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Validación de "TesTactico para F7": Una herramienta para analizar el Conocimiento Táctico Declarativo basada en un Sistema de Observación de la Competencia Futbolística

Validation of "TesTactico for F7": A tool to analyse Declarative Tactical Knowledge based on a Football Competence Observation System

Validação do "TesTactico F7": Um instrumento para analisar o Conhecimento Tático Declarativo baseado em um Sistema de Observação da Competência Futebolística

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RESUMEN

Este estudio tuvo como objetivo diseñar y validar una prueba de respuesta múltiple con imágenes de situaciones de juego del fútbol para evaluar el conocimiento táctico declarativo (CTD) del jugador. "TesTactico para F7" (fútbol-7) está compuesto por 62 situaciones de juego relacionadas con los criterios (fases, roles, acciones de los subroles adquiridos, principios operacionales y fundamentales/específicos) del Sistema de Observación de la Competencia Futbolística (FOCOS), analizando 67 variables. El coeficiente de validez de contenido (9.63/10) se estimó mediante grupo de expertos (n=13), calculando grado de acuerdo y aceptación. La validez de constructo se calculó mediante la prueba T-Student para muestras independientes. Participaron 155 jóvenes futbolistas organizados según su competencia futbolística (alta=80; baja=75). El cálculo del tamaño de la muestra post-hoc usando G*Power reveló .93 de poder (d=0.5, p=0.5). Se utilizó la corrección de Bonferroni para controlar la tasa de error familiar en cada criterio. Los resultados reflejaron que el grupo de alto nivel fue mejor en las 67 variables, con diferencias significativas ($p \leq .008$) en 38 de ellas. También se calculó el tamaño del efecto d-Cohen para evaluar la magnitud de diferencias que fueron grandes (d = 1.38) para el Promedio Total. La fiabilidad de la herramienta se determinó a nivel inter-observador mediante el índice de concordancia kappa de Fleiss (k = .882), y a nivel intra-observador mediante el método test-retest utilizando kappa de Cohen (k = 1.000). La consistencia interna fue estimada a través del coeficiente alfa de Cronbach (α = .925). El análisis de generalizabilidad mostró también una excelente fiabilidad (G =.985) y una representatividad perfecta (r2 = 1.00), evidenciándose que la variabilidad es

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explicada por las situaciones de juego que componen el test. Se concluye que el instrumento presenta valores óptimos de validez y confiabilidad.

Palabras clave: Toma de decisión, habilidad perceptivo-cognitiva, evaluación táctica, talentos deportivos, fútbol.

ABSTRACT

This study aimed to design and validate a multi-response test with images of football game-play situations to evaluate the player's declarative tactical knowledge (DTK). “TesTactico for F7” (seven-a-side football) is made up of 62 game-play situations related to the criteria (phases, roles, actions of the acquired subroles, operational and core/specific principles) of the Football Competence Observation System (FOCOS), analysing a total of 67 variables. The content validity coefficient (9.63 out of 10) was estimated via expert group (n=13), calculating the averages of the degree of agreement and acceptance of the experts. The construct validity was calculated using Student's T-test for independent samples. 155 young football players participated according to their football competence (high-level=80; low-level=75). The post-hoc sample size calculation using G*Power revealed .93 of power (d=0.5, p=0.5). Bonferroni correction was used to control the family-wise error rate in each criterion. The results reflected that the high-level group was better in the 67 variables, with significant differences ($p \leq .008$) in 38 of them. Cohen’s d-effect size was also calculated to assess the magnitude of the difference between both groups, which were large (d = 1.38) for the Total Average. The reliability of the tool was determined at the inter-observer level using the Fleiss kappa index of concordance (k = .882), and at the intra-observer level through the test-retest method using the Cohen kappa index (k = 1.000). Internal consistency was estimated through Cronbach's alpha coefficient (α = .925). The generalizability analysis also showed excellent reliability (G = .985) and perfect representativeness (r2 = 1.00), showing that the variability is explained by the game-play situations that make up the test. It is concluded that the instrument shows optimal validity and reliability values.

Keywords: decision-making, perceptual-cognitive skill, tactical assessment, sports talent, soccer

RESUMO

Este estudo teve como objetivo validar um teste de múltipla escolha com imagens de situações de jogo de futebol para avaliar o conhecimento tático declarativo (CTD) do jogador. O "TesTactico F7" (futebol-7) é composto por 62 situações de jogo relacionadas com os critérios do Sistema de Observação da Competência Futebolística (FOCOS) , analisando 67 variáveis. O coeficiente de validade de conteúdo (9,63/10) foi estimado por um grupo de especialistas (n=13), calculando o grau de concordância e aceitação. A validade de construto foi calculada usando a T-Student para amostras independentes. Participaram 155 jovens jogadores de futebol, organizados de acordo com sua competência futebolística (alta=80; baixa=75). O cálculo do tamanho da amostra post-hoc usando G*Power revelou poder de 0.93 (d=0.5, p=0.5). A correção de Bonferroni foi usada para controlar a taxa de erro em cada critério. Os resultados mostraram que o grupo de alto nível foi melhor nas 67 variáveis, com diferenças significativas ($p \leq .008$) em 38 delas. O tamanho do efeito d-Cohen também foi calculado para avaliar a magnitude das diferenças entre os dois grupos, que foram grandes (d = 1.38) para o Escore Total. A confiabilidade do instrumento foi determinada no nível interobservador pelo índice de concordância Fleiss kappa (k = .882), e no nível intraobservador pelo método teste-reteste usando o kappa de Cohen (k = 1.000). A consistência interna foi estimada por meio do coeficiente alfa de Cronbach (α = 0,925). A análise de generalização também apresentou excelente confiabilidade (G = .985) e representatividade perfeita (r2 = 1.00), mostrando que a variabilidade é explicada pelas situações de jogo que compõem o teste. Conclui-se que o instrumento apresenta valores ótimos de validade e confiabilidade.

Palavras chave: tomada de decisão, habilidade perceptivo-cognitiva, avaliação tática, talento esportivo, futebol

INTRODUCTION

Due to the nature of football, the development of the tactical-strategic component is key to obtaining high levels of performance (Bayer, 1986; Castelo, 1994; Errekagorri et al., 2020; Garganta, 1997; Gréhaigne, 1992; Teodorescu, 1984). Therefore, it is necessary for coaches and scouts to consider the technical-tactical skill of players as a key variable in the identification of sports talent (Sarmento et al., 2018). However, the grassroots and academies have traditionally been concerned of teaching football from the technical dimension in its most restrictive way (Garganta, 1997). In this sense, for a long time, technique was considered the fundamental and basic element in the configuration and development of game action in team sports (Hernández Moreno, 1994). On the one hand, regarding this traditional approach, teaching football would be teaching how to master the ball with your feet. On the other hand, from other game-based perspectives, teaching how to play football would be teaching how to relate well with teammates to oppose rivals. Under this last idea, communication and counter-communication (Parlebas, 1977) are especially important in football competence (Parlebas, 2018). Thus, the football teaching and training process should focus on tactical aspects to improve the performance of the players (Teoldo, Garganta, Greco, & Mesquita, 2010), at the same time that the evaluation processes must specifically point to the relational dimension of the game and the analysis of behaviours that the players display during their performances.

Tactical knowledge has been defined as the ability of the players to adapt to the game context (González-Víllora et al., 2015), being a determining variable in their decision-making within a game loaded with uncertainty and high variability (Duarte Araújo, 2013). Tactical knowledge has been classified in two perspectives: a perspective that refers to declarative tactical knowledge (DTK), that is, "knowing what to do", through knowledge of the rules, positions, functions, offensive and defensive strategies, and understanding of the technical-tactical logic of the game (Thomas et al., 1986); and a perspective of the procedural tactical knowledge (PTK), intimately linked to the particular motor action (Kirkhart, 2001; Teoldo, Garganta, Greco, & Mesquita, 2011; Williams & Davids, 1995), that is, “to know how to do". This second, the tactical dimension of behaviour, is decisive and refers to the player's performance in the context of the game (French & Thomas, 1987), or to football competence (Parlebas, 2018). The problem is to determine if the players' PTK is linked to their DTK. During these last decades, there has been a constant debate between the supporters of a cognitive understanding, connoted with motor programs and mental representations, and the cultists of ecological psychology and the theory of dynamic systems, these more committed to the variables that govern the perception and production of patterns (Garganta, 2005). In this sense, ecological psychology distinguishes between perceptual knowledge or "knowledge of” the environment and symbolic knowledge or "knowledge about" the environment (Duarte Araújo et al., 2009), associated with PTK and DTK respectively. However, the dynamical properties of both types of knowledge are emphasized.

Since the hypothesis used by cognitive theory, it has been assumed that knowing how a subject understand reality (declarative knowledge), it would be possible to know how he would behave (procedural knowledge). From this approach, numerous tools have been presented to evaluate tactical knowledge from the representational plane, understanding this type of knowledge in this work as declarative. Some outstanding tools have been the base knowledge questionnaires (Del Villar et al., 2004; Elferink-Gemser et al., 2004; García-González et al., 2012; García-López et al., 2013; Iglesias et al., 2005; Moreno-Domínguez et al., 2006; Pinto, 1997; Serra-Olivares et al., 2015), verbal protocols (McPherson, 2000; McPherson & Kernodle, 2003, 2007), interviews (Griffin et al., 2001; MacQuet, 2009; Macquet & Fleurance, 2007), self-reports (Iglesias, 2006), scales of appreciation (Kannekens et al., 2009), the multi-response questionnaires based on propositions or conditional statements "if ... then ...", which establish that "if X occurs, , then I do Y ”(McPherson y Thomas, 1989; Thomas y Thomas, 1994), multi-response tests with images of tactical situations (Blomqvist et al., 2005; De la Vega, 2002; Fontana, 2004; Machado & Teoldo, 2020; Mangas, 1999; Praça et al., 2016; Serra-Olivares & García-López, 2016), video game sequences (Bard et al., 1994; Bennett et al., 2019; Blomqvist et al., 2005; Den Hartigh et al., 2018; García-López et al., 2010; Giacomini, 2007; González-Víllora, García-López,

Gutiérrez-Díaz, et al., 2010; González-Víllora, García-López, Pastor-Vicedo, et al., 2010; Helsen & Starkes, 1999; Keller et al., 2018; Machado & Teoldo, 2020; McMorris & Graydon, 1997; Price et al., 2021; Starkes & Deakin, 1984; Williams et al., 1993), computerized tests (Buscà et al., 2010) and game simulators (De la Vega et al., 2008; Sánchez-López et al., 2012). All of these tools have been used in different investigations, but it remains unclear whether a relationship exists between performance on those tests of perceptual-cognitive skill and actual on-field performance (van Maarseveen et al., 2018), since correlation does not imply causality. A player may have a similar declarative and procedural score, but his mental representations may not be related to the behaviours he performs. Furthermore, most of these tools can measure, in one way or another, the players' DTK, but practically none of them provide specific scores based on game principles or subroles that allow identifying possible points of improvement in the knowledge that players have on specific aspects of the game (Sánchez-López et al., 2021a).

Therefore, it seems justifiable to have a tool with a representative game design, which helps to clarify to what extent the declarative and procedural knowledge can go hand in hand in specific aspects of the game. Considering all the above, the aim of this work was to design and validate a multi-response test with images of football game-play situations to evaluate the player's DTK based on the Football Competence Observation System -FOCOS- (Sánchez-López et al., 2021b). This will allow, in future research, the evaluation of the DTK and PTK of the players using these two tools ("TesTactico for F7" and "FOCOS" respectively), contributing to the comparison of data under the same study framework. This fact, without a doubt, will bring us closer to answering questions that are currently still not very clear.

METHOD

Design

The reference framework that supports this study comes from the validation of an observational instrument (Sánchez-López et al., 2021b). However, to validate TesTactico, the selective methodology was used, fulfilling the following requirements (Anguera, 2003): the mental representations of the sample were accessed from the direct intervention of the participants; a standardized multi-response test was used; the variables of interest were selected prior to the study; possible covariance relationships between the variables were analysed; and it was nomothetic, since the test was applied extensively to a set of participants.

Participants

To validate the instrument and calculate its reliability, a group of 13 experts was used. Experts had to meet at least 2 of the following 3 requirements: i) have more than 10 years of experience training, ii) be graduates in Physical Activity and Sports Sciences with a specialty in football, iii) and be active coaches with a minimum qualification of UEFA PRO or equivalent.

For the construct validity process of the tool, two independent samples were needed. Based on sample size calculation using G*Power (d = 0.5, p = .05, Power = .80), a total minimum sample size of 102 participants (51 and 51) was estimated. Following this indicator, the sample was made up of 155 male football players between 10 and 15 years old, divided into two independent samples that were selected according to their level of football competence (High-level players: n = 80, age 12.90 ± 1.45 years; Low-level players: n = 75, age 12,73 ± 1.51 years). The post-hoc sample size calculation using G*Power revealed .93 of power. The players from the high-level group were selected from a high-performance football academy. These players, in addition to attending training sessions at the academy, were playing for different federated clubs that competed in the highest federated leagues in Madrid. These players trained at least 3 days a week with their clubs, plus match, and an additional day at the high-performance football academy. The players from the low-level football competence group were part of six teams from the same club. These teams had 2 training sessions a week and a match in a local competition in Madrid.

All players and their families were informed about the research procedures, participating voluntarily. The study was conducted according to the guidelines of the Declaration of Helsinki (Bošnjak, 2001; Tyebkhan, 2003) and Organic Law 15/1999 of 13th December on the protection of personal data (BOE,

298, 14th December 1999) in order to guarantee the ethical considerations of scientific research with human subjects. According to what is established in the Belmont Report (National Comission for the Protection of Human Subjects of Biomedical and Behavioral Research, 2014), ethical approval was not required for this study because the study did not involve observing people, nor intervention by the investigators or direct interaction with the individuals studied.

Instrument

"TesTactico for F7" (seven-a-side football) can be included within the range of instrument classified as multi-response tests with images of game-play situations. It is developed from the 7-a-side football, for allowing a more pertinent approach to the players of lower ages and is made up of 62 game-play situations classified around the criteria of the "FOCOS" (Sánchez-López et al., 2021b). This served as a basis to design and validate the game-play situations proposed in the test based on the general tactical behaviours of the observational tool. These general tactical behaviours are identifying names which represents the channel networks of compatible categories for the attack and defence of the criteria in FOCOS (see table 1).

Table 1. Game-Play situations of "TesTactico for F7" associated to the General Tactical Behaviours of "FOCOS".

Channel	Role	Sub-role (action)	Operational principle	Specific/Core principle	General Tactical Behaviour that identifies the category channel	Game-Play Situations in the test	
1	Attacker with the ball	Ball control	Progress towards rival area	Penetration	Control the ball ahead of previous action (*)	1	14
2	Attacker with the ball	Ball control	Maintain ball possession	Width and length	Control the ball at the same height or behind the previous action (*)	2	15
3	Attacker with the ball	Ball control	Achieving the goal	Penetration	Control the ball in the rival area or in front of the last defender (or surpassed this one)	3	16
4	Attacker with the ball	Driving	Progress towards rival area	Penetration	Driving the ball forward (*)	4	17
5	Attacker with the ball	Driving	Maintain ball possession	Width and length	Driving the ball backwards, right, or left (*)	5	18
6	Attacker with the ball	Driving	Achieving the goal	Penetration	Driving the ball in the rival area or in front of the last defender (or surpassed this one)	6	19
7	Attacker with the ball	Dribble	Progress towards rival area	Penetration	Dribble to beat the rival (*)	7	20
8	Attacker with the ball	Dribble	Maintain ball possession	Width and length	Dribble without progress avoiding rival tackle (*)	8	21
9	Attacker with the ball	Dribble	Achieving the goal	Penetration	Dribble in the rival area or in front of the last defender (or surpassed this one)	9	22
10	Attacker with the ball	Passing	Progress towards rival area	Penetration	Pass the ball forward (except to assist)	10	23
11	Attacker with the ball	Passing	Maintain ball possession	Width and length	Pass the ball backward, right, or left (except to assist)	11	24
12	Attacker with the ball	Passing	Achieving the goal	Penetration	Assist teammate to score goal	12	25
13	Attacker with the ball	Shooting	Achieving the goal	Penetration	Shoot at goal	13	26
14	Attacker without the ball in the game center	Move off-the-ball	Progress towards rival area	Depth mobility	Move giving close option ahead of the ball	27	35
15	Attacker without the ball in the game center	Move off-the-ball	Achieving the goal	Depth mobility	Appear in a space suitable to scoring a goal (near the teammate with the ball)	28	36
16	Attacker without the ball in the game center	Positioning	Maintain ball possession	Offensive coverage	Take care of the back of the partner with the ball or give option close to the right / left	29	37
17	Attacker without the ball out of the game center	Move off-the-ball	Progress towards rival area	Depth mobility	Move away from the ball appearing between rival lines or behind the defence	30	38
18	Attacker without the ball out of the game center	Move off-the-ball	Achieving the goal	Depth mobility	Appear in a space suitable to scoring a goal (away from the teammate with the ball)	31	39
19	Attacker without the ball out of the game center	Positioning	Progress towards rival area	Width and length	Give depth to the attack by positioning in length	32	40
20	Attacker without the ball out of the game center	Positioning	Maintain ball possession	Width and length	Give amplitude to the attack by positioning in width	33	41
21	Attacker without the ball out of the game center	Positioning	Maintain ball possession	Offensive unity	Relocate in coordination with the teammates on the last line	34	42
22	Defender in the intervention space	Tackling	Regain Possession	Delay	Make a tackle to the rival	43	53
23	Defender in the intervention space	Interception	Regain Possession	Delay	Intercept, clear or divert a pass	44	54
24	Defender in the intervention space	Interception	Protect the goal	Delay	Block a shot	45	55
25	Defender in the intervention space	Dissuading	Prevent opponent's progression	Delay	Redirect the opponent's attack	46	56
26	Defender in the intervention space	Dissuading	Protect the goal	Delay	Do not give the opponent a shot option without entering him (avoid possible shot)	47	57
28	Defender in game center	Dissuading	Prevent opponent's progression	Defensive coverage	Take care of the partner's back in the intervention space in a staggered manner	48	58
28	Defender in game center	Dissuading	Prevent opponent's progression	Balance	Move to create superiority in the game center or mark/watch opponents	49	59
29	Defender out of game center	Dissuading	Prevent opponent's progression	Defensive unity	Create uncertainty in the last opponent line or reduce the effective playing space	50	60
30	Defender out of game center	Relocating	Protect the goal	Defensive unity	Relocation in the last defensive line reducing the effective playing space	51	61
31	Defender out of game center	Relocating	Protect the goal	Concentration	Increase the protection of the goal, marking or watching opponents	52	62

(*) Except in the rival area or in front of the last defender, or surpassed this one

Procedure

The design of the instrument, and the processes of validity and reliability were carried out in four stages (see figure 1): (a) design of the provisional test made up of 93 game-play situations in relation to the general tactical behaviours of the FOCOS (Sánchez-López et al., 2021b); (b) content validation of the game-play situations that make up the test, forming a group of experts for this purpose, (c) reliability and optimization of the instrument, and (d) construct validation using two independent samples to test the tool.

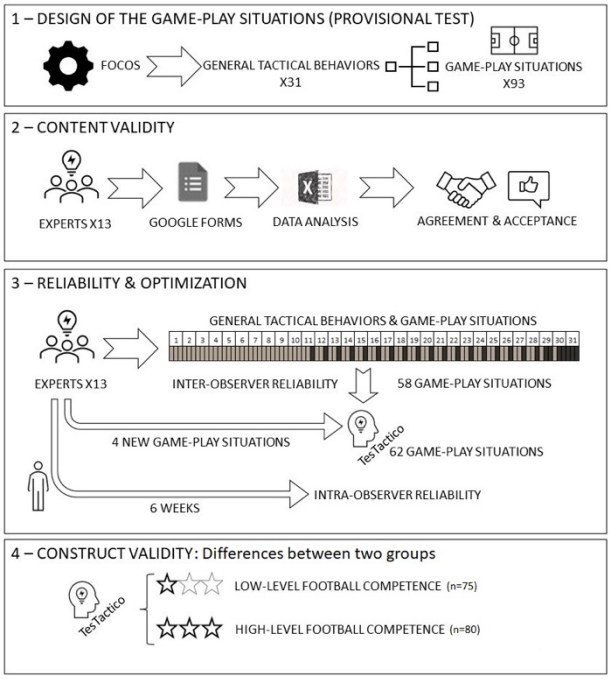

Figure 1. Stages for the design and validation of "TesTactico for F7".

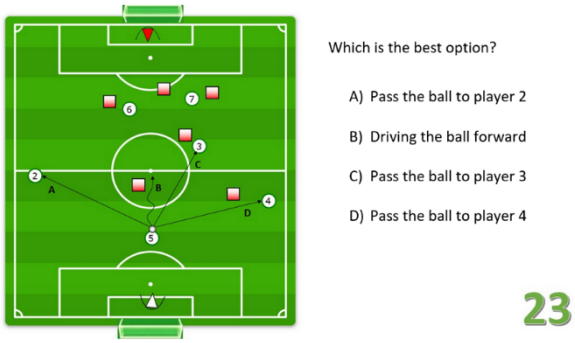

Figure 2. Game-play situation number 23 of "TesTactico for F7": Evaluation of DTK about Attacker with the ball, Passing, Progress towards rival area, Penetration, Pass the ball forward (except to assist).

In the first stage, taking the 31 general tactical behaviours of FOCOS, 3 game-play situations were designed for each general tactical behaviour. This gave rise to 93 game-play situations represented through static images (see an example in figure 2) where the participant must put himself in the shoes of one of the players in the image and choose based on four options presented to him. Each situation has only one correct solution, following the criteria of the experts.

In the second stage, once the game-play situations were designed, a test type form was developed through "google forms". Following the Delphi method (Helmer & Dalkey, 1963), a group made up of 13 football experts were asked, through a Likert 1-10 scale, about each of the 93 game-play situations raised on: (a) degree of agreement, regarding to what extent they considered that the situation raised was associated with attributed general tactical behaviour; (b) degree of adequacy, as to what extent they considered that the game-play situation should be part of the Test; (c) comments, observations and problems detected regarding the game-play situation. Through this method the averages were determined in terms of degree of agreement and degree of acceptance of each of the game-play situations proposed.

In the third stage, parallel to the previous stage, the experts faced the resolution of the situations raised, exposing the most appropriate option of the four that were presented for each situation. Through this process, the reliability of each of the 93 game situations was calculated independently (number of answers from the experts who indicated the option considered correct versus the number of total answers). Although 71 of the 93 situations raised obtained a reliability index of above 0.8, in addition to an average degree of agreement and acceptance above 9 out of 10; the purpose of this step was to reduce the test to 62 situations, discarding a game-play situation for each of the 31 general tactical behaviours proposed. Because of this, for general tactical behaviours that had 3 valid and reliable game-play situations (n = 10), the situation with the lowest reliability index was discarded; for general tactical behaviours that had 2 valid and reliable situations (n = 18), the remaining situation was

simply discarded; for general tactical behaviours that had 1 valid and reliable situation (n = 2), this situation was accepted and one of the two remaining situations was reformulated until consensus was obtained from the group of experts; and for general tactical behaviours that had 0 valid and reliable situations (n = 1), 2 new situations were designed being accepted by the group of experts. After this process, the inter-observer reliability was calculated through the Fleiss´ kappa index for the 62 game-play situations that would make up the final test. For this, the reliability indices obtained during the previous process were used in the 58 accepted situations, and a reliability index of 1 was determined for the 4 reformulated situations, since the consensus among the experts was unanimous. Six weeks later, following the test-retest reliability method, an observer repeated the process of solving the situations raised in the test, comparing the results obtained with his previous intervention to calculate the intra-observation reliability through the Cohen's kappa index. As has been mentioned, the final instrument was made up of a total of 62 game-play situations, which means that the participant can obtain a maximum of 62 points (1 point for correct situation). However, to facilitate the analysis, the ratings are calculated for each variable on a 0–10-point scale, except for each general tactical behaviour, whose values can only be 0, 1 or 2 points (considering that the participant does not knows what to do (0 points), has doubts about what to do (1 point) and knows what to do (2 points)).

Finally, in the last stage, the construct validity of the tool was estimated in its perspective of discriminant validity, to measure the degree of the instrument to distinguish between groups of players that are expected to be different (McDowell & Newell, 1996). To do this task, Gpower 3.1.9.7 statistical software was used to establish the adequacy of the sample size and the post-hoc calculation. In this way, two independent samples of young football players were selected according to their level of football competence.

Data analysis

The content validity of the instrument has been approached qualitatively, through consensual agreement (Anguera, 1990) of a group of experts, through the Delphi method and using the content validity coefficient (Hernández Nieto, 2002). It has also been analysed quantitatively, by calculating intra-observer reliability, using Cohen's kappa; and inter-observer reliability, using the fleiss kappa index. To carry out this process, the "XrealStats" plugin for Microsoft Excel 365 (Microsoft Corporation, Washington, USA) was used. The construct validity of the instrument was calculated, comparing the scores of the 67 tactical variables obtained by both groups. Following the procedure used in a previous work (Serra-Olivares & García-López, 2016), the data were analysed by *Student's T-test for independent samples* using the software SPSS Statistics 19 (IBM Corporation, New York, USA). The Bonferroni correction was used to control the family-wise error rate by set of variables in each criterion. Cohen's d-effect size (Cohen, 1988) was also calculated to assess the magnitude of the difference between both groups. Differences based on effect size are referred to descriptively as very large ($d \geq 2$), large ($2.0 > d \geq 1.2$), moderate ($1.2 > d \geq 0.6$), small ($0.6 > d \geq 0.2$) and trivial ($0.2 > d \geq 0$) (Hopkins et al., 2009).

RESULTS

About the Validity

The total content validity coefficient (Hernández Nieto, 2002) of the tool was estimated, calculating the averages of the degree of agreement (9.55 out of 10) and the degree of acceptance (9.71 out of 10) of the experts regarding the game-play situations of the instrument. From these two factors, the total content validity of the tool was obtained (9.63 out of 10), concluding that it is a very high validity. To measure the construct validity (see table 2) of the tool, the *p* value was calculated using Bonferroni Correction, obtaining the following statistical significance for each criterion: Overall scores (n = 3, $p \leq .017$), Roles (n = 6, $p \leq .008$), Sub-role actions (n = 11, $p \leq .005$), Operating principles (n = 6, $p \leq .008$), Core/specific principles (n = 10, $p \leq .005$) and General tactical behaviours (n = 31, $p \leq .002$). The results reflected that the high-level group was better than the low-level group in the 67 variables, with significant differences in 38 of them. Regarding the differences in effect size, the results showed that the Total Average variable had a large effect, 23 variables a moderate effect, 37 variables a small effect, and 6 variables a trivial effect.

Table 2. Differences in DTK between high-level and low-level football competence groups.

Criteria	Variable	Number of Game-play situations	High-level group	Low-level group	*P* value	Mean difference (95% IC)	Cohen's d	Influence
Overall scores (0-10 points) ($p \leq .017$)	Total Average	62	8.29 ± 0.68	7.18 ± 1.00	**0.000**	1.11 [0.84, 1.38]	1.29	Large
	Offensive Average	42	8.56 ± 0.79	7.48 ± 1.23	**0.000**	1.08 [0.76, 1.41]	1.05	Moderate
	Defensive Average	20	7.71 ± 1.04	6.55 ± 1.05	**0.000**	1.15 [0.82, 1.48]	1.10	Moderate
Role (0-10 points) ($p \leq .008$)	Attacker with the ball	26	8.99 ± 0.86	7.82 ± 1.35	**0.000**	1.17 [0.81, 1.52]	1.03	Moderate
	Attacker without the ball in the game center	6	8.56 ± 1.79	7.44 ± 2.15	**0.001**	1.12 [0.49, 1.74]	0.57	Small
	Attacker without the ball out of the game center	10	7.46 ± 1.57	6.61 ± 1.77	**0.002**	0.85 [0.32, 1.38]	0.51	Small
	Defender in the intervention space	10	8.80 ± 1.23	8.04 ± 1.44	**0.001**	0.76 [0.34, 1.18]	0.57	Small
	Defender in game center	4	6.53 ± 2.16	5.10 ± 2.15	**0.000**	1.43 [0.75, 2.12]	0.66	Moderate
	Defender out of game center	6	6.67 ± 2.15	5.04 ± 2.09	**0.000**	1.62 [0.95, 2.30]	0.76	Moderate
Own action of the sub-role (0-10 points) ($p \leq .005$)	Ball control	6	8.57 ± 1.49	7.58 ± 2.42	**0.002**	0.99 [0.36, 1.62]	0.49	Small
	Driving	6	9.19 ± 1.27	7.96 ± 1.89	**0.000**	1.23 [0.72, 1.74]	0.76	Moderate
	Dribble	6	8.48 ± 1.74	6.56 ± 2.23	**0.000**	1.92 [1.29, 2.56]	0.96	Moderate
	Passing	6	9.54 ± 0.92	8.87 ± 1.74	**0.003**	0.68 [0.24, 1.11]	0.49	Small
	Shooting	2	9.50 ± 1.88	8.80 ± 2.58	0.054	0.70 [-0.01, 1.41]	0.31	Small
	Move off-the-ball	8	8.44 ± 1.48	7.68 ± 1.65	**0.003**	0.75 [0.26, 1.25]	0.48	Small
	Positioning	8	7.31 ± 1.62	6.17 ± 2.01	**0.000**	1.15 [0.57, 1.72]	0.63	Moderate
	Tackling	2	7.69 ± 2.86	6.47 ± 3.84	0.026	1.22 [0.15, 2.29]	0.36	Small
	Interception	4	9.22 ± 1.52	8.67 ± 1.90	0.047	0.55 [0.01, 1.10]	0.32	Small
	Dissuading	10	7.55 ± 1.26	6.57 ± 1.23	**0.000**	0.98 [0.58, 1.37]	0.78	Moderate
	Relocating	4	6.59 ± 2.79	4.43 ± 2.35	**0.000**	2.16 [1.34, 2.98]	0.84	Moderate
Operational principle (0-10 points) ($p \leq .008$)	Progress towards rival area	14	8.85 ± 0.92	7.94 ± 1.32	**0.000**	0.91 [0.55, 1.26]	0.80	Moderate
	Maintain ball possession	14	8.38 ± 0.97	7.19 ± 1.79	**0.000**	1.19 [0.74, 1.65]	0.83	Moderate
	Achieving the goal	14	8.46 ± 1.21	7.30 ± 1.36	**0.000**	1.15 [0.74, 1.56]	0.90	Moderate
	Prevent opponent's progression	8	6.98 ± 1.54	5.83 ± 1.54	**0.000**	1.15 [0.66, 1.64]	0.75	Moderate
	Regain Possession	4	8.41 ± 1.96	7.60 ± 2.34	0.021	0.81 [0.12, 1.49]	0.37	Small
	Protect the goal	8	8.08 ± 1.58	6.75 ± 1.42	**0.000**	1.33 [0.85, 1.81]	0.88	Moderate
Core/specific principle (0-10 points) ($p \leq .005$)	Penetration	18	8.92 ± 0.99	7.77 ± 1.29	**0.000**	1.15 [0.79, 1.52]	1.00	Moderate
	Offensive coverage	2	7.69 ± 2.86	6.73 ± 3.72	0.074	0.95 [-0.10, 2.00]	0.29	Small
	Depth mobility	8	8.44 ± 1.48	7.68 ± 1.65	**0.003**	0.75 [0.26, 1.25]	0.48	Small
	Width and length	12	8.34 ± 1.10	7.01 ± 1.78	**0.000**	1.33 [0.87, 1.80]	0.90	Moderate
	Offensive unity	2	8.00 ± 3.04	7.60 ± 3.22	0.428	0.40 [-0.59, 1.39]	0.13	Trivial
	Delay	10	8.80 ± 1.23	8.04 ± 1.44	**0.001**	0.76 [0.34, 1.18]	0.57	Small
	Defensive coverage	2	6.38 ± 3.73	4.40 ± 3.67	**0.001**	1.98 [0.80, 3.15]	0.53	Small
	Balance	2	6.69 ± 2.75	5.80 ± 2.73	**0.046**	0.89 [0.02, 1.76]	0.32	Small
	Concentration	2	7.56 ± 3.18	6.33 ± 3.71	0.028	1.23 [0.14, 2.32]	0.36	Small
	Defensive unity	4	6.22 ± 2.52	4.40 ± 2.28	**0.000**	1.82 [1.05, 2.58]	0.76	Moderate
General tactical behaviour (0-2 points) ($p \leq .002$)	Control the ball ahead of previous action (*)	2	1.81 ± 0.39	1.71 ± 0.49	0.137	0.11 [-0.03, 0.25]	0.24	Small
	Control the ball at the same height or behind the previous action (*)	2	1.78 ± 0.42	1.64 ± 0.65	0.124	0.14 [-0.04, 0.31]	0.25	Small
	Control the ball in the rival area or in front of the last defender (or surpassed this one)	2	1.55 ± 0.65	1.20 ± 0.72	**0.002**	0.35 [0.13, 0.57]	0.51	Small
	Driving the ball forward (*)	2	1.93 ± 0.27	1.75 ± 0.55	0.010	0.18 [0.04, 0.31]	0.41	Small
	Driving the ball backwards, right, or left (*)	2	1.81 ± 0.39	1.48 ± 0.58	**0.000**	0.33 [0.18, 0.49]	0.67	Moderate
	Driving the ball in the rival area or in front of the last defender (or surpassed this one)	2	1.78 ± 0.50	1.55 ± 0.64	0.015	0.23 [0.05, 0.41]	0.40	Small
	Dribble to beat the rival (*)	2	1.69 ± 0.49	1.40 ± 0.52	**0.001**	0.29 [0.13, 0.45]	0.57	Small
	Dribble without progress avoiding rival tackle (*)	2	1.79 ± 0.47	1.44 ± 0.64	**0.000**	0.35 [0.17, 0.53]	0.62	Moderate
	Dribble in the rival area or in front of the last defender (or surpassed this one)	2	1.61 ± 0.54	1.09 ± 0.76	**0.000**	0.52 [0.31, 0.73]	0.79	Moderate
	Pass the ball forward (except to assist)	2	1.89 ± 0.32	1.72 ± 0.45	0.008	0.17 [0.04, 0.29]	0.43	Small
	Pass the ball backward, right, or left (except to assist)	2	1.93 ± 0.27	1.79 ± 0.55	0.047	0.14 [0.00, 0.27]	0.32	Small
	Assist teammate to score goal	2	1.91 ± 0.28	1.81 ± 0.48	0.120	0.10 [-0.03, 0.22]	0.25	Small
	Shoot at goal	2	1.90 ± 0.38	1.76 ± 0.52	0.054	0.14 [0.00, 0.28]	0.31	Small
	Move giving close option ahead of the ball	2	1.74 ± 0.52	1.43 ± 0.64	**0.001**	0.31 [0.13, 0.50]	0.53	Small
	Appear in a space suitable to scoring a goal (near the teammate with the ball)	2	1.86 ± 0.38	1.69 ± 0.54	0.026	0.17 [0.02, 0.32]	0.36	Small
	Take care of the back of the partner with the ball or give option close to the right / left	2	1.54 ± 0.57	1.35 ± 0.74	0.074	0.19 [-0.02, 0.40]	0.29	Small
	Move away from the ball appearing between rival lines or behind the defence	2	1.93 ± 0.27	1.91 ± 0.34	0.706	0.02 [-0.08, 0.11]	0.06	Trivial
	Appear in a space suitable to scoring a goal (away from the teammate with the ball)	2	1.23 ± 0.71	1.12 ± 0.80	0.390	0.11 [-0.14, 0.35]	0.14	Trivial
	Give depth to the attack by positioning in length	2	1.41 ± 0.74	1.21 ± 0.76	0.100	0.20 [-0.04, 0.44]	0.27	Small
	Give amplitude to the attack by positioning in width	2	1.30 ± 0.70	0.85 ± 0.71	**0.000**	0.45 [0.22, 0.67]	0.63	Moderate
	Relocate in coordination with the teammates on the last line	2	1.60 ± 0.61	1.52 ± 0.64	0.428	0.08 [-0.12, 0.28]	0.13	Trivial
	Make a tackle to the rival	2	1.54 ± 0.57	1.29 ± 0.77	0.026	0.24 [0.03, 0.46]	0.36	Small
	Intercept, clear or divert a pass	2	1.83 ± 0.38	1.75 ± 0.47	0.254	0.08 [-0.06, 0.21]	0.18	Trivial
	Block a shot	2	1.86 ± 0.41	1.72 ± 0.48	0.049	0.14 [0.00, 0.28]	0.32	Small
	Redirect the opponent's attack	2	1.61 ± 0.56	1.37 ± 0.63	0.014	0.24 [0.05, 0.43]	0.40	Small
	Do not give the opponent a shot option without entering him (avoid possible shot)	2	1.96 ± 0.19	1.91 ± 0.34	0.202	0.06 [-0.03, 0.14]	0.20	Small
	Take care of the partner's back in the intervention space in a staggered manner	2	1.28 ± 0.75	0.88 ± 0.73	**0.001**	0.40 [0.16, 0.63]	0.53	Small
	Move to create superiority in the game center or mark/watch opponents	2	1.34 ± 0.55	1.16 ± 0.55	0.046	0.18 [0.00, 0.35]	0.32	Small
	Create uncertainty in the last opponent line or reduce the effective playing space	2	1.36 ± 0.62	1.25 ± 0.62	0.274	0.11 [-0.09, 0.31]	0.18	Trivial
	Relocation in the last defensive line reducing the effective playing space	2	1.13 ± 0.77	0.51 ± 0.55	**0.000**	0.62 [0.40, 0.83]	0.92	Moderate
	Increase the protection of the goal, marking or watching opponents	2	1.51 ± 0.64	1.27 ± 0.74	0.028	0.25 [0.03, 0.46]	0.36	Small

Mean Differences (*p* value) and standardized (Cohen) differences between high-level (n = 80) and low-level players (n = 75); (*) Except in the rival area or in front of the last defender, or surpassed this one

About the reliability

The inter-observer reliability was calculated, for the 62 game-play situations that would make up the final test, through the concordance index for more than 2 observers (n = 13) Fleiss kappa (k = .882). Six weeks later an observer repeated the test, and the intra-observer stability was measured through the test-retest method using Cohen's kappa index (k = 1.000). Internal consistency also indicates the reliability of an evaluation instrument (Collet et al., 2019), so it was estimated from Cronbach's Alpha coefficient (α = .925).

About the Generalizability

The analysis of generalizability was carried out using the software SAGT v1.0 build 218.0.1. (Hernández-Mendo et al., 2016), estimating three aspects: reliability, variability and representativeness of the model. For this, three facets were used: Game-play situations [S], answer options [A] and observers [O] (see table 3).

Table 3. Estimated values of the relative ($\xi\rho^2_{(\delta)}$) and absolute ($\xi\rho^2_{(\Delta)}$) coefficients of generalizability for the design [SA/O].

Sources of variation	Sum of squares	Degree of freedom	Mean square	Standard error	%
Game-Play Situations [S]	0.000	61	0.000	0.005	0.000
Answer options [A]	18.979	3	6.326	0.005	1.799
[S][A]	491.213	183	2.684	0.021	81.300
Observers [O]	0.000	12	0.000	0.000	0.000
[S][O]	0.000	732	0.000	0.000	0.000
[A][O]	2.102	36	0.058	0.000	0.106
[S][A][O]	92.206	2196	0.042	0.001	16.795
Design [SA/O]	$\xi\rho^2_{(\delta)}$= .985 y $\xi\rho^2_{(\Delta)}$ = .985				
Representativeness	r^2 = 1.00				

The [SA/O] design, which used the game-play situations and answer options as facets of differentiation, showed relative ($\xi\rho^2_{(\delta)}$= .985) and absolute ($\xi\rho^2_{(\delta)}$= .985) generalizability coefficients close to 1. Therefore, the observers agreed in their observations, associating this with a high reliability in the precision of generalizability of the results (close to 1). The possible sources of variance showed that most of the variability (81.30%) is explained when the game-play situations facet is related to the answer options facet. This reveals the heterogeneity shown by these two facets, as well as the homogeneity in the observations facet; ideal situation that attends to the fact that the recording made by the observers has not influenced the values obtained, without there being notable differences between the records (Usabiaga et al., 2013). Finally, the coefficient of determination (r^2 = 1.00) revealed that the proposed model is fully representative.

DISCUSION

The aim of this work was to design and validate a multi-response test with images of football game-play situations to evaluate the player's DTK. In this sense, "TesTactico for F7" is presented as a valid and reliable instrument that allows data collection in a rigorous and pertinent way.

The instrument was developed following the findings found in the systematic review on DTK evaluation tools based on game-play scenarios in soccer (Sánchez-López et al., 2021a). Likewise, the use of verbalization was avoided, knowing that there is no theoretical support to defend the relationship between verbal behaviour and tactical behaviour (Duarte Araújo et al., 2010). Likewise, it was decided to design the game situations of the tool through static images, since unlike video sequences, they allow access to the earliest ages (U8, U9, U10), being a crucial aspect to detect possible talents.

The instrument is articulated around the "FOCOS" (Sánchez-López et al., 2021b). This supposes a great advantage, with respect to other instruments included in the introduction of the present study, since it allows to group the scores obtained by the participant around the different criteria that make up the

instrument: roles, own actions of the acquired subroles, operational principles and core/specific principles; providing the possibility of comparing these scores obtained in this declarative tool, with the scores obtained in the mentioned procedural tool. In addition, each of the general tactical behaviours also served as a variable when collecting scores and evaluating DTK, a very interesting and useful aspect when approaching the language used by the coaches; fulfilling one of the objectives of any applied research in the field of sport, that is, bringing science closer to the teaching and training process.

A group of experts were used to validate the content of the game-play situations. This stage shows a very careful aspect in the process of elaboration of the tool, since it presents a real process of content validity evaluating whether the game-play situations measure what is really wanted to measure (Can each game-play situation be measured with the associated analysis variable?). As could be discovered in the systematic review that preceded this work (Sánchez-López et al., 2021a), most of the tools shown in the introduction to this study do not use groups of experts to validate the content, but rather to measure concordance, an aspect associated with inter-observer reliability (what is the correct answer in each game-play situation?).

The construct validity of the tool was calculated in its perspective of discriminant validity, to measure the degree of the instrument to distinguish between groups of players that are expected to be different (McDowell & Newell, 1996). In this sense, it should be noted that although the high-level group obtained better scores than the low-level group in all the variables, significant differences were found between the two groups in 38 of them, none showing a very large effect size. From the findings of other studies, this could be due mainly to the fact that more competent soccer players have better results than those less qualified (O'Connor et al., 2016; Ward & Williams, 2003), although factors such as the experience (García-Ceberino et al., 2020b), the context (Serra-Olivares et al., 2017) or the teaching/training method (Gamero et al., 2021; García-Ceberino et al., 2020a) could also have an influence.

The criterion validity of the tool could not be calculated, which is reflected by the degree of relationship with an external criterion that seeks to measure the same, as there is no tool in the scientific literature that can detail the player's DTK in the same way as "TesTactico for F7". Therefore, it is considered that other tools described in the introduction to this study would not be measuring the same. Nor was it decided to use the external opinion of the coaches, as has been done in other studies (Serra-Olivares & García-López, 2016) because it could be influenced by what the players are capable of doing, rather than by what they really know declaratively.

Reliability assessment is also a key point in the development of an instrument in order to inform whether a change observed in participants' performance is a result of a training program/intervention or of an unreliable test (Machado & Teoldo, 2020). In our study, both inter-observer and intra-observer reliability obtained excellent values, as well as internal consistency, which allows to ensure a high quality of the data collected by the tool.

Finally, at this time of expansion of the theory of generalizability, its application in this study was very interesting. Thanks to this, it was possible to estimate the quality of the data obtained from another perspective.

PRACTICAL APPLICATIONS, LIMITATIONS AND FUTURE PROSPECTS

Once the players take the test, excel and python software are used to display the data collected in evaluation reports and graphs from different levels: club, team and player. At the club level, it is possible to show how the DTK of the players evolves by age categories or teams, determining reference values within the club that may be of great interest to delve into each stage of development (Sabarit et al., 2022), and can be used in the process of attracting new players, or monitoring future players. In other words, it could be a useful tool for a technical direction or a scouting department, since the DTK level of the players could be evaluated quickly, validly and reliably. At the team level, those game-play situations of the test that are not declaratively mastered by the majority of team players could be identified in order

to create representative training tasks of these situations, since declarative knowledge is a characteristic of football competence. At the player level, it is understood that knowledge of the scores of each player, with respect to the average of the scores of all the players on the team, by the coach or coaching staff can be used to determine the strengths and weaknesses of each player at the declarative level. This would help in the training process of young players during those moments of reflection and questioning, which revolve around understanding the game from sub-roles (divergent learning) or principles (convergent learning).

Regarding the limitations of the study, and therefore of the tool, it can be commented that the game-play situations are based on seven-a-side football, so a future adaptation to eleven-a-side football would be interesting. The test uses static game images, so the design and validation of a tool based on video sequences using the same analysis framework could also be of interest; because the video seems to have a positive effect on improving decision-making (Silva et al., 2021). The first-person perspective is another improvement that could be implemented.

The future prospects in this line of research aim to answer to what extent there is a relationship between the declarative and the procedural in specific aspects within the field of football competence. It is evident that players in a specific football context show better levels of DTK than players from a school context, but within the same context it is not so evident that the most competent players on the team are the ones with the most declarative tactical knowledge. Providing solid scientific evidence for this fact will mean more consistent use of these types of DTK assessment tools to improve training processes.

CONCLUSIONS

It is concluded that the presented assessment instrument shows optimal validity and reliability values, emphasizing that "TesTactico for F7" is based on a previously validated Football Competence Observation System -"FOCOS"- (Sánchez-López et al., 2021b). This fact means that the design of both tools from the representativeness of the football game, can helps to clarify to what extent declarative and procedural knowledge can go hand in hand in specific aspects of the game. In this way, both tools allow an exhaustive evaluation of the player from both levels (representation and action), based on the same analysis variables: the roles, the actions of the acquired sub-roles, the operational principles, the core/specific principles of the game of football and the general tactical behaviours.

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DATA AVALIABILITY STATEMENT

The data that support the findings of this study are openly available in data.mendeley.com at https://data.mendeley.com/datasets/7j9gpjpk6t/2

REFERENCES

1. Anguera, M. T. (1990). Metodología observacional. En J. Arnau, M. T. Anguera, & J. G. Benito (Eds.), *Metodología de la investigación en ciencias del comportamiento* (pp. 125-238). Universidad de Murcia.
2. Anguera, M. T. (2003). La metodología selectiva en la Psicología del Deporte. En A. Hernández Mendo (Ed.), *Psicología del Deporte (Vol. 2)* (EFDeportes, pp. 74-96).
3. Araújo, Duarte. (2013). The study of decision-making behavior in sport. *Revista Internacional de Ciencias del Deporte*, *9*(31), 1-4.
4. Araújo, Duarte, Cornovil, R., Ribeiro, J., Davids, K., & Fernandez, O. (2009). How does knowledge constrain sport performance? An ecological perspective. En D. Araújo, H. Ripoll, & M. Raab (Eds.), *Perspectives on Cognition and Action in Sport* (pp. 100-120). Nova Science Publisher.

https://doi.org/https://doi.org/10.1002/9781119568124.ch25

5. Araújo, Duarte, Travassos, B., & Vilar, L. (2010). Tactical skills are not verbal skills: A comment on Kannekens and Colleagues. *Perceptual and Motor Skills*, *110*(3), 1086-1088. https://doi.org/10.2466/pms.110.C.1086-1088
6. Bard, C., Fleury, M., & Goulet, C. (1994). Relationship between perceptual strategies and response adequacy in sport situations. / Relation entre les strategies perceptives et l'adequation de la reponse dans des situations sportives. *International Journal of Sport Psychology*.
7. Bayer, C. (1986). *La enseñanza de los juegos deportivos colectivos.* (Hispano Eu).
8. Bennett, K. J. M., Novak, A. R., Pluss, M. A., Coutts, A. J., & Fransen, J. (2019). Assessing the validity of a video-based decision-making assessment for talent identification in youth soccer. *Journal of science and medicine in sport*, *22*(6), 729-734. https://doi.org/10.1016/j.jsams.2018.12.011
9. Blomqvist, M., Vänttinen, T., & Luhtanen, P. (2005). Assessment of secondary school students' decision-making and game-play ability in soccer. *Physical Education & Sport Pedagogy*, *10*(2), 107-119. https://doi.org/https://doi.org/10.1080/17408980500104992
10. Bošnjak, S. (2001). The Declaration of Helsinki - The cornerstone of research ethics. En *Archive of Oncology* (Vol. 9, Número 3).
11. Buscà, B., Riera, J., & Sevilla, L. G. (2010). Diseño de un nuevo test para evaluar las aptitudes cognitivas en el deporte. Estudio de habilidad y validez. *Revista de Psicologia del Deporte*, *19*(2), 277-290. https://ddd.uab.cat/record/62561
12. Castelo, J. (1994). *Futebol. Modelo técnico-táctico do jogo.* Edições FMH.
13. Cohen, J. (1988). Statistical power analysis for the behavioural sciences. Hillside. En *NJ: Lawrence Earlbaum Associates*.
14. Collet, C., Nascimento, J. V., Folle, A., & Ibáñez, S. J. (2019). Desing and validation of an instrument for analysis of sportive formation in volleyball. *Cuadernos de Psicologia del Deporte*, *19*(1). https://doi.org/10.6018/cpd.326361
15. De la Vega, R. (2002). Desarrollo del metaconocimiento táctico y comprensión del juego: un enfoque constructivista aplicado al fútbol [Tesis Doctoral. Universidad Autónoma de Madrid]. En *Cultura, Ciencia y Deporte*. https://doi.org/https://doi.org/10.6018/185481
16. De la Vega, R., Del Valle Díaz, M. S., Maldonado Rico, A., & Moreno Hernández, A. (2008). Una nueva herramienta para la comprensión táctica en el fútbol. *Revista Internacional de Medicina y Ciencias de la Actividad Fisica y del Deporte*, *8*(30), 130-145. https://www.redalyc.org/pdf/542/54223019001.pdf
17. Del Villar, F., Iglesias, D., Perla Moreno, M., Fuentes, J. P., & Cervelló, E. M. (2004). An investigation into procedural knowledge and decision-making: Spanish experienced-inexperienced basketball players differences. *Journal of Human Movement Studies*, *46*, 407-420. https://www.researchgate.net/profile/Fernando_Del_Villar/publication/270217076_An_investigation_into_procedural_knowledge_and_decision-making_Spanish_experienced-inexperienced_basketball_players_differences/links/54a2db6b0cf256bf8bb0dc0a.pdf
18. Den Hartigh, R. J. R., Van Der Steen, S., Hakvoort, B., Frencken, W. G. P., & Lemmink, K. A. P. M. (2018). Differences in game reading between selected and non-selected youth soccer players. *Journal of Sports Sciences*, *36*(4), 422-428. https://doi.org/10.1080/02640414.2017.1313442
19. Elferink-Gemser, M. T., Visscher, C., Richart, H. C., & Lemmink, K. A. P. M. (2004). Development of the tactical skills inventory for sports. *Perceptual & Motor Skills*, *99*(3), 883-895. https://doi.org/10.2466/pms.99.3.883-895
20. Errekagorri, I., Castellano, J., & Echeazarra, I.

(2020). Analysis of the ball possession in youth soccer in relation to situational variables: Case study. *Cuadernos de Psicologia del Deporte*, *20*(2). https://doi.org/10.6018/CPD.370261

21. Fontana, F. E. (2004). *The development of a decision making instrument for soccer* [Master's degree dissertation. University of Pittsburgh]. http://d-scholarship.pitt.edu/10124/
22. French, K. E., & Thomas, J. R. (1987). The relation off knowledge development to children's basketball performance. *Journal of Sport Psychology*, *9*, 15-32. https://doi.org/10.1123/jsp.9.1.15
23. Gamero, M. G., García-Ceberino, J. M., Ibáñez, S. J., & Feu, S. (2021). Analysis of declarative and procedural knowledge according to teaching method and experience in school basketball. *Sustainability (Switzerland)*, *13*(11). https://doi.org/10.3390/su13116012
24. García-Ceberino, J. M., Gamero, M. G., Feu, S., & Ibáñez, S. J. (2020a). Differences in technical and tactical learning of football according to the teaching methodology: A study in an educational context. *Sustainability (Switzerland)*, *12*(16). https://doi.org/10.3390/su12166554
25. García-Ceberino, J. M., Gamero, M. G., Feu, S., & Ibáñez, S. J. (2020b). Experience as a determinant of declarative and procedural knowledge in school football. *International Journal of Environmental Research and Public Health*, *17*(3). https://doi.org/10.3390/ijerph17031063
26. García-González, L., Moreno-Domínguez, A., Perla Moreno, M., Iglesias, D., & del Villar, F. (2012). Tactical knowledge in tennis: A comparison of two groups with different levels of expertise. *Perceptual and Motor Skills*. https://doi.org/10.2466/30.10.25.PMS.115.5.567-580
27. García-López, L. M., González-Víllora, S., Gutiérrez-Díaz, D., & Serra-Olivares, J. (2013). Development and validation of the game performance evaluation tool (GPET) in Soccer. *Sportk: revista euroam.ericana de ciencias del deporte*. https://doi.org/10.6018/185791
28. García-López, L. M., Gutiérrez-Díaz, D., Abellán, J., González-Víllora, S., & Webb, L. A. (2010). Expert-novice differences in procedural knowledge in young soccer players from local to international level. *Journal of Human Sport and Exercise*, *5*(3), 444-452. https://doi.org/10.4100/jhse.2010.53.14
29. Garganta, J. (1997). Modelação táctica do jogo de Futebol: Estudo da organização da fase ofensiva em equipas de alto rendimento [University of Porto]. En *Faculty of Sport Sciences and Physical Education*. https://doi.org/https://doi.org/10.20396/conex.v15i1.8646428
30. Garganta, J. (2005). Dos Constrangimentos da Acção à Liberdade de (Inter)acção, para um Futebol com Pés... e Cabeça. En *O contexto da Decisão: A Acção Táctica no Desporto*. https://doi.org/https://doi.org/10.5628/rpcd.03.03.87
31. Giacomini, D. S. (2007). Conhecimento tático declarativo e processual no futebol: estudo comparativo entre jogadores de diferentes categorias e posições [Universidade Federal de Minas Gerais, Belo Horizonte, Brasil]. En *Dissertação de Mestrado em Ciências do Esporte*. https://doi.org/https://doi.org/10.1590/s0101-32892011000200011
32. González-Víllora, S., García-López, L. M., Gutiérrez-Díaz, D., & Contreras-Jordán, O. R. (2010). Estudio descriptivo sobre el desarrollo táctico y la toma de decisiones en jóvenes jugadores de fútbol (12 años). *Infancia y Aprendizaje*, *33*(4), 489-501. https://doi.org/10.1174/021037010793139644
33. González-Víllora, S., García-López, L. M., Pastor-Vicedo, J. C., & Contreras-Jordán, O. R. (2010). Estudio descriptivo sobre el desarrollo táctico y la toma de decisiones en jóvenes jugadores de fútbol (10 años). *Revista de Psicología del Deporte*, *20 (1)*, 79-97. https://www.redalyc.org/pdf/2351/235119302007

.pdf

34. González-Víllora, S., Serra-Olivares, J., Pastor-Vicedo, J. C., & Teoldo, I. (2015). Review of the tactical evaluation tools for youth players, assessing the tactics in team sports: football. *SpringerPlus*, *4*, 663. https://doi.org/10.1186/s40064-015-1462-0
35. Gréhaigne, J.-F. (1992). *L'Organisation du jeu en football.* Editions Actio.
36. Griffin, L. L., Dodds, P., Placek, J. H., & Tremino, F. (2001). Chapter 4: Middle School Students' Conceptions of Soccer: Their Solutions to Tactical Problems. *Journal of Teaching in Physical Education*, *20*(4), 324-340. https://doi.org/10.1123/jtpe.20.4.324
37. Helmer, O., & Dalkey, N. (1963). An Experimental Application of the DELPHI Method to the Use of Experts. En *Management Science*. https://doi.org/10.1287/mnsc.9.3.458
38. Helsen, W. F., & Starkes, J. L. (1999). A multidimensional approach to skilled perception and performance in sport. *Applied Cognitive Psychology*. https://doi.org/10.1002/(sici)1099-0720(199902)13:1<1::aid-acp540>3.3.co;2-k
39. Hernández-Mendo, A., Blanco-Villaseñor, Á., Pastrana, J. L., Morales-Sánchez, V., & Ramos-Pérez, F. J. (2016). SAGT: New software for generalizability analysis. *Revista Iberoamericana de Psicologia del Ejercicio y el Deporte*, *11*(1). https://doi.org/https://www.redalyc.org/articulo.oa?id=311143051009
40. Hernández Moreno, J. (1994). *Análisis de las estructuras del juego deportivo*. INDE.
41. Hernández Nieto, H. (2002). Contributions to statistical analysis. *Mérida: Universidad de Los Andes*.
42. Hopkins, W. G., Marshall, S. W., Batterham, A. M., & Hanin, J. (2009). Progressive statistics for studies in sports medicine and exercise science. En *Medicine and Science in Sports and Exercise* (Vol. 41, Número 1). https://doi.org/10.1249/MSS.0b013e31818cb278
43. Iglesias, D. (2006). *Efecto de un protocolo de supervisión reflexiva sobre el conocimiento procedimental, la toma de decisiones y la ejecución, en jugadores jóvenes de baloncesto.* [Tesis doctoral no publicada. Universidad de Extremadura, Cáceres]. https://dialnet.unirioja.es/servlet/tesis?codigo=562
44. Iglesias, D., Perla Moreno, M., Santos-Rosa, F. J., Cervelló, E. M., & Del Villar, F. (2005). Cognitive expertise in sport: Relationships between procedural knowledge, experience and performance in youth basketball. *Journal of Human Movement Studies*.
45. Kannekens, R., Elferink-Gemser, M. T., Post, W. J., & Visscher, C. (2009). Self-Assessed Tactical Skills in Elite Youth Soccer Players: A Longitudinal Study. *Perceptual and Motor Skills*, *109*(2), 459–472. https://doi.org/10.2466/pms.109.2.459-472
46. Keller, B. S., Raynor, A. J., Iredale, F., & Bruce, L. (2018). Tactical skill in Australian youth soccer: Does it discriminate age-match skill levels? *International Journal of Sports Science and Coaching*, *13*(6), 1057-1066. https://doi.org/10.1177/1747954118760778
47. Kirkhart, M. W. (2001). The nature of declarative and nondeclarative knowledge for implicit and explicit learning. *Journal of General Psychology*, *128*(4), 447-461. https://doi.org/10.1080/00221300109598921
48. Machado, G. F., & Teoldo, I. (2020). TacticUP Video Test for Soccer: Development and Validation. *Frontiers in Psychology*, *11*(1690). https://doi.org/10.3389/fpsyg.2020.01690
49. MacQuet, A. C. (2009). Recognition within the decision-making process: A case study of expert volleyball players. *Journal of Applied Sport Psychology*, *21*(1), 64-79. https://doi.org/10.1080/10413200802575759
50. Macquet, A. C., & Fleurance, P. (2007). Naturalistic decision-making in expert badminton players. *Ergonomics*, *50*(9), 1433-1450. https://doi.org/10.1080/00140130701393452
51. Mangas, C. J. (1999). *Conhecimento declarativo no futebol: Estudo comparativo em praticantes*

federados e não-federados, do escalão de sub-14 [Dissertação de Mestrado. Faculdade de Desporto da Universidade do Porto]. https://doi.org/https://doi.org/10.5628/rpcd.04.03.42

52. McDowell, I., & Newell, C. (1996). *Measuring healh: a guide to rating scales and questionnaires*. Oxford University Press.
53. McMorris, T., & Graydon, J. (1997). The effect of exercise on cognitive performance in soccer-specific tests. *Journal of Sports Sciences*, *15*, 459-468. https://doi.org/10.1080/026404197367092
54. McPherson, S. L. (2000). Expert-Novice Differences in Planning Strategies during Collegiate Singles Tennis Competition. *Journal of Sport and Exercise Psychology*, *22*, 39-62. https://doi.org/10.1123/jsep.22.1.39
55. McPherson, S. L., & Kernodle, M. (2003). Tactics the neglected attribute of champions: Problem representations and performance skills in tennis. En *Recent advances in research on sport expertise*.
56. McPherson, S. L., & Kernodle, M. (2007). Mapping two new points on the tennis expertise continuum: Tactical skills of adult advanced beginners and entry-level professionals during competition. *Journal of Sports Sciences*. https://doi.org/10.1080/02640410600908035
57. McPherson, S. L., & Thomas, J. R. (1989). Relation of knowledge and performance in boys' tennis: Age and expertise. *Journal of Experimental Child Psychology*, *48*(2), 190-211. https://doi.org/10.1016/0022-0965(89)90002-7
58. Moreno-Domínguez, A., Perla Moreno, M., Iglesias, D., García, L., & Del Villar, F. (2006). Estudio del conocimiento declarativo en función de la experiencia y de la edad en jugadores jóvenes de voleibol. *Cultura Ciencia y Deporte*, *5 (2)*, 73-80. https://doi.org/https://doi.org/10.12800/ccd.v2i5.175
59. National Comission for the Protection of Human Subjects of Biomedical and Behavioral Research. (2014). The Belmont Report. Ethical principles and guidelines for the protection of human subjects of research. *The Journal of the American College of Dentists*, *81*(3). https://doi.org/10.1017/cbo9780511550089.028
60. O'Connor, D., Larkin, P., & Mark Williams, A. (2016). Talent identification and selection in elite youth football: An Australian context. *European Journal of Sport Science*, *16*(7). https://doi.org/10.1080/17461391.2016.1151945
61. Parlebas, P. (1977). Les universaux du jeu sportif collectif. *E.P.S.*, *144*, 38-40.
62. Parlebas, P. (2018). Une pédagogie des compétences motrices. *Acciónmotriz*, *20*, 89-96. https://dialnet.unirioja.es/servlet/articulo?codigo=6435703
63. Pinto, D. (1997). Construção de um teste para avaliar o conhecimento declarativo no jogo. En A. Marques, A. Prista, & A. F. Júnior (Eds.), *Educação Física: contexto e inovação. Actas do V congresso de Educação Física e Ciências do Desporto dos países de língua Portuguesa, 24-28 Março 1997: Vol. II* (pp. 337-348).
64. Praça, G. M., Lopes, M., Pérez-Morales, J. C., & Greco, P. J. (2016). Teste de Conhecimento Declarativo no Futebol: TCTD:Fb2: validação preliminar. *Revista de Educação Física do Exército*, *85*(2), 199. https://www.researchgate.net/publication/305699411_Teste_de_Conhecimento_Tatico_Declarativo_no_Futebol_TCTDFb2_Validacao_Preliminar
65. Price, A., Collins, D., & Stoszkowski, J. (2021). How do high-level youth soccer players approach and solve game problems? The role of strategic understanding. *Physical Education and Sport Pedagogy*. https://doi.org/10.1080/17408989.2021.1967307
66. Sabarit, A., Rodríguez-López, E., Reigal, R. E., Morillo-Baro, J. P., Vázquez-Diz, J. A., Hernández-Mendo, A., & Morales-Sánchez, V. (2022). Cognitive functioning and sports performance in young soccer players: A systematic review [Funcionamento cognitivo e desempenho esportivo em jovens jogadores de

futebol: uma revisão sistemática]. *Cuadernos de Psicologia del Deporte*, *22*(2), 99-114. https://doi.org/https://doi.org/10.6018/cpd.494741

67. Sánchez-López, R., De la Vega, R., Ruíz-Barquín, R., & Del Valle Díaz, M. S. (2012). Análisis y evaluación de los niveles de toma de conciencia y comprensión táctica en fútbol por medio de un tablero de juego. *SPORT TK-Revista EuroAmericana de Ciencias del Deporte*, *1*(1), 33-38. https://doi.org/10.6018/185481
68. Sánchez-López, R., Echeazarra, I., & Castellano, J. (2021a). Systematic review of declarative tactical knowledge evaluation tools based on game-play scenarios in soccer. *Quality & Quantity*. https://doi.org/10.1007/s11135-021-01204-9
69. Sánchez-López, R., Echeazarra, I., & Castellano, J. (2021b). Validation of a Football Competence Observation System (FOCOS), Linked to Procedural Tactical Knowledge. *Sustainability*, *13*(12), 6780. https://doi.org/https://doi.org/10.3390/su13126780
70. Sarmento, H., Anguera, M. T., Pereira, A., & Araújo, D. (2018). Talent Identification and Development in Male Football: A Systematic Review. *Sports Medicine*. https://doi.org/10.1007/s40279-017-0851-7
71. Serra-Olivares, J., & García-López, L. M. (2016). Design and validation of the soccer tactical knowledge test (STKT) / Diseño y validación del test de conocimiento táctico ofensivo en fútbol (TCTOF). *Revista Internacional de Medicina y Ciencias de la Actividad Física y del Deporte*, *16*(63), 521-536. https://doi.org/10.15366/rimcafd2016.63.008
72. Serra-Olivares, J., García-López, L. M., Calderón, A., & Cuevas-Campos, R. (2015). Relación del conocimiento táctico de jóvenes futbolistas con la edad, la experiencia y el nivel de pericia. / Relationship between young soccer players' tactical knowledge and age, experience and level of expertise. *Cuadernos de Psicología del Deporte*, *15*(3), 105-112. https://doi.org/https://doi.org/10.4321/S1578-84232015000300010
73. Serra-Olivares, J., García-López, L. M., & Gutiérrez-Díaz, D. (2017). Conocimiento táctico de niños de siete-13 años en función del contexto deportivo = Tactical knowledge of seven-13 years old children depending on their sport context. *Revista de Psicología del Deporte*, *26*(1), 135-144. http://search.ebscohost.com/login.aspx?direct=true&db=psyh&AN=2017-10797-011&site=ehost-live
74. Silva, A. F., Ramirez-Campillo, R., Sarmento, H., Afonso, J., & Clemente, F. M. (2021). Effects of Training Programs on Decision-Making in Youth Team Sports Players: A Systematic Review and Meta-Analysis. En *Frontiers in Psychology* (Vol. 12). https://doi.org/10.3389/fpsyg.2021.663867
75. Starkes, J. L., & Deakin, J. (1984). Perception in sport: A cognitive approach to skilled performance. En *Cognitive Sports Psychology*.
76. Teodorescu, L. (1984). *Problemas de teoría y metodología nos desportos colectivos*. Livros Horizonte.
77. Teoldo, I., Garganta, J., Greco, P. J., & Mesquita, I. (2010). Analysis and evaluation of tactical behavior in soccer. *Revista Educación Fisica/UEM*, *21*(3), 443-455. https://doi.org/https://doihttps://doi.org/10.4025/reveducfis.v21i3.8515
78. Teoldo, I., Garganta, J., Greco, P. J., & Mesquita, I. (2011). Proposta de avaliação do comportamento tático de jogadores de futebol baseada em princípios fundamentais do jogo. *Motriz: Revista de Educação Física*, *17*(3), 511-524. https://doi.org/10.1590/S1980-65742011000300014
79. Thomas, J. R., French, K. E., & Humphries, C. A. (1986). Knowledge Development and Sport Skill Performance: Directions for Motor Behavior Research. *Journal of Sport Psychology*, *8*(4), 259-272. https://doi.org/10.1123/jsp.8.4.259

80. Thomas, K., & Thomas, J. R. (1994). Developing expertise in sport: The relation of knowledge and performance. *International Journal of Sport Psychology*.
81. Tyebkhan, G. (2003). Declaration of Helsinki: The ethical cornerstone of human clinical research. *Indian Journal of Dermatology, Venereology and Leprology*, *69*(3).
82. Usabiaga, O., Castellano, J., Blanco-Villaseñor, Á., & Casamichana, D. (2013). La Teoría de la Generalizabilidad en las primeras fases del método observacional aplicado en el Ámbito de la iniciación deportiva: calidad del dato y estimación de la muestra. *Revista de Psicologia del Deporte*, *22*(1).
83. van Maarseveen, M. J. J., Oudejans, R. R. D., Mann, D. L., & Savelsbergh, G. J. P. (2018). Perceptual-cognitive skill and the in situ performance of soccer players. *Quarterly journal of experimental psychology (2006)*, *71*(2), 455-470. https://doi.org/10.1080/17470218.2016.1255236
84. Ward, P., & Williams, A. M. (2003). Perceptual and cognitive skill development in soccer: The multidimensional nature of expert performance. *Journal of Sport and Exercise Psychology*, *25*(1). https://doi.org/10.1123/jsep.25.1.93
85. Williams, M., & Davids, K. (1995). Declarative knowledge in sport: A by-product of experience or a characteristic of expertise? *Journal of Sport & Exercise Psychology*, *17*(3), 259-275. https://doi.org/10.1123/jsep.17.3.259
86. Williams, M., Davids, K., Burwitz, L., & Williams, J. (1993). Cognitive Knowledge and Soccer Performance. *Perceptual and Motor Skills*, *76*(2), 579-593. https://doi.org/10.2466/pms.1993.76.2.579