares et al., 2016b; Serra-Olivares et al., 2015b). In addition, SSCGs modified to exaggerate keeping ball possession as the tactical problem, seemed to present different tactical contextual dynamics from other games (Serra-Olivares et al., 2016b). Therefore, the authors suggested that tactical complexity was more influenced by tactical requests than by structural modifications (e.g., pitch dimensions and/or the number of players) (Serra-Olivares et al., 2016b; Serra-Olivares et al., 2015a, 2015b). Thus, tactical problems should guide the design process of representative learning tasks (Serra-Olivares and Garcia-Rubio, 2017).

Although previous studies have shown that modification strategies differently affect tactical performance, research is still inconclusive about how modification strategies affect tactical performance depending on the age and skill level of players. The players' skill level has been observed to affect team performance in different SSCGs, being an important individual learning constraint (Praça et al., 2018; Silva et al., 2014a; Silva et al., 2014b; Silva et al., 2014c). From these studies, it is suggested that teams composed of players with different skill levels respond differently to the use of game modification strategies and manipulation of task constraints. Therefore, players with different skill levels are not able to perceive the same tactical opportunities from the same sources of information presented during the game (Machado et al., 2019a).

Based on the above, it seems necessary to investigate SSCG modification strategies considering players' skill levels within the same group or team. This information will help practitioners apply more appropriate pedagogical strategies to emphasize tactical behaviours intended to be learned, applying a player-centred and game-based approach. In this perspective, the present study aimed to investigate: i) how Small-Sided and Conditioned Games based on different representation and exaggeration modification strategies, from the TGfU pedagogical principles, affected team performance and exploratory behaviour; and ii) how teams and players of different ages and skill levels were affected by the use of these different modification strategies.

Methods

Participants

Forty-eight non-elite soccer players from two different age categories (U15, n = 24 mean age = 13.06 ± 1.53 years; U17, n = 24 mean age = 16.89 ± 0.11 years) participated in this research. Players were recruited from a sports program for beginners and had no early experience in systematic soccer game-based training. Before the research commenced, one of the authors gave a

brief explanation of the study procedures and only those players whose parents signed informed consent participated in the study. The Ethics Committee in Research with Human Beings (N. 73222617.0.0000.5404) gave approval for the research. In addition, all the procedures of this research were in accordance with the Resolution of the National Health Council (466/2012) and the Declaration of Helsinki (2013).

Experimental design

The experimental design of the present study comprises two steps: i) identification of the player's tactical efficiency level, and ii) evaluation of team performance and exploratory behaviour in SSCGs with different game modifications (structural and rule manipulation).

Identification of player tactical efficiency level

In order to organize players into groups according to their tactical skill level, the System of Tactical Assessment in Football (FUT-SAT) (Costa et al., 2011) was used. This instrument enables identification of the tactical skill level of players through performing a Small-Sided Game in a Gk+3*vs*3+Gk configuration (i.e., each team is composed of three field players and one goalkeeper), on a pitch 36 m long and 27 m wide, for four minutes. Tactical efficiency was evaluated according to the execution of tactical principles (offensive and defensive), as well as their success rate, based on 10 core tactical principles (offensive phase: penetration, offensive coverage, depth mobility, width and length, and offensive unity; defensive phase: delay, defensive coverage, balance, concentration, and defensive unity) (Costa et al., 2009). The games were played in accordance with official soccer rules, except for the offside rule. The players were allowed 30 s for familiarization with the test, i.e., playing a Gk+3*vs*3+Gk game to get used to the game configuration applied in the test protocol (Costa et al., 2011). Practitioners were asked to organize balanced teams with three players and a goalkeeper. All player tactical behaviour was analysed, with the exception of the goalkeepers.

The player's tactical efficiency level was used as an indicator of the player's skill level and was calculated by the ratio between the percentage of success and the total number of tactical actions performed by each player. Next, for analysis purposes, players were grouped within each age category (U15 or U17) according to their tactical efficiency level, as follows: Group 01 – High Skilled Players (HSP): composed of eight players with the best results in the test; Group 02 – Intermediate Skilled Players (ISP): composed of players who ranged from the ninth to the sixteenth positions; and Group 03 – Low Skilled Players (LSP): composed of eight players who presented the lowest results (Figure 1). In an attempt to confirm whether the previous organization into skill levels influenced the tactical efficiency score, a One-way ANOVA was used. Thus, it was observed that in both age categories all skill level groups demonstrated significant differences regarding tactical efficiency ($p < 0.05$).

Small-Sided and Conditioned Games with different modification strategies

Two different SSCGs were used to evaluate team performance and exploratory behaviour. The games were designed using two different game modification strategies: i) the strategy of designing an SSCG modified by structural constraints (Structural SSCG); and ii) the strategy of designing an SSCG modified by rule manipulation (Manipulation SSCG). Both SSCGs were designed to emphasize keeping ball possession, i.e., these games stimulated teams to maintain ball possession through passes and ball circulation rather than exaggerating penetrating-the-defence or attacking-the-goal tactical principles (Bayer, 1992; Costa et al., 2009).

The Structural SSCG was played in a Gk+4vs4+Gk configuration on a pitch 29.54 m long and 47.72 m wide. There were two small goalposts (2.5 m x 1 m) located at the end of the goal line on both side corridors (Figure 1). The Structural SSCG followed the official rules, with the exception of the offside rule. In this SSCG, only structural constraints were manipulated (i.e., field shape and the size and location of goalposts) in an attempt to evaluate the effects of this modification strategy on team performance and exploratory behaviour.

The Manipulation SSCG was modified by manipulating some tactical rules, in order to enhance the tactical problem of keeping the ball. The game was played on the same pitch dimensions; however, the pitch was 47.72 m long and 29.54 m wide and 7-a-side goalposts were used (Figure 1). In the Manipulation SSCG, the following tactical game rules were manipulated:

i) each player was allowed to perform the maximum of two touches to the ball; extra points were registered to the opposing team for each extra touch given by the same player; ii) players of the team with ball possession were required to perform constant switches of lines/zones (pre-determined on the field with cones of different colours); an extra point was registered to the team that could pass the ball from one side of the pitch to the opposite (Figure 1); iii) for each time that the team in ball possession achieved five consecutive passes without returning the ball to the player who performed the previous pass, the team obtained two points; and iv) a goal could only be scored after five consecutive passes, with an extra reward of eight points. Other studies have found that these kinds of rule manipulations emphasize maintaining the ball possession operational tactical principle (Lizana et al., 2015; Machado et al., 2016).

In both SSCGs, we used a Gk+4vs4+Gk configuration, since this configuration allows more balanced distribution of players across the field, while the use of the smaller game configuration provides more difficulty for less skilled players (Machado et al., 2019b). Both SSCGs were performed by the High Skilled and Low Skilled groups in each age category (U15 and U17).

Each group played six SSCGs during one week, in three different training sessions with a 48-hour interval between each session. In each training session, both groups and age categories played two games with a 10 min duration, one Structural SSCG and one Manipulation SSCG, with a 10 min interval between them (activity/recovery ratio of 1:1). The game order in each session was randomized to avoid biases.

Analysis of team tactical performance and exploratory behaviour

The Offensive Sequences Characterization System (OSCS) (Almeida et al., 2012, 2013) and Lag Sequential Analysis (Barreira et al., 2012, 2013) were used to analyse team tactical performance and exploratory behaviour, respectively.

Offensive Sequences Characterization System

The OSCS was used to analyse team tactical performance during Structural and Manipulation SSCGs. This system was proposed by Almeida et al. (2012, 2013) and is composed of the following performance indicators: duration of ball possession; numbers of players involved; number of ball touches; number of passes; number of shots; players involved/duration of ball possession; ball touches/duration of ball possession; passes/duration of ball possession; ball touches/players involved; passes/players involved; passes/ball touches; and goal/shots.

To verify reliability, the Spearman's Correlation Coefficient was used. The following results were found for intra- and inter-observer reliability: i) intra-observer: the values varied between 0.83 (Ball touches/Duration performance indicator) and 0.89 (Shots performance indicator); ii) inter-observer: the values varied between 0.78 (Ball touches/Duration performance indicator) and 0.85 (Shots performance indicator). These analyses were performed using SPSS 20.0 software.

Sequential Analysis of team offensive patterns

Lag Sequential Analysis (LSA) was used to analyse team exploratory behaviour through the identification of behavioural patterns which have a higher probability of occurring over the game (Tarragó et al., 2017). LSA can be used to analyse exploratory behavior through the variability in actions observed during the offensive phase of each team. Thus, the variability in team offensive patterns of play was observed using LSA.

The SoccerEye observation instrument and software (Barreira et al., 2012; Barreira et al., 2013) were used to analyse team offensive patterns during the SSCGs. This observational instrument comprises 80 exclusive and mutually exclusive categories, distributed according to 7 criteria (Table 1): (1) Start of the offensive phase/ball recovery (BR); (2) Development of defense/attack transition-state (DT); (3) Progress of Ball Possession (DP); (4) End of the Offensive Phase (F); (5) Patterns of pitch space position; (6) Centre of the Game, i.e., context of cooperation and opposition between players who participate or are able to participate in the game according to the player with the ball; and (7) Spatial patterns of team interaction. The SoccerEye software enables simultaneous visualization and recording of player and team actions, as well as direct exportation to the LSA analysis software (SDIS-GSEQ, version 5.1, 2011).

To assess data reliability, the Cohen's

Kappa Index (Cohen, 1960) was used through SDIS-GSEQ software. The results demonstrated adequate values for intra-observer 0.90<k<0.95 and inter-observer reliability 0.87<k<0.92.

Statistical analysis

For simple and composite performance indicators, *Kolmogorov-Smirnov* and *Box's M* tests were applied to verify the normality and homogeneity of covariance matrices, respectively. Descriptive statistics (mean and standard deviation) were calculated for all performance indicators. We analysed each independent variable separately (SSCGs, Skills level, and Age category). For this purpose, Mann-Whitney tests were used to compare team tactical performance between age categories (U15 and U17), groups of players with different skill levels (HSP and LSP), and different game modification strategies (Structural SSCG and Manipulation SSCG). SPSS 20.0 software was used to perform the statistical analysis. Sample size was calculated using GPOWER software (version 3.0.1) with a target effect size = 0.5, αlpha = 0.05, power = 0.8, and allocation ratio = 1.0, resulting in an estimated sample of 134 offensive sequences.

SDIS-GSEQ software (version 5.1, 2011) was used to perform LSA. This software has been shown to enable the analysis of stability/regularity in the succession of events (Bakeman and Quera, 1995). Behaviours that represent attacking efficacy were assumed as conduct criteria: (i) *wide shot* (Fws), (ii) *shot on target* (Fst), (iii) *shot stopped with no continuation of ball possession* (Fso), and (iv) *goal* (Fgl) (Table 1). Diachronic associations between the conducts were determined through retrospective analysis of the five conducts, prior to the end of the attack, in which the higher the *z-score* value ($z \geq 1.96$; $p \leq 0.05$) the stronger the association between the events.

Results

Differences between Small-Sided and Conditioned Games

Regarding the differences between SSCGs, we found that both game designs presented similar offensive sequence duration, since it was not possible to observe statically significant differences between the Structural and Manipulation SSCGs for the simple performance indicator *Duration of Ball Possession* ($p > 0.05$). In general, Manipulation SSCGs stimulated a higher number of players involved ($p < 0.001$) and passes performed ($p < 0.001$) than Structural SSCGs. However, Structural SSCGs stimulated more ball touches (U15 HSP: $p = 0.020$; U17 LSP: $p = 0.009$) and shots performed ($p < 0.001$) than Manipulation SSCGs.

It was also possible to observe significant differences between SSCGs for almost all composite performance indicators. Manipulation SSCGs stimulated a higher rhythm of collective involvement ($p = 0.014$ for U15 HSP; $p = 0.046$ for U15 LSP; $p < 0.001$ for U17 LSP) and ball circulation ($p < 0.001$). In addition, in Manipulation SSCGs, players presented higher individual contributions to ball circulation ($p < 0.001$) and teams demonstrated higher offensive dynamics ($p < 0.001$). However, Structural SSCGs led to a higher rhythm of ball intervention ($p < 0.001$) and offensive efficacy ($p < 0.001$), as well as more individual contribution to ball intervention ($p < 0.001$).

Differences between groups of players with different skill levels

Regarding the differences between groups of players with different tactical efficiency levels, the U15 HSP presented a higher number of ball touches than the LSP in Structural SSCGs (i = 0.032). It was also possible to observe that the U15 HSP presented a higher rhythm of ball intervention ($p = 0.015$) and ball circulation ($p = 0.021$), as well as that players showed more individual contribution to ball circulation (*Passes/Players involved*) in Structural SSCGs ($p = 0.048$). In these SSCGs, the U15 HSP also presented higher offensive efficacy ($p = 0.049$). In Manipulation SSCGs, the U15 HSP presented higher offensive dynamics (*Passes/Ball touches*) ($p = 0.017$). In the U17 category, the HSP presented a higher number of shots performed ($p = 0.002$) and offensive efficacy ($p = 0.003$) in Structural SSCGs, however, players in the U17 LSP showed higher individual contribution to ball circulation than HSP players ($p = 0.033$). In Manipulation SSCGs, the HSP presented higher offensive dynamics ($p = 0.003$), while the LSP presented a higher rhythm of ball intervention ($p = 0.008$).

Differences between Categories

Regarding the differences between categories, the U17 LSP presented a higher number of shots performed than the U15s in

Manipulation SSCGs (p = 0.049), as well as a higher rhythm of collective involvement (*Players involved/Duration*) (p = 0.047). It was also observed that the U17 LSP presented a higher number of ball touches (p = 0.035) and passes performed (p = 0.049) in Structural SSCGs. Moreover, the U17 LSP presented a higher rhythm of ball intervention (p = 0.003) and ball circulation (p = 0.012), as well as more individual contribution to ball circulation than the U15s in Structural SSCGs (p = 0.033). Finally, the U17 HSP presented higher offensive efficacy than the U15s in Manipulation SSCGs (p = 0.028).

Lag Sequential Analysis

Offensive patterns of play identified for U15s and U17s for both groups (HSP and LSP) in Structural and Manipulation SSCGs are presented in Figure 2. Regarding the U15 HSP, it was observed that shots on target (Fst) in Structural SSCGs tended to be preceded by dribbling (DPd – z = 4.16), performed at zone 9 (z = 2.51) and in relative numerical inferiority (Pr – z = 3.46). We also observed that the U15 HSP frequently scored goals after a positive short passing (DTpsp – z = 2.55) through a fast attack performed at zone 12 (z = 2.82). No goals were scored by the U15 HSP in Manipulation SSCGs, probably due to the high difficulty level imposed by the game rules. Nevertheless, it was observed that shots on target performed by the HSP tended to be preceded by an opponent's intervention with no success (DPns – z = 2.47), also in zone 12 (z = 3.08). Moreover, a wide shot (Fws) often emerged after a ball control (DTbc – z = 2.14) and dribbling (DPd – z = 4.47). However, these dribbling actions were often preceded by running with the ball (DPrb – z = 6.08), which in the game rules would not be possible, since this kind of action is characterized as three consecutive ball touches made by the player with ball possession.

In turn, the U15 LSP usually performed wide shots in Structural SSCGs after a positive long passing (DTplp – z = 3.32) in offensive transition and after a positive short passing (DPpsp – z = 4.19). Moreover, shots on target performed by the U15 LSP were often preceded by running with the ball (DPrb – z = 2.08). Regarding goals scored by the U15 LSP in Structural SSCGs, these were preceded by an interception (BRi – z = 2.83), running with the ball action through an offensive transition (DTrb – z = 2.69), a positive short passing (z = 2.71), and an opponent's intervention with no success (DPns – z = 2.23). In Manipulation SSCGs, the U15 LSP performed wide shots after a positive short passing (DPpsp – z = 8.19) in zone 8 (z = 2.77), away from the opponent's goal. Their shots on target (Fst) were often preceded by dribbling (z = 4.65) and an opponent's intervention with no success (z = 3.16). The U15 LSP did not score any goals in Manipulation SSCGs.

Offensive patterns of play identified for both U17 groups of players in Structural and Manipulation SSCGs are also shown in Figure 2. We observed that running with the ball actions often preceded the wide shots performed by the U17 HSP (DPrb – z = 2.43) in Structural SSCGs. Regarding goals scored by the U17 HSP, these were often preceded by a ball control (DPbc – z = 3.11) and by running with the ball actions through offensive transitions (DTrb – z = 2.25), as well as that goals were frequently scored in the left corridor (Zone 10 – z = 4.04). In Manipulation SSCGs, we found that a positive short passing (DPpsp – z = 4.43) often preceded wide shots performed by the U17 HSP. We also observed that positive short passing (z = 2.89) often preceded the shots on target (Fst) and goals scored by the U17 HSP (DPpsp – z = 2.89 and z = 4.15, respectively). However, goals scored preceded by an intervention of the goalkeeper in the defensive phase (DPdgk – z = 4.30), originating from a shot (z = 2.11) in zone 11 (z = 3.08), were also found.

Regarding the U17 LSP offensive patterns of play, it was observed that a throw-in (DPti – z = 2.73) often preceded wide shots performed in the Structural SSCGs. Goals were often scored by the U17 LSP in both right and left sides (Zone 10: z = 3.04; Zone 12: z = 2.74). It was also interesting to observe that goals scored were often preceded by a positive long passing (DPplp – z = 3.13), indicating a direct playing style. In addition, we found that a ball control in offensive transition (DTbc – z = 2.68) and running with the ball actions often preceded goals scored by the U17 LSP. In the Manipulation SSCGs, we found that the wide shots (Fws) were often preceded by positive short passing (DPpsp – z = 7.79). However, positive short passing through offense transition frequently preceded the shots on target (Fst) performed by the U17 LSP (z=2.92). Nevertheless, we also observed that running with the ball

actions (DPrb – z = 5.00) and corner kicks (DPc – z = 5.00) often preceded shots on target performed by the LSP. Regarding goals scored by the U17 LSP, these were frequently preceded by positive crossing (DPpcr – z = 6.16).

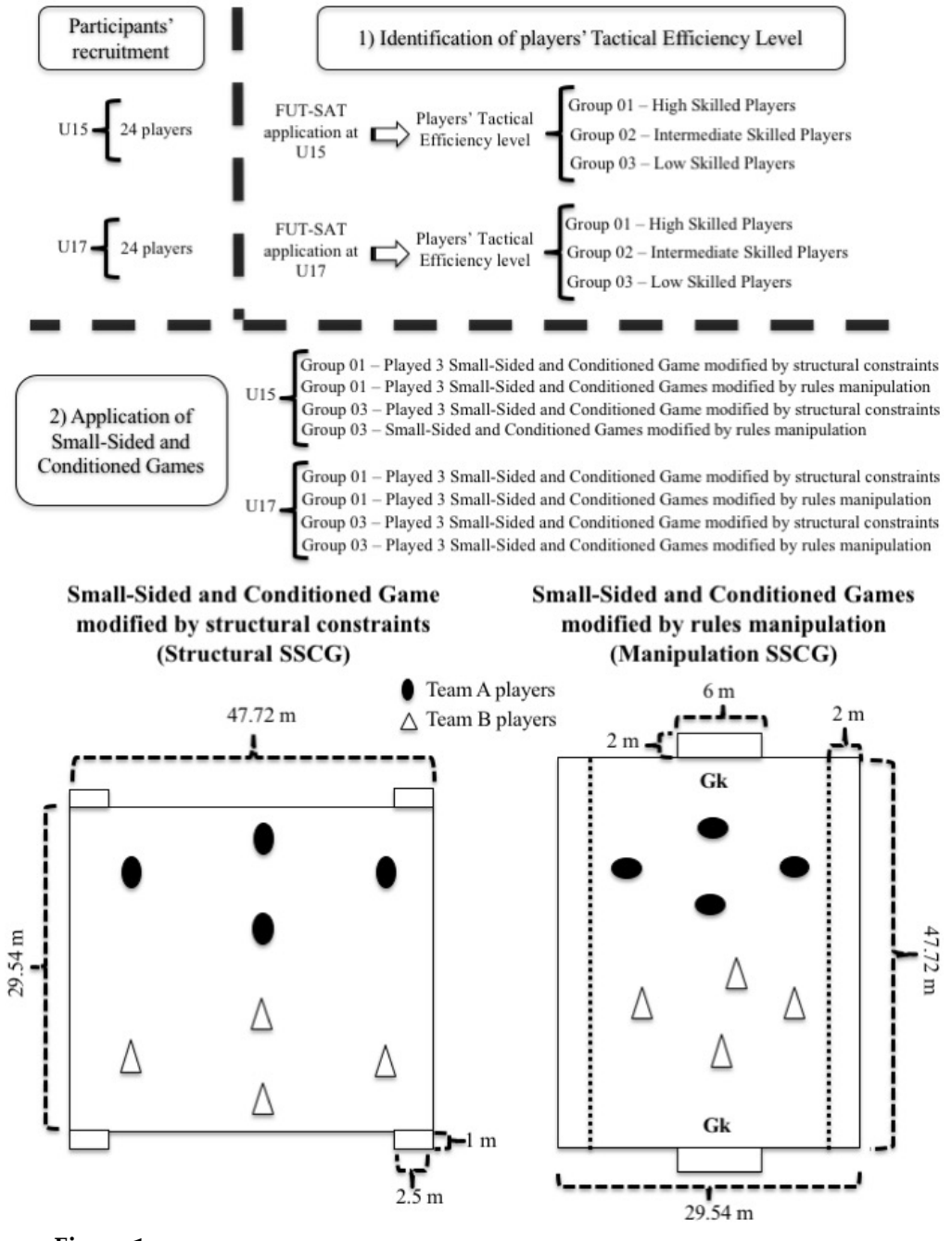


Figure 1

Experimental design used in the present research.

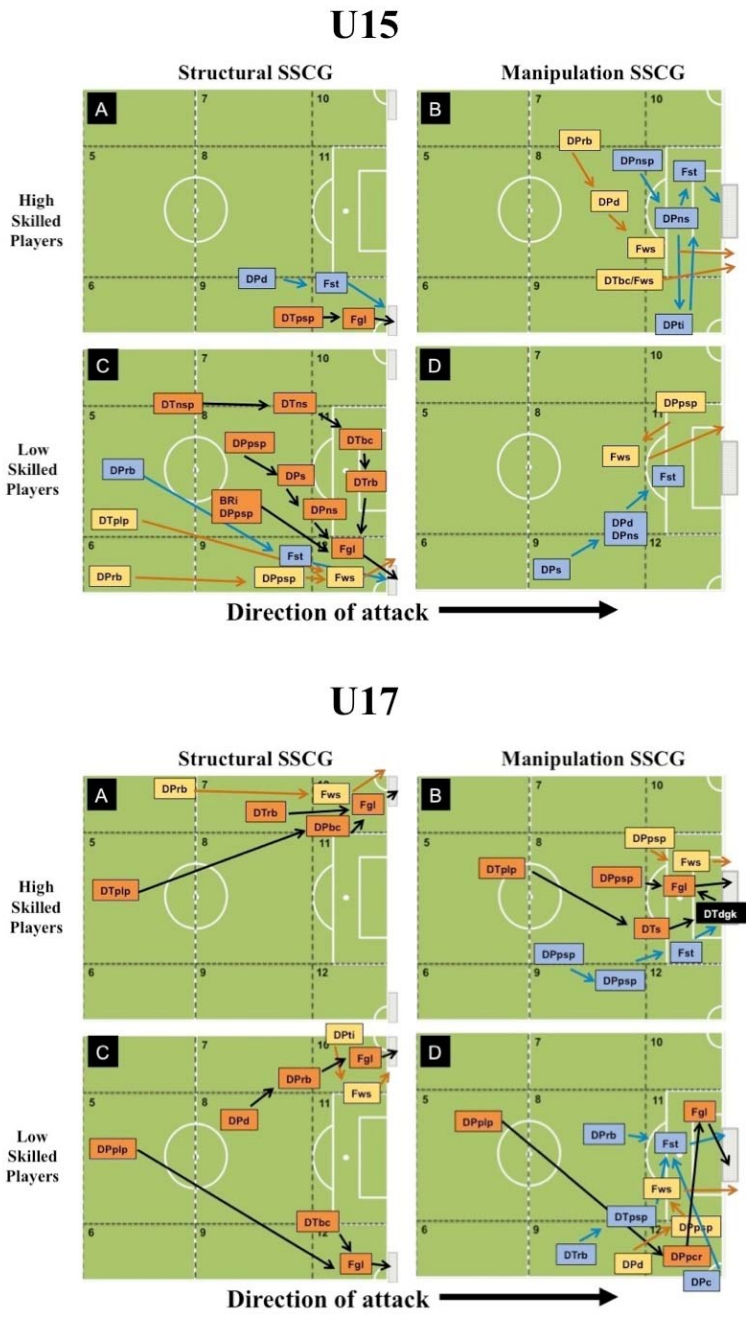


Figure 2

Offensive patterns of play observed in U15 and U17 High Skilled and Low Skilled Players in the Structural SSCG and Manipulation SSCG.

Table 1

SoccerEye observational instrument (Barreira et al., 2012).

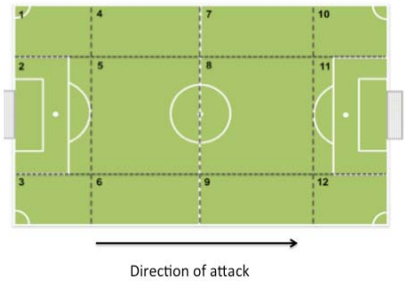
Criteria	Categories
1. Start of offensive phase/ball recovery (BR)	**BRi**: Interception; **BRt**: Tackle; **BRgk**: Intervention of the goalkeeper in the defensive phase; **BRp**: Defensive behavior followed by a pass; **BRst**: Start/restart of the offensive phase; **BRv**: Opponent's violation of the laws of the game; BRc: Corner kick; **BRgki**: Goal kick; **BRdb**: Dropped ball; BRti: Throw-in
2. Development of defence/attack transition-state (DT)	**DTpsp**: Positive short passing; **DTnsp**: Negative short passing; **DTplp**: Positive long passing; **DTnlp**: Negative Long Passing; **DTpcr**: Positive Crossing; **DTncr**: Negative Crossing; **DTrb**: Running with the ball; **DTd**: Dribbling (1x1); **DTbc**: Ball control; **DTdu**: Duel; **DTs**: Shooting; **DTns**: Opponent's intervention with no Success; **DTogk**: Intervention of the goalkeeper in the offensive phase; **DTdgk**: Intervention of the goalkeeper in the defensive phase
3. Progress of Ball Possession (DP)	**DPpsp**: Positive Short passing; **DPnsp**: Negative short passing; **DPplp**: Positive Long Passing; **DPnlp**: Negative Long Passing; **DPpcr**: Positive Crossing; **DPncr**: Negative Crossing; **DPrb**: Running with the ball; **DPd**: Dribbling (1x1); **DPbc**: Ball control: **DPdu**: Duel; **DPs**: Shooting; **DPns**: Opponent's intervention with no success; **DPogk**: Intervention of the goalkeeper in the offensive phase; **DPdgk**: Intervention of the goalkeeper in the defensive phase; DPi: Violation of the laws of the game; **DPc**: Corner kick; **DPgki**: Goal kick; **DPdb**: Dropped Ball; **DPti**: Throw-in
4. End of Offensive Phase (F)	**Fws**: Wide shot; **Fst**: Shot on target; **Fso**: Shot stopped, with no continuation of ball possession; **Fgl**: Goal **Fled**: Loss of ball possession by error of the ball carrier/defender's intervention; **Fgk**: Loss of ball possession by intervention of the opponent's goalkeeper; **Fo**: Throwing the ball out of the pitch; **Fi**: Violation of the laws of the game
5. Pattern of pitch space position	Zones 1 to 12 
6. Centre of the Game (CJ)	**Pr**: Relative numerical inferiority; **Pa**: Absolute numerical inferiority; **Pe**: Pressure in numerical equality **NPe**: No pressure in numerical equality; **NPr**: Relative numerical superiority; **NPa**: Absolute numerical superiority
7. Spatial pattern of teams' interaction (CEI)	**EF**: Ball in the empty zone (goalkeeper) versus offensive line; **BF**: Back line versus offensive line; **BM**: Back line versus mid line; **BE**: Back line versus exterior zone; **MF**: Mid line versus offensive line; **MM**: Mid line versus mid line; **MB**: Mid line versus back line; **FM**: Offensive line versus mid line; **FB**: Offensive line versus back line; **EB**: Exterior zone versus back line; **FE**: Offensive line versus empty zone (goalkeeper)

Table 2

Team performance in different Small-Sided and Conditioned Games.

Performance Indicators	U15				U17			
	High Skilled Players		Low Skilled Players		High Skilled Players		Low Skilled Players	
	Structural SSCG	Manipulation SSCG	Structural SSCG	Manipulation SSCG	Structural SSCG	Manipulation SSCG	Structural SSCG	Manipulation SSCG
Duration of Ball Possession (s)	17.82±14	17.30±15.1	18.74±21.36	16.24±11.88	17.59±17.64	17.74±14.35	16.64±12.16	14.94±10.77
Players Involved	2.62±0.82$^{\#}$	3.21±1.36$^{\#}$	2.41±0.89$^{\#}$	3.05±0.90$^{\#}$	2.60±0.90$^{\#}$	3.39±0.94$^{\#}$	2.57±0.84$^{\#}$	3.27±0.97$^{\#}$
Ball Touches	11.37±8.27$^{\#¥}$	8.28±6.22$^{\#}$	9.98±10.26$^{¥§}$	8.15±5.46	11.38±10.22	8.40±6.30	11.12±7.98$^{\#§}$	7.86±4.74$^{\#}$
Passes	3.31±2.48$^{\#}$	5.34±4.17$^{\#}$	2.71±2.83$^{\#}$	4.69±3.12$^{\#}$	2.85±2.56$^{\#}$	5.01±3.63$^{\#}$	2.96±2.02$^{\#}$	4.37±2.72$^{\#}$
Shots	0.54±0.66$^{\#}$	0.06±0.28$^{\#}$	0.44±0.80$^{\#}$	0.08±0.27$^{\#§}$	0.69±0.62$^{\#¥}$	0.10±0.33$^{\#}$	0.41±0.53$^{\#¥}$	0.19±0.42$^{\#§}$
Players Involved/Duration	0.20±0.10$^{\#}$	0.25±0.12$^{\#}$	0.24±0.26$^{\#}$	0.25±0.14$^{\#§}$	0.23±0.13	0.26±0.13	0.21±0.11$^{\#}$	0.30±0.16$^{\#§}$
Ball Touches/Duration	0.69±0.23$^{\#¥}$	0.54±0.22$^{\#}$	0.60±0.28$^{¥§}$	0.53±0.19	0.69±0.21$^{\#}$	0.51±0.22$^{\#*}$	0.70±0.23$^{§\#}$	0.59±0.23$^{\#*}$
Passes/Duration	0.19±0.10$^{\#¥}$	0.34±0.16$^{\#}$	0.17±0.15$^{\#¥§}$	0.31±0.16$^{\#}$	0.18±0.10$^{\#}$	0.31±0.11$^{\#}$	0.20±0.12$^{\#§}$	0.32±0.13$^{\#}$
Ball Touches/Players Involved	4.15±2.21$^{\#}$	2.48±1.41$^{\#}$	3.83±3.09$^{\#}$	2.60±1.50$^{\#}$	4.03±2.62$^{\#}$	2.28±1.21$^{\#}$	4.14±2.45$^{\#}$	2.29±0.99$^{\#}$
Passes/Players Involved	1.16±0.69$^{\#¥}$	1.59±1.00$^{\#}$	0.97±0.85$^{\#¥§}$	1.47±0.85$^{\#}$	0.97±0.62$^{\#¥}$	1.39±0.67$^{\#}$	1.05±0.56$^{\#¥§}$	1.26±0.57$^{\#}$
Passes/Ball Touches	0.31±0.16$^{\#}$	0.66±0.20$^{\#*}$	0.35±0.28$^{\#}$	0.59±0.21$^{\#*}$	0.30±0.20$^{\#}$	0.64±0.16$^{\#*}$	0.30±0.19$^{\#}$	0.57±0.16$^{\#*}$
Goal/Shots	0.30±0.45$^{¥\#}$	0.00±0.00$^{\#§}$	0.16±0.36$^{¥\#}$	0.02±0.15$^{\#}$	0.34±0.47$^{\#¥}$	0.04±0.20$^{\#§}$	0.15±0.36$^{\#¥}$	0.04±0.20$^{\#}$
Offensive Sequences (Total)	65	86	66	86	80	99	91	94

$^{\#}$Significant differences between Structural SSCG and Manipulation SSCG in the groups;
*Significant differences between High Skilled Players and Low Skilled Players in Manipulation SSCGs;
$^{¥}$Significant differences between High Skilled Players and Low Skilled Players in Structural SSCGs;
$^{\$}$Significant differences Manipulation SSCG realized in U15 and U17;
§Significant differences between Structural SSCG realized in U15 and U17.

Discussion

The present research aimed to investigate: i) how Small-Sided and Conditioned Games with different modification strategies based on *representation* and *exaggeration of the* TGfU pedagogical principles affected team performance and exploratory behaviour; ii) and how teams and players of different ages and skill levels were affected by the use of these different modification strategies. Thus, the discussion is organized according to these two main research goals.

Differences between Small-Sided and Conditioned Games

Both SSCGs were modified in order to emphasize keeping ball possession. Analysis of the effect of game modifications on tactical problems and player behaviour has previously been performed (Lizana et al., 2015; Machado et al., 2016). In this regard, no differences were observed between either SSCG analysed for the *Duration of ball possession* dependent variable, indicating that the games emphasized the tactical principle of maintaining ball possession in both categories and groups of players with different skill levels.

However, our findings showed that SSCGs modified by structural constraints stimulated more ball touches and shots, as well as better offensive efficacy. These results suggest that SSCGs modified by rule manipulation demand higher technical efficiency and tactical complexity than Structural SSCRs. In Structural SSCRs, the key sources of information that regulated player decisions and actions came from the game itself, through the presence of four small

goalposts, the field shape, and the interaction of players. In turn, in Manipulation SSCGs, the key sources of information that regulated player decisions and actions came from both the game structural conditions and the game rules, as different task constraints. This might explain why Manipulation SSCGs presented lower values for performance indicators related to offensive efficiency (*Shots*) and effectiveness (*Goals*/*Shots*). Thus, Manipulation SSCGs are suggested to be a difficult task for players of the present study, since teams of both groups and categories presented much lower offensive efficacy. These results corroborate the importance of modifying the game according to the tactical complexity pedagogical principle. Thus, in order to provide players with an appropriate difficulty level, and allowing them to understand and solve the tactical problems presented, practitioners must carefully manipulate task constraints, especially regarding a high number of rules, since this will increase the task difficulty and decrease offensive efficacy of the teams (Serra-Olivares and Garcia-Rubio, 2017).

Besides team performance, Machado et al. (2016) found that SSCGs designed to emphasize the specific tactical problem of keeping ball possession through rule manipulation also inhibited team exploratory behaviour, since they presented lower variability of patterns of play. Torrents et al. (2016) corroborate this idea, since the authors report that when training tasks present a high level of difficulty, players' exploratory behaviour may be compromised. Therefore, results from the present study indicate that the strategy of SSCG modification through rule manipulation provides players and teams with tasks with a higher difficulty level and tactical complexity, inhibiting team exploratory behaviour.

Differences in tactical performance and exploratory behaviour depending on the skill level and age category

In addition to the finding that Manipulation SSCGs presented a higher difficulty level and tactical complexity than Structural SSCGs for both groups of players, it was found that the HSP developed better tactical adaptations according to the contextual dynamics of both games, demonstrating better offensive dynamics. These results are different to those observed by Serra-Olivares et al. (2016b), who found that modifying a keeping possession game by only altering structural constraints resulted in a game totally different from a real soccer game.

Regarding Structural SSCGs, differences were observed between players with different skill levels. In U15s, the group composed of players with a higher tactical efficiency level (HSP) showed a higher number of ball touches, as well as a higher rhythm of ball intervention and ball circulation than the group of players with lower tactical skills. In addition, the U15 HSP presented better offensive efficacy and higher individual contribution to ball circulation. In U17s, the results also showed that players with higher tactical skills presented higher individual contributions to ball circulation than players with a lower tactical level. Importantly, the findings showed that the U17 HSP presented better offensive efficiency and efficacy than the LSP.

Results of the present study are in line with those observed by Praça et al. (2018), who reported differences between players with different tactical skills. In this sense, Praça et al. (2018) observed that players with higher tactical skills presented better abilities to play collectively, mainly during the defensive phase. This was due to the fact that players needed to coordinate their actions in order to close space, directing the opposing team to play in less dangerous spaces.

Regarding the differences between categories, U17 players presented better results than U15 players in all variables. The U17 HSP showed higher offensive efficacy than the U15 HSP in Manipulation SSCGs. In the same game, the U17 LSP presented higher offensive efficiency and better rhythm of collective involvement. In Structural SSCGs, the U17 LSP presented a higher number of ball touches and passes performed than the U15 LSP. In addition, U17 players with lower tactical skills presented higher individual contributions to ball circulation than U15 players. These findings are in line with other research which demonstrated that older players developed better tactical efficiency levels (Américo et al., 2016) and tactical behaviour (Costa et al., 2010; Machado et al., 2013).

Regarding team exploratory behaviours, no goal scoring offensive patterns of play were observed in Manipulation SSCGs for either U15 group. These results suggest that Manipulation

SSCGs presented a higher difficulty level for this age category, regardless of the players' skill level. However, results concerning Structural SSCGs showed that the U15 LSP presented higher variability in offense patterns, indicating better exploratory behaviour than the U15 HSP. Conclusions of a study conducted by Torrents et al. (2016) might help understand these findings. Those authors highlighted that training tasks with appropriate complexity levels could increase exploratory behaviour and variety of actions, while easier tasks might promote more regular and less varied play actions. Thus, it could be possible that Structural SSCGs encouraged the LSP in the present study to leave their comfort zone, increasing exploratory behaviour. However, it may be the case that the complexity of Manipulation SSCGs was too high, especially for U15 teams and for the LSP groups. This assumption is supported by the results observed in their exploratory behaviours (i.e., smaller variety in offensive patterns and no goal-scoring offensive patterns identified).

The results of the present study contribute to better understanding of the representative task design from the nonlinear pedagogy point of view. One of the bases of nonlinear pedagogy is to highlight the learner as the central element of the process, as well as to understand the mutuality existing between the player and his/her context (Chow et al., 2015; Renshaw et al., 2009; Serra-Olivares and Garcia-Rubio, 2017). Thus, understanding how game modification strategies affect tactical performance and player exploratory behaviour differently, depending on their age and skill level, will contribute to the development of a high quality player-centred and game-based approach.

Although the study analysed how different strategies of modification of SSCGs affected team performance and exploratory behaviour, it is important to emphasize limitations, such as the non-use of team and player positional and displacement variables. This information would also be important to better understand how the tactical behaviour of teams composed of players of different tactical efficiency levels are affected by the use of different SSCG modification strategies.

Conclusion

Performance and exploratory behaviour of teams composed of players with different skill levels were differently affected by the game modification strategies used. In general, teams presented better performance in SSCGs where the tactical task of keeping ball possession was emphasized by structural modifications. In turn, SSCGs where the tactical task of keeping ball possession was emphasized by rule manipulation presented a higher difficulty level and tactical complexity for both groups of players and age categories.

Therefore, it is possible to conclude that the game modification strategy through manipulation with an excessive number of rules promotes an overload of information to guide player's actions, making this game more complex, especially for younger and less skilled players. For these players, it is more appropriate for practitioners to promote the manipulation of structural constraints, such as the pitch dimension and shape, number of players, and size, quantity, and location of goalposts. In addition, for older and higher skilled players, game strategy modification through rule manipulation could be used by practitioners to increase team exploratory behaviours. This information is very important for the design of appropriate representative training tasks as it helps in understanding how to incorporate different SSCG modification strategies applied in the study with players of different skill levels. This enables practitioners to provide effective learning environments to enhance their learning.

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Corresponding author:

João Cláudio Machado

Human Performance Laboratory (LEDEHU), Faculty of Physical Education and Physiotherapy, Federal University of Amazonas, Manaus, Brazil

Address: General Rodrigo Otávio Jordão Ramos Avenue, n.6.200 – Campus Universitário – SETOR SUL. Postal Code: 69.080-900, Manaus, Amazonas.

[2]Faculty of Physical Education, State University of Campinas, Campinas/SP, Brazil

Email: jclaudio@ufam.edu.br