

## Declarative and procedural tactical knowledge in youth soccer players: an exploratory study in Chile

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### Abstract

**Background and Study Aim** Tactical knowledge, both declarative and procedural, is an essential component of cognitive development in youth soccer. The aim of this study is to describe and analyze the declarative and procedural tactical knowledge of youth football players from a professional club in southern Chile.

**Material and Methods** The Soccer Offensive Tactical Knowledge Test and Procedural Tactical Knowledge Test were the instruments used in the study to assess declarative tactical knowledge (game principles and decision making) and procedural knowledge (execution based on the tactical strategy in a 3x3 reduced-field). Assessments of functional differences could be evaluated due to the representation of players from various positions in the sample.

**Results** The results indicated superior performance in off-ball procedural skills (JSB:  $4.19 \pm 1.64$ ) but poor performance in off-ball marking (MJSB:  $3.56 \pm 2.09$ ), illustrating limitations in defensive anticipation and positional reading. Defenders performed better than midfielders and forwards in all procedural dimensions ( $p < 0.05$ ), indicating an internalization of tactics in a functional way according to their positional roles. At the declarative level, operational principles-based knowledge among the participants was found to be relatively higher ( $8.57 \pm 2.63$ ), while decision making was found to be lower in this study ( $5.94 \pm 2.28$ ), indicating a deviation from theory to practical execution. No significant differences were found by position in this type of knowledge.

**Conclusions** The finding of a partial dissociation between declarative and procedural learning, as confirmed earlier in related work, has implications for the methodological design of coaching at the U13 and U14 levels. It indicates why emergent-based methodologies that support the interweaving of tactical thought and action to enable adjusted and effective learning in grassroots football are urgently needed.

**Keywords:** grassroots football, declarative tactical knowledge, procedural tactical knowledge, teaching, learning, coaching.

### Introduction

Tactical knowledge is a crucial component of player development in modern football. At the core of such knowledge are cognitive aspects of performance, including players' ability to interpret, anticipate, and respond to dynamic game situations. In this context, each stage of player development presents specific training characteristics aligned with age-related developmental indicators.

Grassroots football serves as the foundation of the sport, nurturing talent development, promoting social inclusion, and fostering community engagement [1, 2]. Research highlights that teaching and learning methodologies focused on tactical skill development enable players to effectively apply their technical abilities under match conditions. This underscores the necessity of a game-situation-

based teaching approach, often referred to as the active method, which places tactical reasoning and decision making at the core of the learning process [3, 4].

Within this framework, tactical decision making in sports requires athletes to assess what action to take, why it is necessary, how to execute it, when to apply it, and where to position themselves. Ultimately, they must determine the most suitable technical skill to resolve a given task or challenge within the dynamic context of the game [5].

In team sports pedagogy, the development of tactical knowledge is a priority for coaching staff, serving as a cornerstone in youth football training, especially during the early stages of competitive development [3]. Mastery of tactical principles not only enhances players' ability to interpret game demands but also equips them to respond effectively in complex scenarios. In grassroots football, tactical knowledge is considered a fundamental component for fostering adaptive decision making, integrating

both theoretical understanding and practical execution [6].

The literature distinguishes between two types of knowledge: declarative knowledge and procedural knowledge [7, 8]. Declarative tactical knowledge is verbalized through an understanding of player positions and basic defensive and offensive strategies. In sport, this knowledge reflects an athlete's ability to recognize what to do in a specific game situation [9, 10]. On the other hand, procedural tactical knowledge is demonstrated through actions requiring advanced motor skills and is defined by an understanding of how to perform specific movements. As procedural knowledge involves the execution of motor actions, it necessitates complex cognitive processing for effective implementation, making it inherently more intricate than declarative knowledge [11, 12, 13].

In team sports, players who exhibit strong technical ability (such as ball control and refined skills) often struggle with tactical decision making during interactions with opponents. This difficulty may stem from an incomplete transfer of declarative knowledge to the procedural level or the inability to apply knowledge in the correct context, leading to tactical inefficiencies and a lack of game awareness [14, 15]. Sports science research has consistently shown that experienced players possess more structured strategic, declarative, and procedural knowledge, reinforcing the importance of integrating cognitive and motor components in player development [16, 17, 18].

Research suggests that procedural knowledge is a more complex process, encompassing not only the selection of an action but also its execution through a specific technique or technical skill [13, 19, 20]. In team sports, procedural knowledge is directly linked to problem-solving responses in training and match scenarios. Given the unpredictable and adaptive nature of these games, a high level of procedural proficiency is essential for developing effective motor responses to game situations in sports like football [21].

In the instruction and training of grassroots football, many players face difficulties in translating declarative knowledge into effective tactical execution [3]. This gap between knowing and doing presents a critical challenge for coaching staff, highlighting the need for integrated learning approaches.

The analysis of research findings indicates that the development and application of tactical knowledge play a pivotal role in the cognitive and motor performance of youth football players. The authors emphasize the importance of distinguishing between declarative and procedural knowledge and highlight how these forms of knowledge interact within real-game contexts. Furthermore, attention is drawn to the role of

integrated training methodologies that foster both theoretical understanding and practical execution. Nevertheless, despite numerous existing studies, there remains a pressing need for more in-depth research that explores the mechanisms underpinning the transfer of knowledge to effective in-game decision making and tactical execution.

The aim of this study is to describe and analyze the declarative and procedural tactical knowledge of youth football players from a professional club in southern Chile.

## Materials and Methods

### *Participants*

The study examined a sample of 41 athletes aged 13 to 14 years. A single cross-sectional design was conducted in Talca, in the Maule Region of Chile. A non-probabilistic sample was selected from a population of U13 and U14 soccer players. The exclusion criteria for the study included: a) lack of affiliation with the club in the U13 and U14 categories; b) presence of an injury preventing completion of the physical tests; c) absence on the day the instruments were administered; and d) refusal of consent by the player's parents or guardians. The final sample consisted of 41 players who completed both assessments.

Participation was voluntary. Parents or guardians were informed about the study's objectives, procedures, and potential risks and benefits during a meeting at the club. Written informed consent was required for participation, in accordance with the 1964 Declaration of Helsinki and its subsequent updates. The research was approved by the Scientific Ethics Committee of the Universidad Católica del Maule, under document Act 139-2024.

### *Research Design*

#### *Instruments*

To assess Procedural Tactical Knowledge (PTK), the 3x3 Procedural Tactical Knowledge Test proposed by Castro et al. [22] was utilized. The test involves a 3x3 situation performed with the feet to measure the frequency or absence of tactical behaviors during gameplay in game-like or competition-like scenarios. It includes three attackers and three defenders (numbered from 1 to 3, with different colors for each team) playing for four consecutive minutes on a 9x9 square meter field, aiming to maintain possession of the ball. A video camera is positioned in one corner of the field at a height of 1.5 meters, capturing the entire field in focus. A GoPro Hero 11 camera was used for this study. The tests were conducted in the afternoon under clear, well-lit conditions. All recordings took place at the same time on different days, using the same natural grass pitch to ensure consistent environmental conditions.

Defenders can anticipate, intercept, or take the ball from the attacking player. If the defender successfully regains possession, their team transitions to the offensive role. To incentivize defensive efforts, the number of successful interceptions is counted in the same way as the number of passes exchanged. Upon the restart of play (first pass), defenders must refrain from touching the ball and maintain a “statue” position, with arms outstretched beside the body and hands fixed to their sides.

Consistent with previous studies [7, 10, 13], this research presents the overall results for the team under study. However, individual player performance is also documented, allowing for analysis focused on either team dynamics or individual contributions. To evaluate Declarative Tactical Knowledge (DTK), the Soccer Offensive Tactical Knowledge Test proposed by Rechenchosky et al. [23] was administered. This assessment consists of a 15-question multiple-choice questionnaire divided into two sections. The first part contains direct questions assessing general knowledge of offensive actions in the game and its rules.

The second section of the test focuses on tactical problem solving, with responses based on images illustrating offensive game scenarios. Tactical knowledge is assessed across four dimensions: operational tactical principles, collective tactical-technical elements, rules, and decision making. In this study, the test was administered individually in a designated room equipped with chairs, clipboards, questionnaires, and pens. Data collection began with an introduction to the research team and study objectives, followed by participant orientation and completion of the instrument. There was no time limit for the athletes to complete the test. Both tests were selected based on their development and application within cultural contexts similar to the Chilean reality, as evidenced by their inclusion in published research within this field.

*Statistical analysis*

Statistical analysis was conducted using IBM SPSS® version 24. Sample characteristics were described using means ± standard deviation for continuous variables and frequency distributions for categorical variables. The Kolmogorov–Smirnov test was applied to assess normality. Differences between playing positions and categories were examined using the Student’s t-test. Additionally, correlations between numerical variables were analyzed using Pearson’s correlation coefficient, with adjustments for the covariate category in which the player competes. The Shapiro–Wilk test was also used to assess the normality of the sample, while Levene’s test verified the homogeneity of variances. No significant differences were observed between the variances of the compared groups ( $p >$

0.05). Differences based on playing positions and categories were analyzed using the Student’s t-test.

**Results**

Table 1 presents the general characteristics of the players in the U13 and U14 categories. Although the players in both categories show similar anthropometric profiles, minor variations in height and BMI suggest differences consistent with age-related development stages. Notably, players in the U14 group tend to have slightly more experience, which may reflect their longer involvement in structured training environments. These descriptive patterns provide context for interpreting the tactical knowledge results presented in subsequent analyses.

**Table 1.** Player characteristics

Variable	U13 (n = 22)	U14 (n = 19)
Age	13.38	14.27
Height (cm)	166.02	164.15
Weight (kg)	58.48	59.23
BMI (kg/m <sup>2</sup> )	20.85	20.49
Years of experience	6	7

Note. BMI: body mass index

Table 2 summarizes the team and individual scores for each dimension of Procedural Tactical Knowledge.

From the results presented in Table 2, it is evident that players performed better in scenarios involving off-ball movement without direct marking pressure. This may reflect a higher level of spatial awareness and anticipation when players are not constrained by immediate defensive engagement. In contrast, performance decreased in situations where players were required to act with the ball or while being marked, suggesting that decision making and execution under pressure remain areas for development. The distribution of scores across the different roles indicates a consistent trend: players appear more tactically effective in unmarked, off-ball contexts compared to marked or ball-involved situations.

Table 3 presents the individual scores for each dimension of Declarative Tactical Knowledge among the 41 participants. The results indicate that players demonstrated a stronger understanding of conceptual and theoretical frameworks related to tactical principles, suggesting effective internalization of key strategic ideas. In contrast, lower performance in the decision-making dimension may reflect a gap between theoretical knowledge and its application in dynamic game scenarios. This discrepancy points to the need for instructional methods that promote contextualized learning and applied cognitive processing during

play. The moderate results in rule-based and practical knowledge areas suggest an opportunity to reinforce foundational concepts in tandem with situational decision training.

Table 4 presents the levels of tactical performance and declarative tactical knowledge of players according to their playing position (forward, midfielder, defender).

The results reveal that defenders consistently outperformed forwards and midfielders in all dimensions of procedural tactical knowledge, with statistically significant differences observed in all categories ( $p < 0.05$ ). This suggests that defenders possess more developed tactical behaviors, particularly in situations involving both on- and off-ball responsibilities, likely due to the demands of their role in game dynamics.

In contrast, no statistically significant differences were found between playing positions in any of the declarative tactical knowledge dimensions. This indicates a relatively uniform level of theoretical

understanding across positions, suggesting that differences in practical execution are not due to disparities in knowledge but possibly to positional demands or situational experience on the field.

## Discussion

The aim of this study was to describe and analyze the levels of declarative and procedural tactical knowledge among youth football players from a professional club in southern Chile. The findings revealed that players demonstrated higher performance in procedural dimensions related to off-ball situations, particularly among defenders, who outperformed their peers across all tactical tasks. In contrast, while declarative tactical knowledge was generally well developed across all players, no significant differences were observed between positions, indicating a shared theoretical understanding regardless of on-field role.

The results of this study provide valuable insights into the procedural and declarative tactical

**Table 2.** Level of Team and Individual Procedural Tactical Knowledge

Performance Dimension	Global Score (Mean $\pm$ SD)	Individual Score (Mean $\pm$ SD)
Performance at JSB	187.25 $\pm$ 2.89	4.19 $\pm$ 1.64
Performance at JCB	163.25 $\pm$ 2.62	3.60 $\pm$ 1.77
Performance at MJSB	162.50 $\pm$ 3.49	3.56 $\pm$ 2.09
Performance at MJCB	184.25 $\pm$ 3.26	4.05 $\pm$ 1.98

Note. JSB - player without the ball; JCB - player with the ball; MJCB - player with the ball marker; MJSB - player without the ball marker.

**Table 3.** Individual Declarative Tactical Knowledge

Dimension	Mean $\pm$ SD
Practical Knowledge	6.36 $\pm$ 2.22
Operational Tactical Principles	8.57 $\pm$ 2.63
Operational Tactical Elements	7.58 $\pm$ 2.52
Rules	6.35 $\pm$ 2.44
Decision Making	5.94 $\pm$ 2.28

**Table 4.** Level of Tactical Performance and Declarative Tactical Knowledge of Players Based on Playing Position

Dimension	Forward (n = 13)	Midfielder (n = 14)	Defender (n = 14)	p-value
Performance at JSB	3.50 $\pm$ 0.89	3.41 $\pm$ 0.90	5.41 $\pm$ 1.84	0.00
Performance at JCB	2.75 $\pm$ 0.89	2.86 $\pm$ 1.08	4.93 $\pm$ 1.94	0.00
Performance at MJSB	2.61 $\pm$ 1.21	2.61 $\pm$ 1.26	5.15 $\pm$ 2.28	0.00
Performance at MJCB	3.48 $\pm$ 1.95	3.04 $\pm$ 0.90	5.46 $\pm$ 1.95	0.01
Practical Knowledge	5.94 $\pm$ 1.79	6.61 $\pm$ 2.21	7.01 $\pm$ 2.22	0.55
Operational Tactical Principles	8.53 $\pm$ 2.87	8.79 $\pm$ 1.87	8.93 $\pm$ 2.47	0.95
Operational Tactical Elements	7.46 $\pm$ 2.03	8.24 $\pm$ 1.87	7.98 $\pm$ 2.51	0.73
Rules	5.87 $\pm$ 2.06	6.34 $\pm$ 2.48	7.19 $\pm$ 2.34	0.39
Decision Making	5.44 $\pm$ 1.84	6.20 $\pm$ 2.42	6.59 $\pm$ 2.28	0.53

Note. JSB - player without the ball; JCB - player with the ball; MJCB - player with the ball marker; MJSB - player without the ball marker.

knowledge of young soccer players in the U13 and U14 categories of a Chilean professional club. This research not only corroborates findings from previous international literature [8, 13] but also highlights the importance of considering both “on-game” and “in-game” knowledge to deepen the understanding of cognitive-tactical development in grassroots football.

In terms of Procedural Tactical Knowledge, the 3x3 format assessment revealed stronger competence in off-ball performance (JSB:  $4.19 \pm 1.64$ ) compared to lower performance in off-ball marking situations (MJSB:  $3.56 \pm 2.09$ ). This trend aligns with Cardoso et al. [19], who suggest that tasks involving game reading and defensive decision making out of possession demand higher cognitive complexity and advanced anticipatory skills. These findings suggest potential gaps in current training methodologies. Defensive tactical intelligence without the ball may not be sufficiently prioritized, possibly due to an overemphasis on technical and tactical aspects related to ball possession.

However, Santos et al. [24] present a different perspective. Their findings suggest that small-sided games enhance consistency in player positioning both with and without the ball. These results highlight how spatial awareness, including player spacing and proximity to goals, is influenced by variations in technical skills that stem from diverse learning experiences.

Looking at specific positions, the data reveal significant differences across all aspects of procedural tactical knowledge ( $p < 0.01$ ), with defenders demonstrating a stronger understanding than midfielders and forwards. These findings suggest a connection between a player’s role within the team structure and the extent to which tactical behaviors are internalized. This perspective is consistent with the views of Sarmiento et al. [4] and Aquino et al. [11], who argue that specialization in a tactical role influences the quality of motor decisions made during play. Trained players, particularly experienced defenders, appear to be more attuned to these tactical demands, which may contribute to their effectiveness. Regarding declarative tactical knowledge, participants performed better in operational tactical principles and lower in the decision-making dimension. This disparity may indicate a gap between theoretical understanding of the game and its application in context-dependent situations.

The observed disconnection between a general understanding of game principles and the ability to apply them effectively in decision-making processes warrants attention. Gaviria Alzate et al. [20] and García-Ceberino et al. [15] highlight the distinction between conceptual knowledge, which involves understanding what actions to take, and the nuanced ability to execute those actions appropriately in

specific contexts. The lack of significant positional differences in declarative knowledge indicators, contrasted with disparities in procedural knowledge, reinforces the idea that declarative knowledge is less dependent on direct situational experience. Instead, it appears to be more closely associated with formal or explicit instructional methods [9].

One of the key contributions of this study is the empirical evidence supporting the partial dissociation between declarative tactical knowledge and procedural tactical knowledge. These findings reinforce the arguments of López et al. [14] and de Castro Júnior et al. [7], who suggest that the development of tactical knowledge is neither linear nor homogeneous. Simply understanding rules and principles does not guarantee effective execution on the field, which underscores important implications for training methodologies. Consequently, integrating both levels of knowledge in a situated, dynamic, and contextually relevant manner is essential [5, 25].

Acknowledging the methodological and pedagogical implications of this study, the findings advocate for training paradigms grounded in authentic game scenarios, exemplified by the situational method. This approach supports the simultaneous development of tactical acumen and technical proficiency within ecologically valid contexts. Consequently, practitioners are encouraged to critically reassess the prevalent reliance on decontextualized analytical drills and instead prioritize learning environments that cultivate advanced tactical reasoning, real-time problem-solving skills, and post-activity reflection as a metacognitive tool [3, 26]. This pedagogical shift aims to nurture players who possess a deep understanding of the game’s inherent logic while demonstrating adaptability to its dynamic demands. Accordingly, the design of training tasks should seek an optimal challenge point—one that fosters exploratory behavior and tactical innovation without inducing cognitive overload, which could hinder creative expression.

Gradually introducing more complex game situations, while carefully maintaining a balance that promotes player autonomy and informed decision making, appears to be a more effective developmental strategy in foundational football programs. In contrast, research by Matos et al. [10] highlights significant variance in tactical performance, based on underlying game principles, which is contingent upon players’ specific field positions. These findings reinforce the need for tactical instruction that is carefully contextualized to the unique demands of each role. A well-founded understanding of tactical training principles, grounded in the logic of the game, can enhance both coaches’ and players’ ability to anticipate individual actions within the broader team dynamic.

Among the primary limitations of this study are the relatively small sample size and its confinement to a single club, which inherently restrict the generalizability of the findings. Furthermore, the cross-sectional nature of the research design precludes an exploration of longitudinal developmental trajectories in tactical knowledge acquisition. Future research should therefore adopt a longitudinal perspective and integrate qualitative methodologies to gain deeper insights into players' cognitive schemata. Additionally, it is recommended that future studies validate the assessment instruments within the Chilean context and explore the interplay between tactical knowledge and technical, physical, and psychological performance across developmental stages.

## Conclusions

This study presents empirical evidence on the relationship between procedural and declarative tactical knowledge in young Chilean footballers (U13 and U14 cohorts). The results reveal a significant disparity: although players demonstrate

a basic understanding of game tactics, they struggle to apply this knowledge effectively in real match situations due to the dynamic pressures involved. This discrepancy is especially evident in off-ball defensive scenarios, where players must anticipate and respond under higher cognitive demands.

Integrating both types of knowledge within authentic and adaptive learning contexts is crucial for enhancing performance. Coaches and educators should create training environments that foster tactical reasoning, decisional autonomy, and the effective transfer of theoretical knowledge into practical execution. Targeted pedagogical strategies that address the gap between declarative ("knowing what") and procedural ("knowing how") knowledge are essential for developing tactically intelligent players capable of responding effectively to the dynamic nature of the game.

## Conflict of interests

The authors declare that there is no conflict of interests.

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