BALTIC JOURNAL OF SPORT & HEALTH SCIENCES
No. 2(133); 2024; 32–46; ISSN 2351-6496 / eISSN 2538-8347
DOI: https://doi.org/10.33607/bjshs.v2i133.1547

Development and Validation of a Video-Based Passing Decision-Making Test for Soccer and Futsal

Aristotelis Gioldasis, Michalis Mitrotasios, Athanasia Smirniotou
National and Kapodistrian University of Athens, Department of Physical Education and Sport Science, Dafni, Greece

ABSTRACT

Background: Success in team sports such as soccer and indoor soccer depends heavily on the ability to make accurate and quick decisions due to the dynamic and unpredictable nature of game conditions. This study aimed to create and verify a video-based test that evaluates decision making abilities in players participating in soccer and futsal (VPD SocFut).

Methods: The test was carefully designed using real-world video clips and underwent rigorous validation procedures that included content validity checks as well as assessments, for test retest reliability, construct and face validity.

Results: Content validity was ensured through two phases of expert evaluation of video clips, resulting in the selection of soccer and futsal clips that demonstrated 70% to 100% agreement in decision appropriateness and difficulty. Reliability was confirmed via test-retest measures, with Cohen's Kappa values ranging from 0.402 to 1.000. Construct validity was supported by significant differences in passing decision-making performance between sub-elite and recreational adult and U18 soccer and futsal players ($p < .001$). Participants consistently rated the test as realistic and enjoyable, which confirmed its face validity.

Conclusion: Therefore, the VPD-SocFut suggests a reliable and valid tool for objectively evaluating passing decision-making performance in soccer and futsal.

Keywords: soccer, performance, decision-making, testing

INTRODUCTION

Making effective decisions is crucial for achieving optimal sports' performance. It is characterized by the ability to utilize information from a situation, and the knowledge possessed about it, so as to plan, choose, and execute appropriate sport-specific actions (Williams & Ford, 2013). The results of these decisions can be observed through verbal or motor responses, relying on both perceptual-cognitive and perceptual-motor abilities respectively (MacMahon & McPherson, 2009). Cognitive abilities pertain to how we perceive and comprehend information; on the other hand, perceptual motor skills involve perceiving information and executing actions through physical movement. Consequently, decision-making is fundamentally dependent on cognitive processes, including visual perception, attention, anticipation, and memory (Bekris et al., 2023a; Murgia et al., 2014).

In the context of sports, the ability to make quick and accurate decisions in complex, high pressure and time constrained situations is crucial for in-game performance, especially in unpredictable sports (Gonzaga et al., 2014; Höner, et al., 2023). Moreover, high competitive level players have been shown to have superior perceptual-cognitive skills than their lower competitive level counterparts (Roca et al., 2011). In this regard, soccer, which is a dynamic and highly unpredictable sport, necessitates effective decision-making for success (Assis et al., 2021; Bekris et al., 2023b; Murr et al., 2021; Romeas et al., 2016; Teoldo et al., 2021). The simultaneous interactions among soccer players, create various action possibilities, known as affordances, within specific limitations, known as constraints, necessitating continuous decision-making regarding timing, location, and manner of actions

to achieve successful performance (Corrêa et al., 2014). Similarly, a sport like futsal, which involves a wide variety of constraints and affordances, demands enhanced decision-making skills (Smirniotou et al., 2023).

In both soccer and futsal, passing is a fundamental skill, requiring players to receive and deliver a moving ball to specific locations or teammates (Mohammed et al., 2014; Rampinini et al., 2009). Efficient and consistent selection of the appropriate action at the optimal moment is crucial for skillful play (Baker et al., 2003; Gioldasis et al., 2022; Rein et al., 2017). It has been found that passing ability is a determinant factor for the outcome of a soccer game (Bekris et al., 2014), as effective passing creates scoring opportunities and enhances team success by reaching a teammate in an advantageous position. This requires precise motor execution and advanced perceptual-cognitive skills (Romeas et al., 2016). Decision-making in these scenarios involves selecting the optimal action from a range of possibilities, such as passes at different velocities and distances in various directions (Corrêa et al., 2019; Travassos, 2014).

Nowadays, advancements in technology have enabled researchers to create task-representative assessments of decision-making skills. Video-based tests offer the advantage of providing controlled environments and standardized conditions for all participants, which is often difficult to achieve in field settings (Berry et al., 2008; Bruce et al., 2012). In addition, the quality of the measurements obtained depends on the evidence of validity and reliability of the tests used, ensuring they measure what they intend to and provide consistent results (Thomas et al., 2012). The assessment of athletes' anticipation and decision-making skills in soccer frequently employs video-based methods, including the observation of video sequences from matches with temporal occlusion techniques (Brenton et al., 2016). These assessments often require players to verbalize or write down the most appropriate response (Keller et al., 2018; O'Connor et al., 2016), or perform a soccer-specific skill (Vaeyens et al., 2007; Vänttinen et al., 2010) after viewing video footages of simulated match scenarios. Specifically, video is usually used to present stimuli that demand participants' either perceptual-cognitive or perceptual motor responses (Bergmann, et al., 2021; Hadlow et al., 2018; Larkin et al., 2015). Typically, these assessments involve watching sequences of short clips and making decisions on sport-specific conditions (Lorains et al., 2013).

Decision-making video-based tests are essential, due to their ability to demonstrate competitive conditions' progression and higher ecological validity compared to static image monitoring measures. Literature indicates that these tests can discriminate high and low-level players in several sport contexts (Breed et al., 2018; De Waelle et al., 2019; Larkin et al., 2011; Murr et al., 2021). They also offer greater experimental control than evaluations in actual game conditions (Larkin et al., 2014). However, literature suggests that video-based tests frequently lack validity and reliability assessments (Farrow & Raab, 2008; Kittel et al., 2019; Larkin et al., 2015). This lack of validity and reliability is concerning because, as without established validity it is unclear whether a video-based test assesses what it claims to assess, while without reliability assessment it is unknown whether a change is a result of random error or familiarization with the test (Gadotti et al., 2006; Hadlow et al., 2018; Schweizer et al., 2020). Additionally, video-based decision-making tests should be grounded in established theoretical frameworks that support sport-specific decision-making performance. Thus, the video clips must include a great variety of situations that enable the generation of possible outcomes before choosing an appropriate decision (Farrow et al., 2013). To our knowledge, no scientific studies in soccer or futsal have simultaneously examined the most important types of validity and reliability for video-based passing decision-making tests. Thus, developing of such instruments is crucial for objectively measuring decision-making performance. Furthermore, although soccer and futsal share similarities and frequently athletes have participated in both, they encounter distinct constraints and affordances that differentiate these sports. It would therefore be valuable to develop standardized assessments that enable comparative analysis between these two sports.

This study aims to develop a valid and reliable video-based passing decision-making test based on real-world soccer and futsal paradigms (VPD-SocFut), comprehensively following methodologies recommended in previous research (Américo et al., 2017; Breed et al., 2018; Machado & Da Costa, 2020). To our knowledge, this is the first study to develop and evaluate the validity and reliability of a video-based passing decision-making test specific to soccer and futsal. Validating this test is important for sports science professionals to objectively evaluate the passing decision-making performance of players. We hypothesized that the large number of video clips, incorporating a variety of sport-specific

conditions, would result in a comprehensive examination of their validity and reliability simultaneously, thus providing a broad range of reliable and valid clips for the development of a comprehensive test.

METHODS

Development and Validation of the VPD-SocFut

The test development and validation adhered to the procedures recommended by Cronbach (1988). The study considers the following statistical procedures which ensure reliability and validity: (a) content validity (the content of the clips is relevant and representative for measuring passing decision-making ability); (b) test-retest reliability (the repeatability of the measurements); (c) construct validity (the clips can discriminate participants according to their skill level); and (d) face validity (the clips assess the passing decision-making skill) (Anastasi, 1988; Cronbach, 1988; Cronbach & Meehl, 1955; Grehaigne et al., 1997; Hopkins, 2000; Landis & Koch, 1977). By addressing these aspects, the study aims to establish an assessment tool for evaluating passing decision-making in soccer and futsal.

Structure & Test description of the VPD-SocFut

This diagnostic instrument included a frozen image where participants were required to choose the most appropriate response in soccer and futsal video sequences, utilizing a method similar to those employed in previous studies (Murr et al., 2021; Nascimento et al., 2021). A third-person perspective was utilized, demonstrating high validity and reliability indices even higher than a first-person view (Breed et al., 2018; Larkin et al., 2014; Larkin et al., 2018; Mann et al., 2009; Mann et al., 2007).

The video sequences included patterns, specifically focusing on passing decision-making scenarios. These sequences encompassed various conditions including several numerical relationships among players, playing positions, phases of play (e.g., build-up or attacking conditions), game locations (e.g., forward; midfield; wing defense; central defense), as well as types and directions of passing (Breed et al., 2018; Dieze, 2015; Mann et al., 2009; Murr et al., 2021; Nascimento et al., 2021). Each participant individually completed the test indoors and received specific instructions, such as "a short frozen image with your player circled will appear in the beginning of each clip so as to orientate yourself on the condition", "your decision concerns the final passing action which you believe the most appropriate". Then they viewed five familiarization video clips before testing (Engelbrecht, 2011). Participants were subsequently given the opportunity to pose any inquiries they had, before testing, concerning the video content or the procedures for responding.

The video sequences were projected from a HD projector (Epson Powerlite X14) on a white screen 3.04m wide × 2.28m high with a 0.50m high from the ground and 5m distance from the participants. Each clip began with a 3 sec frozen image with the player who role plays the participant circled so as to orientate the participants to the playing situation (Murr et al., 2021). Then, each video clip was playing for 5–6 sec in duration and had three possible passing options which were appearing in the end of the scene in a final 3 sec frozen image. During the final frozen image, the participants had to verbally choose the most appropriate of the three options (Murr et al., 2021; Nascimento et al., 2021; Oppici et al., 2018) (Figure 1). Participants were instructed not to consume caffeine for 24 hours before the test (Cardoso et al., 2021b). The points awarded for each scene response ranged from 1 to 3, based on the appropriateness of each passing decision. Each video sequence comprised 30 scenes with a total duration of 10 minutes for soccer and 10 minutes for futsal, with difficulty progressively increasing.

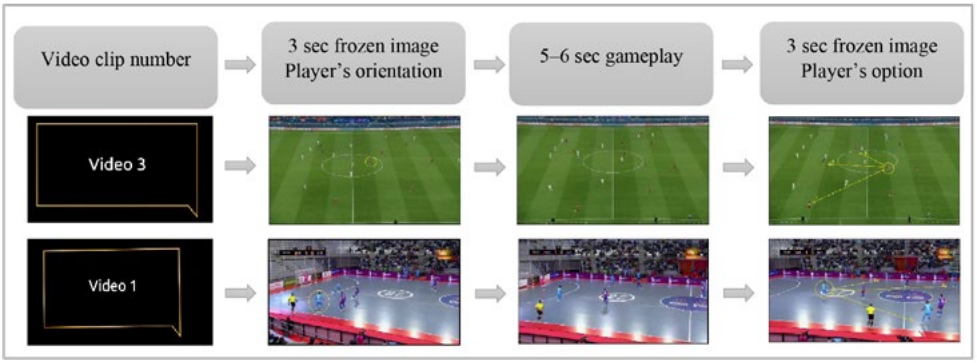


Figure 1. **Presentation of VPD-SocFut**

Content validity

The selection and processing of video clips were conducted in two phases based on conceptual and technical descriptions and requirements of soccer and futsal (Rein et al., 2017; Reilly, 2003; Xie et al., 2020).

In the first phase, two sports science professionals specializing in soccer and performance analysis, who are also UEFA-licensed in soccer and futsal, reviewed and processed the full matches from the final phase (semi-finals and finals) of the 2021–2022 Soccer and Futsal Champions League. The editing and development of video clips were carried out using Windows Video Editor 2021. The selection of the evaluators was based on Ericsson's theory (Ericsson, 2006; Ericsson et al., 1993), which posits that a minimum of ten years of experience, education, and expertise is required to be considered an "expert" in a field. The selection of passing video clips was based on the following content elements (Figure 2; Point i): (a) maintaining ball possession, (b) the outcome and (c) the type of pass, (d) the distances of opponents and teammates, (e) the numerical relationships of players and the available space for passing, (f) the athlete's body position, (g) the passing leg (dominant or non-dominant), (h) the observed player being in possession of the ball with sufficient time and options to make a decision, (i) the realism of the conditions, and (j) continuous visual tracking of the ball as well as the defending and attacking players (Cardoso et al., 2021a; Cardoso et al., 2019). After achieving 100% agreement that the video clips met the selection criteria, they identified and rated the three most appropriate passing decision options for each video clip in order to conclude with 100% agreement (Figure 2; Point ii).

In the second phase, a panel of eight UEFA-licensed soccer coaches, as well as a panel of eight soccer UEFA-licensed futsal coaches, participated in the assessment of the soccer and futsal video clips, respectively. The expert coaches individually received, viewed, and rated the soccer and futsal video clips. To avoid bias, each coach rated the clips independently using a Likert scale, where 1 indicated the most inappropriate option and 3 indicated the most appropriate option. They also rated the difficulty of each video clip on a Likert scale, where 1 represented the least difficult and 3 represented the most difficult. Then they formed a live panel to discuss their scores for each video clip, considering both the suitability and difficulty ratings, and they had the option to change their ratings during these discussions (Figure 2; Point iii).

Reliability

A test-retest measurement was used to evaluate the reliability of the remaining soccer and futsal passing decision-making video clips (Jackson & Baumgartner, 1991). The repeated measure was performed in a 21-day distance between the 1st and the 2nd measurement in order to avoid test familiarization (Robinson & O'Donoghue, 2007). A total of 40 soccer and futsal adult and U18 players participated in test-retest method. *Cohen's Kappa* was used to determine the reliability of each video sequence between the 1st and 2nd measurement. The categorization of Kappa values followed the scale proposed by Landis and Koch (1977): no agreement (< .00), slight agreement (.00 – .20), slight to moderate agreement (.21 – .40), moderate agreement (.41 – .60), high agreement (.61 – .80), and almost perfect agreement (.81 – 1.00). The researchers excluded clips with values less than .40 which is a satisfactory value for the inclusion in the test (Larkin et al., 2014) (Figure 2; Point iv).

The researchers then categorized the remaining soccer and futsal video clips into three groups of difficulty (low, medium and high difficulty). The video clips were proportionally divided into four age categories for each sport according to their difficulty, ensuring that each video sequence consisted of 30 clips. The principal researcher included a variety of clips in each video sequence in terms of their content (Figure 2; Point v).

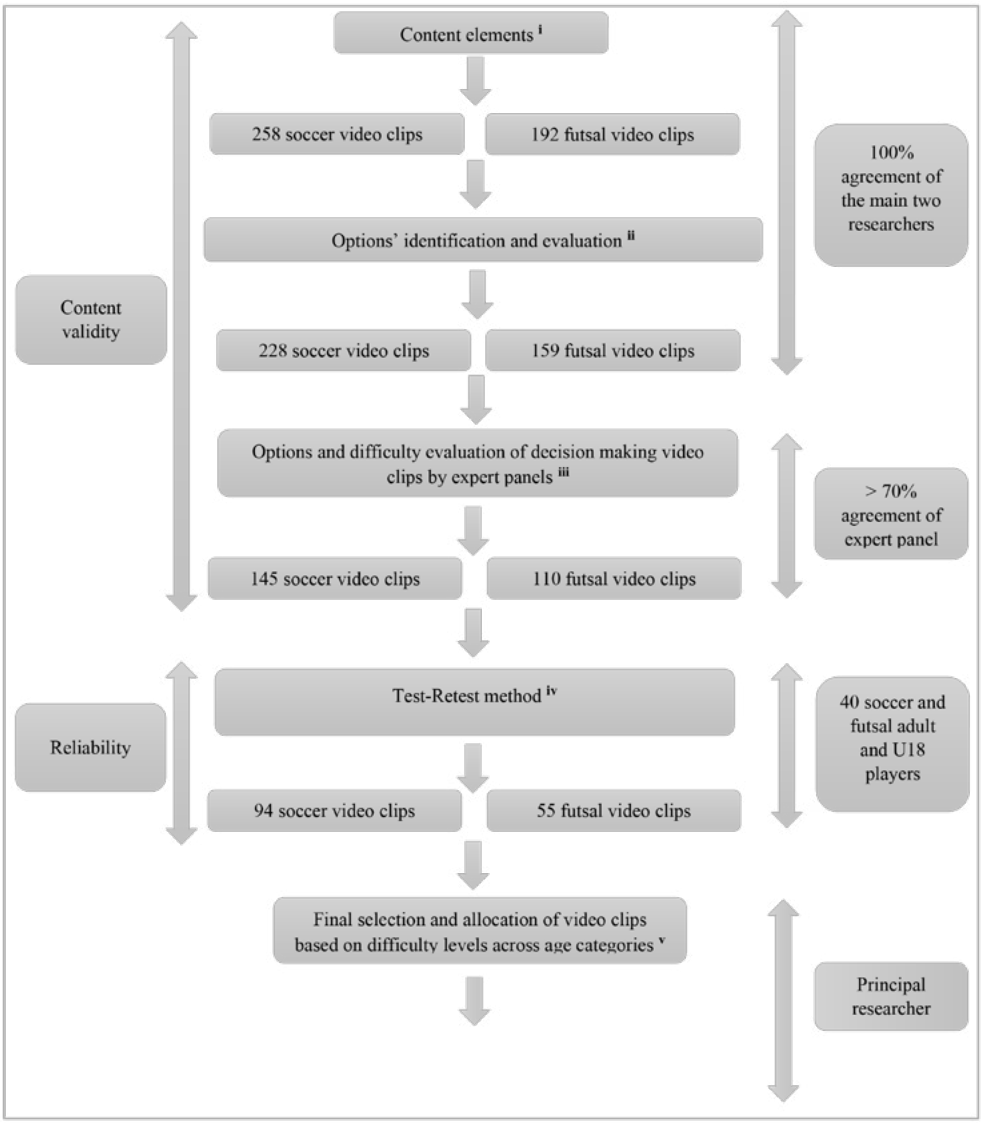


Figure 2. **Content validity and reliability of VPD-SocFut**

Construct validity

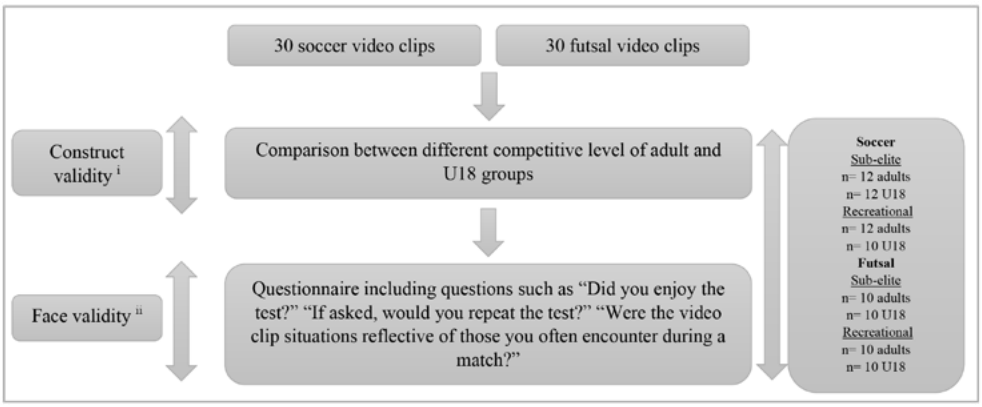
The final video sequences were observed by players of different competitive levels in order to assess the construct validity of the test. In particular, adult and U18 soccer and futsal players were classified into the following groups: Sub-elite adult soccer (n = 12; age = 23.74 ± 3.32) and futsal groups (n = 10; age = 25.10 ± 4.88), Sub-elite U18 soccer (n = 12; age = 17.33 ± 0.52) and futsal groups (n = 10; age = 17.45 ± 0.40), consisted of players who participated in the local formal soccer championship and in the national futsal championship respectively with three training sessions per week; and recreational adult soccer (n = 12; age = 26.51 ± 5.63) and futsal groups (n = 10; age = 28.74 ± 4.93), as well as recreational U18 soccer (n = 10; age = 17.16 ± 0.74) and futsal groups (n = 10; age = 17.36 ± 0.50) consisted of players who participated in non-formal tournaments and friendlies without organized training sessions (Figure 3; Point i). Regarding age categories of U16 and U14, construct validity was not assessed. Instead, the researchers relied on existing literature, which suggests that experience and early involvement in soccer is a more significant factor than age in determining decision-making skills (Machado & Da Costa, 2020; Roca et al., 2012; Serra-Olivares & García-López, 2016). Therefore, the researchers verified the between-group differences of the two adult and the two U18 groups using Mann-Whitney U tests. Effect sizes for the Mann-Whitney tests were calculated using Rank-biserial correlation (r). The interpretation of r-values followed Ferguson's (2016) guidelines: no effect (0–0.19), minimum effect (0.20–0.49), moderate effect (0.50–0.79), and strong effect (>0.80).

Face validity

As the researchers developed the video

sequences to reflect realistic soccer and futsal conditions, they asked participants to respond to the following questions after the testing procedures in order to confirm the acceptance and suitability of the test: "Did you enjoy the test?"; "If asked, would you repeat the test?"; "Were the video clip situations reflective of those you often encounter during a match?"; "The instructions provided were clear?"; "The length of the video-based test was the appropriate?"; and "The quality of the video clips was high?" (Figure 3; Point ii) (Larkin et al., 2014; Machado & Da Costa, 2020; Sun et al., 2022). The answers were given in a 5-point Likert scale (Strongly Disagree "1", Disagree "2", Neutral "3", Agree "4", Strongly Agree "5") of which the researchers calculated means and standard deviations for each item in order to determine the overall test's face validity.

Figure 3. **Construct and Face validity of VPD-SocFut**



STATISTICAL ANALYSES

The researchers used *Cohen's Kappa* values to assess reliability through test-retest measurement method. Furthermore, for the assessment of construct validity the researchers applied Mann-Whitney U tests to evaluate between-group differences. Effect sizes for the Mann-Whitney tests were also calculated using Rank-biserial correlation (r). The significance level of the comparisons was set at $p < 0.05$. Statistical analysis was conducted using Statistical Package for the Social Sciences software (SPSS; IBM Corp. Released 2019. IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY: IBM Corp.).

RESULTS

Content Validity & Reliability

The preliminary dataset included 258 soccer video clips and 192 futsal video clips, which were evaluated by researchers for adherence to content elements. In particular, the researchers achieved 100% agreement on 258 soccer clips and 192 futsal clips that met the selection criteria and were included in further analysis. Then, they identified and rated the three most appropriate passing decision options for each video clip. After reaching 100% agreement, the final selection included 228 soccer video clips and 159 futsal video clips, which were then presented to groups of expert coaches who received, viewed, and rated individually the decisions' options and the difficulty of each video clip. Finally, in accordance with previous studies (Machado & Da Costa, 2020; Natsuhara et al., 2020), the principal researcher collected the panel's final suggestions and excluded the video clips that had less than 70% agreement among the experts regarding the most appropriate decision option and the video's difficulty. Consequently, 145 soccer video clips and 110 futsal video clips met the criteria for content validity. Then, a test-retest measurement was used to evaluate the reliability of the 145 soccer and 110 futsal passing decision-making video clips (Jackson & Baumgartner, 1991). The researchers excluded video clips with values less than 0.40 which is a satisfactory value for the inclusion in the test. The following table presents the panels' agreement percentages and the *Cohen's Kappa* values of the remaining 94 soccer and 55 futsal video clips which ranged from 0.411 to 1.000 for soccer and from 0.402 to 1.000 for futsal indicating they were classified between moderate and almost perfect agreement (Table 1).

Table 1. **Content Validity and Reliability for the video clips selected for use in the VPD-SocFut**

SOCCER Difficulty level	Video clip Nº	Overall agreement (%) M ± SD	Cohen's Kappa	FUTSAL Difficulty level	Video clip Nº	Overall agreement (%) M ± SD	Cohen's Kappa
Easy	1	81 ± 4.34	0.840	Easy	98	90 ± 4.08	0.822
	3	94 ± 3.17	1.000		107	90 ± 6.81	0.701
	5	82 ± 5.60	0.762		114	88 ± 6.26	0.889
	13	85 ± 6.95	0.633		115	89 ± 7.37	0.936
	14	90 ± 2.26	0.901		119	90 ± 4.03	0.764
	20	95 ± 4.67	0.864		121	97 ± 3.88	0.954
	24	80 ± 5.89	0.617		122	89 ± 5.91	0.936
	27	82 ± 6.12	0.729		123	95 ± 5.54	1.000
	30	93 ± 4.55	0.710		124	90 ± 7.13	0.728
	36	96 ± 4.05	0.836		125	84 ± 6.26	0.637
	42	92 ± 3.38	1.000		126	92 ± 5.82	0.817
	44	93 ± 4.91	0.924		127	95 ± 3.68	0.895
	46	90 ± 7.40	0.685		133	80 ± 6.75	0.776
	47	95 ± 5.83	0.744		136	95 ± 2.86	1.000
	53	97 ± 3.27	1.000		137	81 ± 5.09	0.620
	54	98 ± 5.69	0.939		139	90 ± 3.42	0.861
	55	97 ± 2.78	1.000		140	75 ± 7.80	0.429
	60	83 ± 6.19	0.644		142	91 ± 4.18	0.783
	64	85 ± 4.81	0.813		145	80 ± 5.04	0.555
	74	94 ± 3.22	1.000				
	80	90 ± 6.35	0.651				
	81	95 ± 5.32	0.887				
	84	84 ± 5.87	0.752				
	86	91 ± 5.96	0.770				
Medium	2	82 ± 7.55	0.594	Medium	95	92 ± 6.61	0.790
	4	84 ± 11.12	0.762		96	83 ± 5.96	0.656
	6	88 ± 6.24	0.685		97	91 ± 5.29	0.861
	9	76 ± 10.23	0.515		104	72 ± 8.21	0.544
	10	83 ± 9.89	0.561		108	70 ± 10.90	0.570
	11	80 ± 5.61	0.741		109	80 ± 7.67	0.627
	15	90 ± 7.70	0.703		111	78 ± 12.87	0.588
	18	86 ± 8.87	0.876		112	77 ± 13.11	0.430
	21	86 ± 9.06	0.812		116	84 ± 10.56	0.747
	33	80 ± 8.48	0.649		117	90 ± 7.55	0.768
	35	79 ± 11.50	0.722		118	74 ± 7.40	0.511
	39	74 ± 12.24	0.637		131	82 ± 6.92	0.682
	52	78 ± 8.75	0.628		134	72 ± 9.38	0.457
	66	75 ± 11.02	0.527		135	95 ± 6.17	0.979
	73	85 ± 9.17	0.667		138	73 ± 12.18	0.526
	75	74 ± 6.30	0.701		147	83 ± 8.48	0.613
	77	86 ± 5.61	1.000		149	70 ± 7.86	0.464
	79	76 ± 8.73	0.655				
	85	76 ± 10.56	0.733				
	87	90 ± 5.45	0.797				

SOCCER Difficulty level	Video clip Nº	Overall agreement (%) M ± SD	Cohen's Kappa	FUTSAL Difficulty level	Video clip Nº	Overall agreement (%) M ± SD	Cohen's Kappa
	90	88 ± 7.94	0.922				
	91	85 ± 10.32	0.718				
	94	75 ± 13.18	0.591				
Hard	8	71 ± 8.46	0.625	Hard	99	82 ± 8.71	0.716
	16	82 ± 10.87	0.547		100	70 ± 8.37	0.458
	17	70 ± 4.78	0.681		101	84 ± 10.45	0.645
	22	89 ± 11.30	0.709		102	88 ± 7.20	0.687
	26	73 ± 9.24	0.503		103	88 ± 9.65	0.841
	29	80 ± 6.63	0.682		105	71 ± 13.88	0.429
	32	76 ± 13.81	0.577		106	81 ± 8.90	0.630
	37	71 ± 10.59	0.664		110	80 ± 12.54	0.518
	41	70 ± 8.47	0.601		113	72 ± 10.27	0.406
	48	74 ± 11.84	0.556		120	82 ± 9.83	0.543
	49	75 ± 12.66	0.523		128	84 ± 6.04	0.735
	57	72 ± 7.93	0.432		129	73 ± 8.36	0.488
	59	82 ± 10.82	0.744		130	70 ± 11.77	0.413
	61	73 ± 8.38	0.490		132	70 ± 7.20	0.402
	63	90 ± 6.10	0.637		141	74 ± 9.64	0.597
	70	73 ± 12.64	0.492		143	75 ± 7.11	0.516
	71	70 ± 10.77	0.449		144	77 ± 6.89	0.603
	76	86 ± 7.21	0.774		146	72 ± 10.57	0.415
	78	82 ± 7.86	0.836		148	75 ± 13.04	0.424
	82	70 ± 8.07	0.509				
	88	80 ± 6.37	0.780				
	89	71 ± 8.79	0.687				
	92	80 ± 8.20	0.660				
	7	90 ± 4.40	0.774				
	12	77 ± 10.60	0.451				
	19	73 ± 13.98	0.411				
	23	80 ± 8.22	0.515				
	25	74 ± 10.03	0.572				
	28	80 ± 5.37	0.694				
	31	82 ± 9.97	0.701				
	34	70 ± 11.10	0.433				
	38	91 ± 7.45	0.566				
	40	72 ± 5.89	0.425				
	43	73 ± 10.37	0.617				
	45	72 ± 4.42	0.788				
	50	85 ± 8.77	0.649				
	51	80 ± 6.79	0.833				
	56	93 ± 6.64	0.714				
	58	72 ± 9.50	0.430				
	62	74 ± 12.11	0.502				
	65	75 ± 11.84	0.443				

SOCCER Difficulty level	Video clip Nº	Overall agreement (%) M ± SD	Cohen's Kappa	FUTSAL Difficulty level	Video clip Nº	Overall agreement (%) M ± SD	Cohen's Kappa
	67	70 ± 9.46	0.605				
	68	77 ± 9.28	0.424				
	69	79 ± 12.30	0.551				
	72	72 ± 7.59	0.481				
	83	84 ± 10.07	0.691				
	93	74 ± 6.11	0.579				

Construct validity

To examine construct validity, the 94 soccer video clips and the 55 futsal video clips were presented to adult and U18 sub-elite and recreational soccer and futsal groups, respectively. To assess construct validity the researchers applied, Mann-Whitney U tests to determine passing decision-making differences between groups on video sequences including 30 video clips. In presentations the sub-elite adult soccer player groups scored significantly higher than the recreational player groups (U= 6.500, p= .000), the sub-elite U18 soccer player groups scored significantly higher than the recreational player groups (U= 17.500, p= .000), the sub-elite adult futsal player groups scored significantly higher than the recreational player groups (U= 7.500, p= .000), and the sub-elite U18 futsal player groups scored significantly higher than the recreational player groups (U= 14.000, p= .000), thereby supporting the construct validity of the test (Table 2).

Table 2. **Mann-Whitney test of construct validity**

Groups				**Score**		**Mann-Whitney test**		**Effect size**
	n	*min*	*max*	*M*	*SD*	*U*	*p*	
Soccer adults (Sub-elite)	12	77	93	84.29	4.767	6.500	.000	0.87
Soccer adults (Recreational)	12	55	79	70.59	6.992			
Soccer U18 (Sub-elite)	12	71	90	80.59	5.316	17.500	.000	0.65
Soccer U18 (Recreational)	10	55	80	67.24	7.014			
Futsal adults (Sub-elite)	10	71	90	81.82	5.139	7.500	.000	0.85
Futsal adults (Recreational)	10	58	79	68.00	5.408			
Futsal U18 (Sub-elite)	10	68	85	77.18	5.139	14.000	.000	0.72
Futsal U18 (Recreational)	10	54	76	63.53	6.012			

Face validity

The high face validity of the results was confirmed because all scores had a mean over 4.0. Particularly, the results expressed in means ± standard deviations, showed the following statistics for the questions: "Did you enjoy the test?" (*M*= 4.2 ± 0.9); "If you were asked, would you have this test again?" (*M*= 4.4 ± 0.6); "Were the video clip situations similar to those experienced in a game?" (*M*= 4.5 ± 0.6); "The instructions provided were clear" (*M*= 4.3 ± 0.8); "The length of the video-based test was appropriate?" (*M*= 4.6 ± 0.7); "The video clips were of high quality?" (*M*= 4.5 ± 0.5).

DISCUSSION

In sports, decision-making skills are complex relationships between cognitive processes and behaviors that occur in a particular context (Bar-Eli & Raab, 2006). By assessing cognitive and behavioral dimensions in competitive settings, we are able to understand better the total level of these skills. Consequently, the purpose of the present study was to address this need by designing and investigating a video-based passing decision-making test for soccer/futsal in order to develop an appropriate effective testing tool ensuring its validity and reliability. The results demonstrate the capacity for video-based assessments to capture and evaluate the complex decision-making skills that are essential in these sports. The rigorous processes employed to ensure content validity, test-retest reliability, construct validity, and face validity increases the strength and external usefulness of the instrument. Briefly, the test demonstrated high content, construct, and face validity, along with reliability in measuring perceptual-cognitive and decision-making skills.

Content Validity and Reliability

The content validity of the test was confirmed through a rigorous selection process involving expert evaluations, ensuring the video clips were representative of realistic soccer and futsal scenarios. The initial selection of 450 clips (258 soccer, 192 futsal) was refined to 205 clips (145 soccer, 110 futsal) based on expert consensus, achieving 100% agreement on content relevance. This meticulous process aligns with established guidelines and underscores the test's adherence to real-world conditions (Rein et al., 2017).

Reliability assessment, using a test-retest method over 21 days, demonstrated moderate to almost perfect agreement (*Cohen's Kappa* values from 0.402 to 1.000), indicating the test's consistency in measuring passing decision-making abilities. Regarding reliability, the findings of the current study are consistent with other field tests that assess decision-making skills (Calle-Jaramillo et al., 2023; Machado & Da Costa, 2020). This step is crucial as it ensures that the test results are reproducible and not influenced by random error or test familiarity (Jackson & Baumgartner, 1991).

CONSTRUCT VALIDITY

Construct validity was supported by the test's ability to distinguish between different skill levels. Sub-elite and recreational players' scores significantly differed ($p < .0001$) across testing groups (adult and U18 soccer and futsal), validating the test's effectiveness in measuring decision-making proficiency. These findings are consistent with prior research indicating that video-based decision-making tests can effectively differentiate between varying levels of expertise (Catteeuw et al., 2009; Larkin et al., 2011; Williams & Ford, 2008).

Face Validity

Participants' positive feedback further confirmed the test's face validity, with mean scores above 4.0 across all items, indicating high acceptance and perceived relevance of the test. Although face validity is often regarded as the lowest level of validity, its importance should not be underestimated (Gadotti et al., 2006). This is particularly relevant in the context of video-based decision-making tests, where face validity is frequently omitted in conjunction with other validity measures. This validation from the actual users is essential as it confirms that the test scenarios are reflective of real-game situations, the instructions are clear, and the test is enjoyable and appropriately challenging.

Implications, Limitations and Future Research

The creation of this video-based passing decision-making test for soccer and futsal introduces an appropriate method for objectively evaluating the decisions made by on-field players. This provides a strong scientific basis for both investigation and practical implementations in sports science. Specifically, it achieves this through providing natural stimuli with an ability to obtain valid as well as reliable measurements.

Nevertheless, the study's limitations include examining the test's validity and reliability within a specific population regarding nationality, gender, age, and playing level. Additionally, expert coaches all came from the same country of birth, which commonly affects how you view and understand soccer.

Further research should be conducted with this test in other nationality groups, or in a different age/gender/competition level populations to enhance the generalization of validity. In addition, using eye tracking systems or conducting research in a virtual environment would present an even deeper and more representative evaluation. In future studies, we plan to incorporate the current test with an eye-tracking system in order to investigate gaze behavior between futsal and soccer players more deeply.

CONCLUSIONS

The current study successfully developed and validated a novel video-based test for evaluating passing decision-making in soccer and futsal. It further addresses the critical need for reliable and valid assessment tools in sport research. Briefly, this study makes a considerable contribution to the field by providing the methodology for the development of reliable and valid video-based tests which adopt real-game conditions.

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Received on August 23, 2024
Accepted on November 07, 2024