



Unlocking Team Dynamics: Exploring the Influence of Group Regulation on Technical Development in Small-Sided Soccer Games

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Abstract

Purpose Discussions held by players during the halftime of a soccer match are widely recognized as influential factors in boosting their involvement and physical activity of soccer players. This study aimed to investigate the impact of learning small-sided games (SSG) through player discussions on decision-making, as well as the technical and tactical skills of young soccer players.

Methods Forty-two U-15 male amateur soccer players were randomly assigned to 6 groups and participated in a study comprising 4 sessions of small-sided games (SSG). Each session consisted of two sets of 15 min each. The SSG sessions were conducted with and without the inclusion of self-regulation of learning. Technical actions (i.e., balls won, balls received, balls lost, shots, and goals) were measured during each set of sessions using a digital camera recorder.

Results The results showed no significant differences in the main effects of the time, group, session, and group × session × time interactions for most technical actions. However, there was a significant main effect of group observed for shoot action ($P = 0.021$; $\eta_p^2 = 0.102$), with a higher number of shoot actions in the co-regulation of learning group than in the self-regulation of learning group.

Conclusion The self-regulation approach employed by players alone did not lead to significant improvements in technical performance during SSG. Further research is needed to explore additional factors and/or interventions that could potentially enhance the effectiveness of learning through discussions in SSG.

Keywords Adolescent · Coaching · Cooperative behavior · Decision making · Football · Motor skills · Peer interaction · Performance improvement · Self-directed learning

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Introduction

Small-sided games (SSG) are commonly utilized to replicate the demands of a football game in terms of technical skill, tactical awareness, speed, acceleration/deceleration, and endurance [1, 18, 19].

Many factors influence SSG intensity, such as pitch size, game duration, presence of goalkeepers, and coach encouragement [10, 12, 24]. The diverse format of SSGs, such as 6 × 6 in soccer, allows players more opportunities to touch the ball, thereby enhancing their technical, tactical, and physical abilities [4, 13, 28]. Consequently, the physical, tactical, and technical performance observed in SSGs has the potential to serve as a reliable indicator for match performance.

SSGs have been extensively examined within the framework of Bunker Thorpe's (1982) pedagogy of understanding. This pedagogical approach emphasizes the importance of teaching the game through understanding, with verbalization occurring between the game situations. The student is placed at the core of the learning process, with an alternating pattern and verbalization of the action [8, 29]. During the verbalization sequence, students engage in discussions and confrontations to collaboratively develop a collective action project in the form of a shared decision [28].

Physically, SSGs demand a constant balance of power involving rapid transitions between defensive and offensive situations, which require duels, changes in direction, repeated sprints, effective use of space, and more. Professional soccer players, in particular, benefit from the aerobic demands associated with high-intensity intermittent work, a well-documented requirement [9]. Furthermore, SSG-based exercises have demonstrated greater effectiveness in enhancing player motivation than other training methods [6, 16]. These exercises foster intrinsic motivation, satisfaction, and even physical enjoyment among players [16].

Gréhaigne [6] emphasized the significance of teacher-facilitated discussions in team sports, as these discussions help students or players understand the importance and practicality of the information and skills being taught. In line with the sociosemioconstructivist theory of learning in team sports, problematization plays a prominent role. Within the SSG framework, the focus is on uncovering practical solutions to problems arising from interactions among individuals or oppositional relationships.

Examining sociosemioconstructivism within sports coaching involves understanding how individuals construct knowledge and meaning through socio-cultural interactions. In the realm of coaching, this theory suggests that coaching practices are not only shaped by individual cognition but are also heavily influenced by social and semiotic processes [17].

Problematization refers to critically examining and questioning established norms and practices, challenging assumptions and considering alternative perspectives. Konoval et al. [15] delve into the application of problematization in sports coaching, particularly in the collaboration between a Foucauldian-informed coach developer and a university endurance running coach. The study explores the challenges and opportunities that arise when coaches engage in critical questioning the techniques and instruments within their discipline, aiming to rethink the broader impacts of coaching practices.

The prevailing emphasis in current soccer-related research centers around self-regulation as a fundamental construct [1, 18, 19]. However, a discernible shift in focus emerges, directing attention toward exploring the impact of group dynamics on technical development within small-sided games [7, 18]. This thematic evolution is encapsulated in the exploration of "learning small-sided games through discussions of technical development."

As the narrative progresses, a crucial connection between self-regulation and the emerging emphasis on collective influence becomes apparent. This alignment seeks to seamlessly bridge the initial discussion on self-regulation with the subsequent exploration of how group dynamics, discussions, and reflective practices play a role in shaping technical development during small-sided soccer games [26, 27].

During small-sided games (SSGs), the overall organization of the team appears to diminish when facing higher physical demands but improves when the physical demands are reduced [5]. The team's structure stability is influenced by the number of players involved in the match, which dictates pitch location and defines roles during the match [21].

The dynamical systems approach has established the bases for understanding the emergence of collective variables that describe the spatiotemporal pattern of interpersonal coordination and the emergent states that occur in response to game constraints [20]. Among these emergent states, group cohesion stands out in sport group dynamics, reflecting the tendency for a group to stick together and remain united in the pursuit of its instrumental and/or for the satisfaction of member affective needs [14].

The absence of comprehensive discussions on group dynamics in preceding sections prompts a refinement. It is vital to include relevant literature addressing collective aspects, group discussions, and reflective practices within the context of sports [11, 23]. This adjustment ensures a cohesive thematic thread throughout the manuscript, establishing a unified trajectory from self-regulation to the evolving landscape of group dynamics in the context of technical development during small-sided games.

Group regulation in sport encompasses the dynamics of individual members' influence within their groups and how individuals are impacted by group-related factors such as

group cohesion and role structures. It also involves team development intervention strategies that can promote group success and enhance members' experiences. Small groups such as teams, training groups, and physical education classes are integral to the sport, and the interactions within these groups significantly impact the overall sporting experience [2].

Research in exercise and sport psychology has also delved into group dynamics, aiming to understand how group dynamics can enhance individual and team athletic performance. This includes examining interpersonal emotion regulation in team sports, focusing on the mechanisms and reasons behind regulating teammates' emotions, thus highlighting the importance of group dynamics in the sporting context [3, 14].

To the best of our knowledge, no study has yet examined the effect of learning SSG through discussions of technical development in team sports, specifically among amateur soccer players, on technical variation during recovery periods between sets of SSGs. We hypothesized that incorporating group-regulation strategies during recovery periods between sets of SSGs among amateur soccer players would positively affect technical variation.

The hypothesis posits that group-regulation strategies, implemented during recovery periods between sets of small-sided games (SSGs) among amateur soccer players, would result in a positive impact on technical variation. Technical variation refers to the diversity or range of technical actions exhibited by players during the specified recovery periods. The expectation is that by incorporating group discussion strategies, there will be an observable improvement or variation in the technical actions performed by amateur soccer players during these specified periods.

Methods

Participants

Based on the medium-sized effect of learning SSGs through discussions on decision-making and technical development, a power analysis was performed using $G \times Power$ software (version 3.1.9.2, University of Kiel, Kiel, Germany), using the difference between two independent means. The results of the analysis indicated that a total sample size of $N = 36$ would be adequate for detecting significant effects of the condition, with a medium effect size ($f = 0.5$) and a significance level of $\alpha = 0.05$, while achieving a power of 0.95.

Thirty-six U-15 males amateur soccer players (age, 16 ± 0.5 years; height, 1.69 ± 0.9 m; body mass, 51.77 ± 3.64 kg; experience, 3 ± 1 years), from Tunisian team "ES-Tajerouine", were selected as participants. All players voluntarily provided written informed consent prior

to participation. None of the players reported any neuromuscular disorders, specific musculoskeletal injuries, or rehabilitation periods during the study. Players were divided randomly into six groups of six players, with one substitute player for each group ($n = 06$): three experimental groups (EG1, EG2, and EG3) and three control groups (CG1, CG2, and CG3). In a random order, each group was assigned to perform four sessions of an SSG, either with or without self-regulation of learning.

The players performed all sessions at consistent times of the day, separated by at least 48 h. The study was conducted in accordance with the guidelines of the Declaration of Helsinki and approved by the Scientific and Ethics Committee of the High Institute of Sports and Physical Education of Kef (UC-UR22JS01-2023).

Procedures

In each session, 6 vs. 6 players (EG and CG) played two sets of 15 min of SSG on a handball pitch with dimensions of 20 m length and 40 m width. The SSG followed the same rules as soccer. The observation grid was written based on the recorded videos of each set during each session. During the 5 min of recovery (between sets), only the experimental groups discussed the difficulties of the game in order to provide possible solutions in set 2. During the SSG, neither the evaluator nor the coach provided any feedback or verbal encouragement. Control groups were assigned to perform the SSG without any collective discussion between the sets. To uphold experimental integrity, members of the control group were intentionally separated to minimize interpersonal communication. This separation, including measures taken during intermissions, aimed to prevent discussions related to the self-regulation strategies under investigation. These steps bolstered internal validity, ensuring that observed effects were linked to the specified self-regulation interventions rather than unintentional interactions within the control group. The coach used the video sequences recorded during the sessions to construct observation grids, consisting of five parameters: the balls played, the ball conquered, the balls lost, the shots, and the goals.

Technical Features

A digital camera (Go Pro Hero 2, 1280×960 , 25 Hz) was positioned at an optimal angle (90°) to capture all sets and sessions on each game pitch. The evaluation focused on five specific technical actions: ball won (CB), ball received (RB), ball lost (LB), shot (S), and goal (G). These technical actions were selected based on a team sports assessment tool [20]. These technical actions were chosen based on the team sports assessment tool [20]. The recording of these technical actions followed specific criteria: CBs were coded whenever

a player successfully stole the ball from an opponent; RBs were counted when a player received a pass without losing control of the ball; LBs were considered when a player lost possession of the ball to an opponent or when it went out of bounds; LBs were recorded when a player executed a targeted shot; and G was recorded when a player successfully scored a goal.

Statistical Analyses

Data are expressed as means \pm standard deviation (SD). The normality of the data distributions and homogeneity of variance were assessed and confirmed using Kolmogorov–Smirnov and Levene tests, respectively.

Three-way analysis of variance (ANOVA) 2 groups \times 4 sessions \times 2 times was computed for the technical features of soccer. When significant differences were observed, LSD post hoc tests were used. Effect sizes were calculated as partial eta squared (η_p^2). Values of 0.01–0.059, 0.06–0.13, and ≥ 0.14 were considered as small, intermediate and large effects, respectively [22]. In addition, we plotted group changes in each set of SSG using the delta percentage ($\Delta\%$) for all parameters. The level of significance was set at $P < 0.05$. All statistical analyses were performed using SPSS version 16 for Windows (SPSS, version 16 for Windows. Inc., Chicago, IL, USA).

Results

All the technical actions measured during each set of sessions are displayed in Table 1. Using analysis of variance (ANOVA), no significant difference was found in the main effect of time, main effect of group, main effect of session, or Group \times Session \times time interactions for the majority of technical actions. However, our results showed a significant main effect of group ($P = 0.021$; $\eta_p^2 = 0.102$) between the two groups only for shoot action. In fact, we found a significant increase in the number of shoot actions in the EG compared to the CG in all sessions ($42\% < \Delta < 207\%$).

Discussion

The main purpose of this study was to analyze the effect of learning SSG through discussions of technical development in young soccer players. No statistically significant differences in technical performance were found between the two groups with or without discussion during the halftime of the SSG. However, significant improvement was observed only in the number of shots on target for the experimental group, who engaged in a collective discussion, without any

verbal intervention from the evaluator or coach during the recovery period.

This study is the first to investigate the effect of soccer players engaging in discussions during halftime (recovery between sets) of small-sided games on technical performance. Previous studies have highlighted the significance of SSG in enhancing the physical and technical qualities of young footballers [1, 18, 19]. Notably, SSG, characterized by reduced playing area and player numbers, has been associated with increased volumes of both individual and collective technical actions [7, 18].

In terms of technical performance, the findings of the current study indicated no significant differences between groups in terms of CB, RB, and LB during small-sided sessions, irrespective of whether players engaged in self-discussion during rest periods. However, a significant difference was observed between the groups in terms of the number of goals scored, with a higher number of shoot actions in the co-regulation learning group than in the self-regulation learning group.

These results could be attributed to the primary objective of players in team sports, which is to move the ball towards the scoring area and score goals [6, 27]. Zghibi [27] demonstrated that 9th-grade students, during an 8-session football cycle, were able to improve their offensive capacity index (number of shots on target to goals scored) following a period of inter-student idea discussion. Through verbalization during separated game situations, students were able to take more shots and score more goals, particularly in the last 3 sessions [27].

Furthermore, Zghibi [27] showed that during an 8-session football cycle, those who engaged in player-to-player discussions were able to effectively implement their action plans in terms of shots on target and goals scored, particularly in the last two sessions, compared to the team without inter-individual discussion. In handball, Zerai et al. [26] found similar results in girls who learned verbalization. Their study revealed improvements in game parameters, such as balls played, balls won, shots on target, and goals scored.

After each idea discussion, an improvement in the game organization was observed. The discussion methodology allowed for collective reflection, leading to tactical and motor improvements [11].

Harvey & Gittins [11] used video recordings to provide feedback to students during idea discussions and noted a significant increase in performance among players engaged in video-recorded idea discussions.

The author emphasized the importance of learning based on the authentic semiotics of motor actions in handball. Small-sided games are a promising tool for teaching and learning processes in football. Integrating moments of peer discussion during physical education lessons is crucial for establishing reflective practice within and through action.

Table 1 The effect of learning small-sided games through discussions made by players on technical features

Technical features	Groups	Session 1		Session 2		Session 3		Session 4		Group effect (η_p^2)	Session effect (η_p^2)	Time effect (η_p^2)	Group \times session \times time (η_p^2)
		Set 1	Set 2	Set 1	Set 2	Set 1	Set 2	Set 1	Set 2				
Balls won	EG	2.14	2.00 (1.41)	2.43	2.71	2.29	2.57	2.29	3.29 (2.36)	0.467 (0.028)	0.243 (0.072)	0.075 (0.065)	0.988 (0.003)
	CG	-1.07		-1.51	-1.5	-1.5	-1.99	-1.5					
Balls received	EG	1.71	1.57	2.14	2.43	1.71	2	2	2.57	0.438 (0.031)	690 (0.036)	0.221 (0.031)	0.819 (0.019)
	CG	-0.95	-1.27	-1.95	-1.4	-1.38	-1.15	-1.41	-1.72				
Balls lost	EG	25.2	27.4	13.6	11.5	33.9	28.5	14.5	28	0.458 (0.029)	0.583 (0.043)	0.258 (0.027)	0.235 (0.084)
	CG	-1.27	-1.25	-1.21	-0.53	-1.11	-0.98	-0.82	-0.69				
Shots	EG	1.29	1.14	0.86	1	1.71	1.57	1.29	1.29	0.050 (0.099)	0.543 (0.046)	0.965 (0.00)	0.961 (0.006)
	CG	-1.11	-1.07	-0.9	-0.82	-1.38	-1.13	-1.11	-0.76				
Goals	EG	1.43	1.29	0.86	0.43	1.71	1.43	1	0.86				
	CG	-0.9	-0.69	-0.76	-0.82	-0.95	-0.9	-0.82	-0.53				
Shots	EG	1	1.43	0.86	0.71	1.57	1.29	0.71	0.71	0.438 (0.031)	690 (0.036)	0.221 (0.031)	0.819 (0.019)
	CG	-0.82	-1.13	-0.9	-0.76	-1.27	-1.25	-0.76	-0.95				
Goals	EG	14	24.6	17.4	40.9	17.8	33.3	40.9	39.4	0.050 (0.099)	0.543 (0.046)	0.965 (0.00)	0.961 (0.006)
	CG	-0.53	-0.53	-0.9	-0.95	-0.79	-0.79	-0.38	-0.79				
Goals	EG	0.43	0.29	0.36	0.5	0.29	0.14	0.29	0.29	0.511 (0.025)	0.807 (0.028)	0.918 (0.00)	0.451 (0.053)
	CG	-1.11	-0.49	-0.79	-0.79	-0.49	-0.38	-0.49	-0.49				
Goals	EG	65.1	96.6	138.9	42	96.6	207.1	51.7	96.6				
	CG	0.29	0.29	0.14	0.14	0.29	0.29	0.14	0.43				
Goals	EG	-0.49	-0.49	-0.38	-0.38	-0.76	-0.49	-0.38	-0.79				
	CG	0.14	0.14	0	0.29	0.43	0	0.29	0.14				
Goals	EG	-0.38	-0.38	0	-0.49	-0.79	0	-0.76	-0.38				
	CG	107.1	107.1	140	-51.7	32.6	290	51.7	207.1				

Verbalization is a pedagogical tool that allows students to focus more on tasks and may enhance learning and students' abilities during collective play [26]. Similarly, Sahli et al. [23] demonstrated that peer verbal encouragement had beneficial effects on parameters such as shots on target and balls played, compared to encouragement provided by teachers. In other words, when students encourage each other, they demonstrate better ball retention and take more shots on goal than when playing under the verbal encouragement of their teacher.

The homogeneity of the groups, along with their shared emphasis on attacking and defensive aspects, including ball recovery, may have contributed to our results. We deliberately maintained the same groups throughout the four sessions to minimize the potential impact of group heterogeneity. The players' relatively limited experience, ranging from 2 to 4 years, could have enhanced their technical stability during SSGs, even when engaging in collective discussions during the recovery period (between sets) in the experimental group.

The deliberate selection of this cohort allows us to isolate the effects of controlled learning environments and explore the relationship between limited experience and enhanced technical proficiency. While acknowledging potential variations, our study aims to carefully analyze and understand this variability, providing valuable insights into dynamics of skill development. This research approach contributes to a nuanced understanding of how limited experience may influence technical stability, with potential implications for athlete development and training programs.

It is worth noting that although players were able to identify difficulties and tactical errors during the first set, the choice of solutions applied may not have been appropriate, considering their technical proficiency. Previous studies have highlighted the importance of experience in soccer competitions [25]. Furthermore, considerable variations in individual performance among players can negatively impact the overall performance of the group [1]. Regarding shot actions, the present study indicates that the number of shots was significantly higher in the EG than in the CG, without a significant main effect of time, session, or Group \times Session \times time interaction. However, this improvement did not affect the effectiveness of shots, as no significant difference existed between the EG and CG in terms of goal numbers.

Conclusions

Based on the findings of our study, it can be concluded that player-only discussions during SSG did not lead to significant improvements in technical performance among soccer players. Future research should explore the potential impact of player discussions facilitated by coach intervention on the

learning process in soccer, particularly concerning changes in technical and tactical behaviors. This would provide valuable insights into how the inclusion of coach interventions during player discussions can affect skill development and overall on-field performance.

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Data Availability Data will be made available on reasonable request.

Declarations

Conflict of Interest The authors have no relevant financial or non-financial interests to disclose.

Ethics Approval This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of the High Institute of Sports and Physical Education of Kef, University of Jendouba (2023/UC-UR22JS01).

Consent to Participate Informed consent was obtained from all individual participants included in the study.

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