Proximus Journal of Sports Science and Physical Education
Volume 2, Issue 9, September 2025
https://proximusjournal.com/index.php/PJSSPE
ISSN (E): 2942-9943

CONSTRUCTING AND STANDARDIZING A SCALE OF GENERAL AND LOBAR BRAIN DOMINANCE TO ASSESS ITS CONTRIBUTION TO ATTENTIONAL ABILITIES AMONG FUTSAL REFEREES IN IRAQ

Ahmed Hisham Ahmed, Shakir Mahmood Abdullah, Othman Adham Ali
1 College of Basic Education, University of Mosul, Iraq. Ahmed_hisham@uomosul.edu.iq, 1 https://orcid.org.0009-0008-4297-1143
2 College of Physical Education and Sport Sciences, University of Anbar, Iraq. Alshakir_1972@unanbar.edu.iq, 2 https://orcid.org/0000-0003-4928-377X
3 College of Physical Education and Sport Sciences, University of Anbar, Iraq. othmanadhamali@uoanbar.edu.iq, https://orcid.org/0000-0003-3695-7413

Abstract
This research aims to construct and standardize a scale for general and lobar brain dominance to assess its contribution to the attentional abilities of futsal referees in Iraq. The developed scale is grounded in a review of existing literature and specifically targets the attentional capabilities required for futsal officiating. A descriptive research design was employed, using an intentional selection approach for the study population and a random selection for the sample. The total sample consisted of 225 subjects, with 135 designated for reliability analysis and 90 for standardization. The scale demonstrated a high degree of reliability as determined by expert consensus, with reliability coefficients of 0.80, 0.866, and 0.933. The final scale consists of 46 items. The scale's contribution to attentional abilities was significant at the $p < 0.05$ level, with specific contributions to attention shifting (0.469), attention distribution (0.656), and attention focus (0.698). The findings confirm that the scale meets the scientific requirements for assessing whole-brain dominance. Furthermore, the observed relationship between brain dominance and the referees' attentional abilities is logically and scientifically supported. In conclusion, the researchers successfully constructed and standardized a valid and reliable scale tailored to the study sample. The findings reveal varying degrees of brain dominance contributions to the attentional abilities of the sample. Based on these results, the researchers recommend increased attention to studies on brain dominance and attentional abilities, given their critical role for futsal referees. Future research is suggested to replicate this study with different samples and variables to further enhance the general and individual performance of referees.

Keywords: brain dominance, attentional abilities, futsal referees

Introduction

Brain dominance is a physiological and neural phenomenon that plays a vital role in directing the conceptual and motor abilities of humans. Both lobar synchronize to handle data efficiently. Neurological studies proved that the left labor mainly related to analytical side like language, logical thinking, and conscious moves of the right side of the body, while the right lobar is concerned with visual abilities, creativity, imagination, and moves of counter side (Knecht et al, 2000-Springer & Duetch, 2013). Brain's dominance is crucial for referees to use guided thinking – problem solving to reach a solution rapidly, assure correct athletic behaviour, in addition to fulfill the perfect image of a referee with precise decisions (Khadija bin Flees, 2009). Conceptualizing all these fragments acquires special importance in areas of quick decisions and perfect performance, such as sports arbitration. Referees face all kinds of situations amidst a match, all of which demand mental control with attentional abilities, including more than attention aspects, clarity of mind, focus

Proximus Journal of Sports Science and Physical Education
Volume 2, Issue 9, September 2025
https://proximusjournal.com/index.php/PJSSPE
ISSN (E): 2942-9943

during the match, and competition among players (Cox, 2000, 71). A certain study showed that intensive body effort, like matches, affect a negatively on attention indicators like fast reaction and precision. Such a fact necessitates paying attention to physical and psychological factors of referees (Castillo, Yanci, Casajus & Ca'mara, 2016). On the other hand, another study showed that the accuracy of arbitrary decisions related to the way of dividing attention along events of the match and individual variances in attentional abilities affect directly the efficiency of arbitration (Spitz, Wagemans, Memmert & Williams, 2024). All the above-mentioned results assure the importance of understanding the relation between brain dominance and attentive performance. This calls for constructing and standardizing a scientific scale to evaluate this dominance and show its contribution to attentive abilities for futsal referees.

Importance comes from the fact that decisions of referees and their cases are vital elements of competition that may alter the result. Thus, arbitrariness must have some attention in a careful scientific way by providing appropriate means to realize such a purpose. One of which is standardizing brain dominance and attentive performances to have perfect judging skills

Within this atmosphere, athletic arbitration, specially in futsal, represents a complicated dynamic environment require referees to enjoy a high level of mental efficiency, continuous attention to handle matches stresses and take correct decisions in changing circumstances. Studies showed that conceptual processes like awareness, attention, recall, critical thinking, and problem solving are closely related to mechanisms of brain dominance. All these conceptual processes determine the quality of arbitrary performance (Barbar et al, 2013; Cox, 2000)

Despite the increased attention to understand the mental abilities of referees, there is a lack of research connecting brain dominance and their attentive abilities, especially when talking about developing precise standardized scales to evaluate this relation. Saleh et al (2024) said that intensive and rare cases of Futsal require advanced physiological and conceptual strategies to control the game. This increases the importance of studying brain dominance and attentive abilities.

Given all these reasons, the current study tries to bridge the gap by building and standardizing a scale of brain dominance for futsal referees, the known relation between lobar dominance, attentive abilities, and analyzing the influence of this dominance on the precision of referees' decisions during matches. Constructing such a scale will provide a scientific tool to use in processes of selection, training, and professional development to raise levels of referees and assure its integrity.

Research Problem: The Problem of current research is to adopt recommendations of some empirical studies to design specialized tests and scales connected to certain dependent variables to come up with a scale based on literature reviews instead of a general scale. This scale is connected to some attentive abilities of futsal referees and their need for such abilities to rely upon in their decisions.

There must be effective, objective procedures to build and standardize specialized scales to select, train, and develop referees, to know attentive skills that enable referees to do their job without negatively affecting their decisions, thus reach better arbitrary in local and global tournaments.

Referee possesses a certain amount of physical, mental, and psychological abilities based on dominating lobar with attentive abilities to have a high performance level and create a decisive personality. Attentive processes are important when taking the right decisions. In the end, we are confronted by a scientific attempt considers the percentage of each studied variable of futsal players to develop their performance. So, the question of current research is the possibility of constructing and standardizing a scale of brain dominance and its contribution to attentive abilities.

Objectives: Constructing and standardizing a dimensional scale of brain dominance of futsal referees to know the percentage of contribution of attentive abilities to human dominance for futsal referees.

Material methods

Proximus Journal of Sports Science and Physical Education
Volume 2, Issue 9, September 2025
https://proximusjournal.com/index.php/PJSSPE
ISSN (E): 2942-9943

Study Design

This study employed a descriptive research design, utilizing a quantitative approach based on percentages, as it is well-suited for the research objectives. A descriptive design provides a systematic academic framework for analyzing and explaining phenomena to achieve specific goals (Mohammed, 2013, p. 240).

The research tools included a variety of methods and instruments. These comprised a review of academic literature, questionnaires, observation, and a custom-developed scale (Alexandre, 2011). In addition, practical tools such as a stopwatch, a calculator, a laptop, a whistle, and a Mentorum flasher were used for data collection.

Participants

The research population consisted of all Iraqi futsal referees active from May 10, 2024, to September 25, 2025. Sample: A purposeful sampling method was used to select the study participants, ensuring that the sample included all Class A referees for the 2021–2022 season. In qualitative research, intentional selection of a small, specific sample is a common practice, with the sample size being influenced by the data analysis requirements (Albine, 2018). The total sample for this research was 230 referees.

The sample was further divided into several groups for different phases of the study:

Pilot Study: 5 referees

Reliability Analysis: 135 referees

Standardization: 90 referees

A three-alternative scale was used, which corresponds to the 45 items on the research instrument. The distribution of the sample is further detailed in Table 1

Table (1) Sample Details

Sample	No.	percentage
Pilot	5	2,2%
Construction	135	61,4%
Standardizing	90	36,4%
Total	230	100%

Note: the construction sample is for reliability, and standardization is for standard degrees

Procedures

The research followed a structured set of procedures to ensure the validity and reliability of the scale.

Pilot Study

A pilot experiment was conducted on a randomly selected sample of 5 participants on May 10, 2024. These individuals were excluded from the main experiment to prevent any contamination of the data. The pilot study was essential for refining the scale and procedures before full-scale implementation.

Brain Dominance Scale Development

The researchers developed a psychophysical scale for brain dominance based on established scientific principles of reliability and stability (Alexandre et al., 2011; Kristin W. et al., 2023). The scale was designed to align with the theoretical constructs of general, left lobar, and right lobar brain dominance, thus achieving construct validity (Robert, 2023). This alignment ensures the scale measures the intended features as supported by existing literature. The scale's structure consists of three distinct dimensions:

1- General brain dominance
2- Left brain lobar dominance
3- Right brain lobar dominance

Scale Validity and Reliability

Proximus Journal of Sports Science and Physical Education
Volume 2, Issue 9, September 2025
https://proximusjournal.com/index.php/PJSSPE
ISSN (E): 2942-9943

Scale is considered true when it measures the desired feature (Al-Dahiri and Al-Kobaisi, 2000, 53). Reliability was found by passing a panel of 15 experts to determine the reliability of the brain dominance of the sample. Appendix (1) shows brain dominance pre-post amendment. Items of more than 70% credibility was accepted (Fathia 2021) (Perez-Romero, 2022) as shown in table (2).

Table (2) Percentage of Expert Agreement on the Elements of Brain Dominance

Significance	percentage	experts	Brain dominance
Accepted	93,3%	Unaccepted 1	3,6,7,14,15,20,23,30,31,36,37,38,42,43,46
Accepted	86,6%	Agree 14	4,5,8,11,16,19,24,28,29,32,35,44,45
Accepted	80%	Number of experts: 15	9,10,17,18,25,26,27,33,34,1,2,12,13,21,22,39,40,41

Note: all items scored less than (70%) were excluded

To validate and complete the reliability of the scale, researchers made a comparison of parts for all items as shown in Sheirif's (2020) study, and as shown in table (3).

Table (3) discriminative force of items before rearranging them descendingly

Items	Highest group		Lowest group		No.	Sig
	means	Standard deviation	means	Standard deviation		
1	5,58	1,79	3,54	1,66	4,74	0,003
2	6,26	1,64	3,67	1,79	6,03	0,001
3	6,52	1,15	3,61	1,92	7,38	0,001
4	6,26	1,61	3,81	1,72	5,90	0,008
5	6,57	1,72	3,44	1,72	7,30	0,000
6	5,98	1,93	3,70	1,81	4,88	0,000
7	6,51	1,19	3,15	1,67	9,26	0,000
8	6,51	1,12	3,37	1,62	9,04	0,001
9	6,09	1,72	3,63	1,61	5,90	0,004
10	6,51	1,12	3,36	1,65	8,97	0,001
11	6,09	1,72	3,63	1,61	5,90	0,002
12	5,92	1,98	3,09	1,79	6,01	0,000
13	6,59	1,81	3,55	1,75	6,85	0,006
14	6,01	1,79	3,55	1,19	6,47	0,005
15	6,18	1,81	3,37	1,83	6,20	0,004
16	6,02	1,81	3,54	1,62	5,77	0,001
17	6,11	1,82	3,38	1,11	7,22	0,002
18	6,11	1,82	3,70	1,15	6,58	0,001
19	6,59	1,65	3,98	1,84	6,01	0,001
20	6,11	1,12	3,54	1,84	6,47	0,001
21	5,83	1,77	3,37	1,95	5,28	0,001
22	6,62	1,69	3,57	1,75	7,11	0,001
23	6,62	1,69	3,11	1,65	8,43	0,000
24	6,15	1,69	3,54	1,78	6,01	0,000
25	6,52	1,15	3,61	1,92	7,38	0,000
26	6,26	1,61	3,82	1,72	5,90	0,001

Proximus Journal of Sports Science and Physical Education
Volume 2, Issue 9, September 2025
https://proximusjournal.com/index.php/PJSSPE
ISSN (E): 2942-9943

27	6,57	1,71	3,44	1,72	7,30	0,001
28	6,18	1,74	3,54	1,70	6,14	0,000
29	6,55	1,43	3,50	1,45	8,50	0,000
30	6,51	1,48	3,75	1,60	7,22	0,000
31	6,25	1,71	3,11	1,78	7,26	0,000
32	6,20	1,60	3,37	1,85	6,51	0,001
33	6,49	1,39	3,82	1,57	7,29	0,000
34	6,61	1,13	3,48	1,45	9,70	0,000
35	6,10	1,70	3,44	1,42	6,84	0,000
36	5,56	1,81	3,36	1,54	5,30	0,011
37	5,85	1,71	3,36	1,70	5,89	0,001
38	5,89	1,13	3,36	1,467	7,74	0,001
39	6,62	1,63	3,33	1,76	7,75	0,000
40	5,73	1,43	3,31	1,17	7,41	0,000
41	5,63	1,22	3,31	1,23	7,61	0,001
42	6,86	1,21	3,57	1,99	8,06	0,000
43	6,73	1,22	3,31	1,29	10,95	0,000
44	5,68	1,17	3,56	1,82	5,53	0,002
45	6,27	1,22	3,19	1,84	8,09	0,000
46	5,89	1,12	3,69	1,92	5,870	0,001

Table (3) shows that the variance for all items was significant at the level of (0,05) and the freedom degree of (24). Discriminative reliability of the test to discriminate between the highest and lowest values to show individual variances between sample members (Amaral et al, 2024). Discriminative reliability: the test's ability to discriminate between degrees of highest and lowest groups significantly speaking (Tariq, 2016). A scale is said to have internal discriminative reliability with the existence of tangible variances between the highest and lowest groups in certain measure as a hypothetical expression of ability and reliability of the test by showing individual variances within and between sample reliability of that test (Ali & Mohammed Sorowawi, 2023, 250). Thus, the reliability of the scale is achieved via hypothetical construction, experts agreement with discriminative reliability to indicate the validity of the scale. Reliability of tools was verified due to connectivity with the external stake of scale of rain dominance with a moral significance of (0,91) at an error level of (0,05). Reliability of external stake that measures reliability of targeted feature is achieved via statistically significant correlation of results of two tests, with one test, at least, external (Hanan, 2020) Reliability of stake can predict testee results when doing oral standard test or alignment of their results in measure and a test in an external reality to boost reliability and validity of tool (Muqaddam, 2021).

Validity and Stability of the Scale of Brain Dominance :

stability was found by half split, simple correlation factor before correlation, and Spearman Brown correlation factor after correction (A-Jalamdeh, 2015). Validity and stability of the test includes the precision of the scale and the stability of the degree of coordination of the measured feature (Radwan, 2006). Internal coordination is checked by classifying data results for odd and even numbers. Split value is treated by Spearman -Brown split correlation factor so that all values increase (Ebert et al, 2024). The half-split method was adopted as odd and even items with (135) surveys (construction sample), then redivided into (23)*(23) odd and even items. A simple Pearson correlation factor was used between both halves. The r value was (0,66) and after correction

Proximus Journal of Sports Science and Physical Education
Volume 2, Issue 9, September 2025
https://proximusjournal.com/index.php/PJSSPE
ISSN (E): 2942-9943

using Spearman -Brown equation, the total stability factor was (0,795), statistically significant at a false value of (0,05), meaning the scale is valid and stable.

Final Form of the Brain Dominance Scale

Based on the psychometric analysis, the final version of the brain dominance scale was structured into three dimensions, consistent with the literature review. The initial pool of 60 items (20 for each domain) was reduced to 46 after excluding 14 items (marked with # in Table 4) that did not meet the validation criteria. The accepted items were distributed as follows:

- **General Brain Dominance**: 16 items
- **Left Brain Lobar Dominance**: 15 items
- **Right Brain Lobar Dominance**: 15 items

The final scale employs a three-alternative response format: Yes, Maybe, and No. Positive items are scored as follows: Yes=6, Maybe=4, and No=2. For negative items, the scoring is reversed: Yes=2, Maybe=4, and No=6. The total possible score ranges from 92 to 276. With these psychometric features confirmed, the scale was deemed ready for administration to the main sample, as shown in Table 4.

Items before adjustment and discrimination	**No.**	**Final form of accepted items**	**yes**	**no**	**May be**
Always saying the truth makes people think I am ruthless	1	Precise decisions butter than calling me ruthless			
Being kind hearted is for a common reason	2	Dedicate myself to my work and agree with fellow referees with some decisions.			
I can turn situations for my favor	3	I play by rules of international union of futsal			
Know people's needs and consider them	4	Can predict exactly players' movements			
I expect action by intuition	5	My intuition dictates my talk			
I heavily think of consequences	6	I'm not careful when making decisions at competitions			
Love to see people happy	7	Love when I run matches professionally			
Realize my goals and allocate necessary time	8	Try to realize goals as prescribed by the book			
Think of problems to reach solution	9	I get nervous whenever there is a problem in elite tournaments			
I cant bear chaos in my life	10	Consider my physical potentials when exercising			
I try to get social and work on my social aspect	11	Organize my relations and connect them to all pitch situations			
I get so emotional	12	Rely on my senses when evaluate a competition			
I only invest in what is important to me	13	Analyze motor skills inside pitch and photos to learn			
Hate routine and constantly change	14	Hate routine and create change and what is best			
I keep my belongings tidy	15	I don't keep my referee tools tidy			

Proximus Journal of Sports Science and Physical Education
Volume 2, Issue 9, September 2025
https://proximusjournal.com/index.php/PJSSPE
ISSN (E): 2942-9943

I am accused of being unpredictable	16	Use my expertise as a referee			
I am clear about my goals	17	Try to achieve my pre-set goals			
Use step by step strategy	18	Work in precision and one step at a time			
Cherish my social relations	19	Cherish my training mates			
My deeds are louder than my talk	20	As a referee, I am into practical and make decisions without thinking			
Offer help whenever needed	21	Set my mind to work well as a referee			
I take referee decisions objectively without bias	22	I don't innovate when hard situations			
People trust my plans and achievements	23	Put my presumptions into practice			
I am open in public	24	Don't need to review futsal rules before matches			
I love getting wild	25	Use body language in matches			
Analyse situations and consequences	26	Use my right hand			
I don't leave work unfinished	27	I put my whistle in my left hand and use it to explain decisions			
I urge my mates	28	Take decisions based on reality not expectations			
Know all technical and legal aspects of the game	29	I know enough about futsal			
I think I am kind hearted	30	I respect and cherish laws and regulations			
I juggle many balls at the same time	31	Visualize opinions and decisions before, within and after match			
Unconsciously, I look into people's eyes when talking	32	I don't connect situations and visualizations as a referee completely			
Always think positively	33	Respect my co-referees' decisions			
I live by routine	34	Apply decisions learnt by referees committee in a routine way			
Love to be organized	35	Don't accept advice			
Care for generals and details	36	My expectations are always right for match			
Loyalty at work above personal feelings	37	Don't care if my language is not understood, and focus on being a referee			
Colleagues ask me to be a referee in competitions	38	Referee committee nominate me to lead important competitive matches			
Write daily plans and apply them	39	Write my plan as a referee and apply them verbatim			
My sense of humor always brings me trouble	40	My sense of humor brings me trouble in competitions			
As a referee I use my intuition	41	As a referee, I don't use body language			

Proximus Journal of Sports Science and Physical Education
Volume 2, Issue 9, September 2025
https://proximusjournal.com/index.php/PJSSPE
ISSN (E): 2942-9943

I am selective when applying rules	42	I look for core of regulations			
I am adventurous by nature	43	I am rational			
I use my right hand and leg	44	I am creative in using my right lobar to explain my decisions			
I use my left arm and leg	45	I rely on my left lobar to explain my decisions			
I don't leave unfinished business	46	I may leave some unfinished business			
Unconsciously I leave no detail un attendant	47				
I increase my enthusiasm during competition with my mates	48				
Think of critical situations and its bitter consequences	49				
I speak to everybody about my feelings	50				
I make decisions from my personality and confidence	51				
I take things slow in my life	52				
I have fun whenever there is a new relation in my life	53				
Keep my belongings and stuff in a private place	54				
I always please myself as well as others	55				
I make time to realize my goals and expectations	56				
I always look for common interest when working with others	57				
Have benefit of turning situations for my own good	58				
I know my desires as well as others	59				
Avoid expectations and live in real world	60				

Based on the text you provided, here is a clear and organized breakdown of the research methodology.

Dimensions of the Brain Dominance Scale

The scale is composed of 46 items distributed across three main dimensions:

- **General Brain Dominance:** Items 3, 7, 10, 15, 18, 21, 22, 25, 28, 30, 34, 35, 38, 41, 43, and 46. These items assess the overall dominance across emotional, conceptual, and motor aspects.
- **Left Lobar Dominance:** Items 1, 2, 5, 8, 11, 16, 17, 20, 24, 26, 29, 33, 37, 39, and 44. These focus on skills related to logic, language, reading, writing, and control of the right side of the body.
- **Right Lobar Dominance:** Items 4, 6, 9, 12, 13, 14, 19, 23, 27, 31, 32, 36, 40, 42, 45, and 46. These deal with intuition, imagination, artistic abilities, and control of the left side of the body.

Note: The negative statements on the scale are items 6, 9, 12, 15, 22, 24, 32, 34, 35, 37, and 46.

Reliability and Stability of the Attention Test

Proximus Journal of Sports Science and Physical Education
Volume 2, Issue 9, September 2025
https://proximusjournal.com/index.php/PJSSPE
ISSN (E): 2942-9943

The "adjusted attention test" was validated through an expert panel, achieving a reliability (inter-rater agreement) of 86.67% at a $p<0.05$ level of significance. This is a common method for establishing reliability, as expert consensus can be a reliable measure of an instrument's validity (Susan, 2014).

The **stability** of the test, which refers to its consistency and objectivity, was also confirmed (Sami, 2016; Al-Nabhan, 2004). This was done using a split-half method. The initial correlation coefficient (r) was 0.758, and after correction using the Spearman-Brown formula, the final coefficient rose to 0.863. This result is statistically significant at $p<0.05$, indicating that the test is highly reliable and stable.

Description of the Amended (Bordon-Anfimove) Test

This adapted test is specifically designed for athletes to measure various aspects of attention. It consists of 31 forms, each containing groups of 3–5 numbers. There are 10 groups per line, with a total of 40 lines. The entire test contains 1,240 numbers arranged in a standardized, hierarchical manner with an uneven distribution to prevent memorization (Khatr & Albeig, 1978, p. 492).

The test measures three types of attention:

1. Alertness/Focus

- **Purpose:** To measure the subject's alertness.
- **Procedure:** The participant receives a paper with numbers. At the "Go" signal, they start a stopwatch and use a pen to cross out all occurrences of the number **47**, moving from left to right, line by line. They stop when they hear the "Stop" command.
- **Time:** 1 minute.
- Calculation:

$$\text{Attentiveness} =. \frac{(\text{Correctly Deleted Numbers}) - (\text{Wrongly Deleted Numbers})}{(\text{Correctly Deleted Numbers}) + (\text{Forgotten Numbers})}$$

2. Divided Attention

- **Directions:** This follows the same procedure as the first test, but with a variation. The subject is instructed to simultaneously cross out two specific numbers, **96** and 92, from the "Go" signal until the "Stop" signal.
- **Time:** 2 minutes.
- Calculation: After finding the total count for U3 (96) and U4 (92), the formula for divided attention is applied:

$$\text{Divided Attention} = \frac{(U3 - U4) * 100}{(U3 + U4)}$$

3. Diverted Attention

- **Directions:** This test introduces a new variable. The referee must sequentially cross out the numbers 94 and 96 for 30 seconds each, completing two rounds for each number.
- **Time:** 2 minutes (one minute for each round).
- **Calculation:** Scores are calculated for four 30-second intervals as in the first test. The final result is obtained by calculating the difference (subtraction) between the scores from the first, second, third, and fourth intervals.

Main Experiment

The construction phase of the main experiment was conducted with a sample of 135 referees after all preliminary procedures were completed. The brain dominance scale was administered on the first day, and the attention tests were administered on the second. Following the validation of the scale's psychometric properties, it was distributed to an additional sample of 90 referees for standardization.

Proximus Journal of Sports Science and Physical Education
Volume 2, Issue 9, September 2025
https://proximusjournal.com/index.php/PJSSPE
ISSN (E): 2942-9943

As noted by Habal (2017), the development of any test is not complete until its raw scores are standardized through a systematic process. The standardization of the brain dominance scale was achieved by calculating standardized scores, which are detailed in Table 4. Table 5 provides a comparison of the raw and standardized scores (Z-scores).

X	270	255	240	225	210	195	180	165	150	135	120	105	90
Z	2.25	1,875	1,50	1,125	0,75	0,357	00	-0,375	-0,75	-1,125	-1,50	-1,875	-2,25
T	72,5	68,75	65,0	61,25	57,5	53,75	50	46,25	42,5	38,75	35,0	31,25	27,5

Standardization of Scores

The standardization sample for the scale consisted of 80 referees. The raw scores from these participants were converted into standard **T-scores** and **Z-scores** to give them meaning and context. A raw score is generally meaningless on its own; standardization allows for a direct comparison of an individual's performance to that of their peers (Gomez, Barrios, et al., 2024, p. 806).

The conversion from raw scores to standard scores was done using the following equation (Shakir et al., 2023, p. 717):

he Z-score and T is the raw score.

The raw and standardized scores for the 80 futsal referees are detailed in Table 5.

Statistical Methods

The following statistical methods were employed in the study:

- Percentages, Arithmetic Means, Standard Deviation, Skewness Coefficient, Pearson Correlation Coefficient (Ali & Hamid, 2021; Fayyad et al., 2025).
- Regression Coefficient, Spearman Correlation Coefficient (used for stability correction), Coefficient of Determination, F-test (for variance analysis), Standard Degrees (T and Z scores)(Hammood et al., 2024; Khalaf et al., 2025).

Results and Discussion

Statistical Description of Variables

Table 6 presents key statistical measures for brain dominance and attentional abilities among futsal referees. This descriptive analysis provides a summary of the data, including the mean, standard deviation, and skewness for each variable.

Table (6): Statistical description of brain dominance and attentive abilities of futsal referees

No.	Brain dominance and attentive abilities	Arithmetic means	Standard deviation	Lowest value	Highest value	mediator	Twist coefficient
1	Brain dominance	160	33,93	102,00	244,00	180	1,768
2	attentiveness	61	12	25,10	95,10	58	0,75
3	Distributed attention	35	9,25	8,20	98,70	38	-0,96
4	Shifted attention	1,6	0,39	0,03	4,89	1,55	0,33

Proximus Journal of Sports Science and Physical Education
Volume 2, Issue 9, September 2025
https://proximusjournal.com/index.php/PJSSPE
ISSN (E): 2942-9943

Brain Dominance: The average score was 160, with a standard deviation of 33.93. The skewness coefficient was 1.768, indicating a moderate positive skew.
Attentiveness: The average score was 61, with a standard deviation of 12. The skewness coefficient was 0.75, showing a slight positive skew.
Distributed Attention: The average score was 35, with a standard deviation of 9.25. The skewness coefficient was -0.96, which suggests a negative skew.
Shifted Attention: The average score was 1.6, with a standard deviation of 0.39. The skewness coefficient was 0.33, indicating a slight positive skew.
All "twist coefficients" (skewness coefficients) for the variables fall within the acceptable range of +3 to -3, confirming that the data distribution is considered normal (Irawan et al., 2024). This is important because it means the data meets the assumptions for many common statistical analyses.
Table 7 shows the results of a stepwise regression analysis used to determine which attentional abilities contribute most significantly to brain dominance in futsal referees.

No.	Attention variable	Stable value	coefficient	Calculated F	Probability value	Conjunction coefficient	Ratio
1	Diverted attention	190	-36,79	64,4999	0,000	0,685	0,469
2	Distributed attention	226	-30,90 -1,301	68,593	0,000	0,81	0,656
3	attentiveness	152	-23,92 -1,102 0,927	54,653	0,00	0,835	0,697
4	Total attention	219,62	0,789 -1,021 -19,653	34,62	0,000	0,845	0,714

Analysis of Stepwise Regression Results
Step 1: Diverted Attention
The initial step of the analysis found a statistically significant contribution of diverted attention to brain dominance, with a contribution ratio of 0.469 (or 46.9%). The calculated F-value of 64.4999 was significant at a $p<0.05$ level. This result is considered normal and expected, as referees must consistently shift their attention to different triggers during a match, such as players, the ball, and other events on the field. The ability to quickly and accurately shift attention is critical for successful officiating (Khamis & Alwan, 2007, p. 138).
Step 2: Distributed Attention
The second step revealed a moderate and statistically significant contribution of distributed attention, with a ratio of 0.656 (or 65.6%). The calculated F-value of 68.593 was also significant ($p<0.05$). This result highlights the need for referees to focus on multiple stimuli simultaneously without neglecting any single one. A referee must perform both technical and administrative duties with a high degree of concentration and distributed attention to make sound decisions. The ability to distribute attention is defined as an individual's capacity to direct focus toward more than one trigger at the same time (Al-Dhamad, 2000, p. 67).
Step 3: Attentiveness (Focus)
The third step showed the largest and most significant contribution from attentiveness (also referred to as focus or sustained attention), with a ratio of 0.697 (or 69.7%). The calculated F-value of 54.653 was highly significant ($p<0.05$). This finding indicates that a referee's ability to maintain focus throughout the competition

Proximus Journal of Sports Science and Physical Education
Volume 2, Issue 9, September 2025
https://proximusjournal.com/index.php/PJSSPE
ISSN (E): 2942-9943

is a primary factor in their performance, as it allows for consistent accuracy in their decisions. This is crucial for elite referees who must perform their duties accurately and for extended periods under high pressure (Ali, 2010, p. 243; Shamoon, 1996, p. 290).

Total Contribution

The analysis revealed that the combined attentional variables have a strong overall relationship with brain dominance. The multiple correlation coefficient between the attentional variables and brain dominance was 0.845, with a total contribution ratio of 0.714 (or 71.4%). The calculated F-value was 34.62, which is highly significant ($p<0.000$).

This high total contribution is logical, as a referee's performance depends on their ability to overcome distractions like thoughts, emotions, and crowd noise to make precise decisions. The dynamic nature of a match requires referees to constantly gather and refocus their attention to execute decisions and movements with the highest level of concentration (Mohammed, 1994, p. 317). The high contribution ratio suggests that the nature of a referee's performance and their preparation are closely linked to these attentional skills.

Conclusions

Based on the research findings, the following conclusions were reached:

- The study successfully met its first objective by developing and standardizing a valid and reliable brain dominance scale for futsal referees. The scale was established with robust psychometric properties, including reliability and stability, and provides standardized scores for comparison.
- The analysis confirmed that different attentional abilities contribute to brain dominance at varying levels.
    - Distributed attention showed a moderate contribution to brain dominance.
    - Attentiveness (focus) showed a high and significant contribution to brain dominance.
    - Overall, total attention demonstrated the highest and most significant contribution to brain dominance compared to its individual components, successfully achieving the second research objective.

Recommendations

The researchers propose the following recommendations for future research and practice:

- Refine the Scale: The brain dominance scale's validity and reliability should be re-examined and enhanced, possibly by reviewing its items.
- Continuous Development: Comprehensive studies are needed to continuously develop attentional abilities in referees.
- Larger Sample Size: The scale should be re-administered to larger and more diverse samples to produce more accurate and representative standard scores.
- Standardization of Attentional Variables: There is a need to establish standardized scores for attentional variables and their potential in futsal referees.
- Interdisciplinary Research: Future studies should investigate brain dominance in relation to other variables, possibly with the aid of artificial intelligence (AI).
- Sustainable Mental Development: There should be a focus on the sustainable development of mental processes in all athletic fields, using accurate and modern evaluation methods.
- Specialized Test Development: More modern studies should be conducted to mediate and validate specialized scales and general tests for various athletic disciplines.
- Periodic Mental Assessments: Regular mental tests should be implemented to evaluate sports specialists, ensuring their training programs are both scientific and objective.

Proximus Journal of Sports Science and Physical Education
Volume 2, Issue 9, September 2025
https://proximusjournal.com/index.php/PJSSPE
ISSN (E): 2942-9943

- Holistic Training: Referees should be encouraged to integrate mental training and moto-psychological abilities with their physical training to achieve flawless performance.
- Institutional Support: Futsal federations and athletic unions should provide scientific tools and both financial and moral support to referees.

Conflicts of interests: no conflict of interest is found
Funding: This research received no external funding

References

- Abdullah, S. M. et al (2025). Preparing a Scale for Sport Knowledge Management and Standardizing It for Employees in Students Activities Departments in Iraqi Universities. Retos 64, 708-723.
- Al-Dahiri, S. H. A. & Al-Kubaisi, W. M. (2000). General Psychology (1st ed.). Dar Al-Kinzi for Publishing and Distribution. Irbid, Jordan.
- Al-Dhamad, A. (2000). Physiology of Mental Processes in Sports. Dar Al-Fikr Printing. Jordan.
- Alexandre, N.M.C. & Coluci, M.Z.O. (2011). Validade de conteudo nos processos de construcao e adaptacao de instrumentos de medidas. Ciencia & Saude Coletiva, 16 (7), 3061-3068. https://doi.org/10.1590/S1413-81232011000800006
- Ali, M. M. (2010). Ratio of Contribution of Attention Features on Accuracy of Some Basic Skills of Tennis. Al-Qadisya Magazine for Physical Sciences, 10 (1). Iraq.
- Ali, O., & Hamid, H. (2021). Building of Psychological Directions Parameter for Anbar Educational Directorate Teachers for non-specialty Towards Practicing Classroom and Extracurricular Activities. Anbar University Journal of Physical Sciences and Sports, 12(23), 23–46. https://doi.org/10.37655/uaspesj.2021.175083
- Al-Jalamdeh, F. (2015). Measurement and Diagnosis of Autism Spectrum Disorders in Light of the Diagnostic Criteria Contained in DSM-4/DSM-5. Dar Al-Masirah. Amman.
- Al-Nabhan, M. (2004). Basics of Measurement and Evaluation in Behavioral Sciences. Dar Al-Shourouk for Publishing and Distribution. Amman.
- Amaral, C.M., dos S.Moraes, I.F. & Bastos, F. da C. (2024). Perfil e competencias do gestor do espote: construcao e validacao de instrumento de avalicao. PODIUM Sport, Leisure and Tourism Review, 13 (2), 300-332. https://doi.org/10.5585/podium.v13i2.24931
- Ann-Hermann-Nehadi (2010). Creativity and Strategic Thinking: Critical Survival Skills for Every Training Professional. Hermann International USA. Retrieved from https://www.hbdi.com
- Barber, H.A. et al (2013). Concreteness in Word Processing: ERP and Behavioral Effects in Lexical Decision Task. Brain Language, 125, 47-53.
- Barber, J. et al (2013). Cognitive and Attentional Processes in Sports Officiating. Journal of Sports Psychology.
- Bashat, H. & Bouamoucha, N. (2020). Validity and Reliability in Social Research. Journal of Studies in Human and Social Sciences, 3 (2), 117-133.
- Bin Fleese, K. (2009). Types of Split Dominance of Brain, Visual Realization and Memory: Comparative Study Between Pupils with Learning Difficulties (Writing and Mathematics) and Their Normal Peers. Unpublished Ph.D. Treatise. University of Mantouri Brothers. Algeria.
- Cox (2000). Sport Psychology: Concepts and Applications. Brown and Bench.
- Ebert, K.D., Pham, G.T., Levi, S. et al (2024). Measuring Children's Sustained Selective Attention and Working Memory: Validity of New Minimally Linguistic Tasks. Behav Res 56, 709-722. https://doi.org/10.3758/s13428-023-02078-5

Proximus Journal of Sports Science and Physical Education
Volume 2, Issue 9, September 2025
https://proximusjournal.com/index.php/PJSSPE
ISSN (E): 2942-9943

- Fathia, B. et al (2021). An Evaluative Study to Measure Psychometric Properties (Validity and Reliability) in Scientific Research. Diaa Journal of Psychological and Educational Research, 1 (2), 111-131.
- Fayyad, F. H., Hammood, Y. M., Ali, O. A., Mushref, A. J., Awad, A. K., & Shanta, A. (2025). Building and legalizing a test to measure the level of football agility of young players. Retos, 68, 1578–1590. https://doi.org/https://doi.org/10.47197/retos.v68.116368
- Gomez, Barrios et al (2024). Satisfaccion de las necesidades psiologicas basicas de los estudiantes en funcion del modelo organizativo empleado en la asignatura de actividades en el medio natural (Satisfaction of the basic psychological needs of the students according to the organizational model used in the subject of activities in the natural environment). Retos (60), 803-809. https://doi.org/10.47197/retos.v60.109329
- Habal, Y. (2017). Standardization of the Cattell Intelligence Test Scale III for First Year Secondary School Students. Ph.D. Thesis in Measurement and Evaluation. University of Oran. Algeria.
- Hammood, Y. M., Awad, A. K., Ali, O. A., Mushref, A. J., & Hummadi, J. N. (2024). Measuring the aggressive behavior of the teams in the Iraqi Premier League in football and its relation to the results and ranking of the league for the 2022-2023 season. Sportske Nauke i Zdravlje, 14(2), 127–134. https://doi.org/10.7251/SSH2402127H
- Irawan, R. Yenes, R., Mario, D.T., Komaini, A., Garcia-Fernandez, J. Orhan, B.E. & Ayubi, N. (2024). Design of a Sensor Technology-Based Hand-Eye Coordination Measuring Tool: Validity and Reliability. Retos, 56, 966-973. https://doi.org/10.47197/retos.v56.103610
- Khalaf, Y. A., AbdulJabbar, M. A., & Ali, O. A. (2025). The effect of sports job burnout on the performance of workers in student activities departments in Iraqi universities | El efecto del agotamiento laboral deportivo en el rendimiento de los trabajadores de los departamentos de actividades estudiantiles de. Retos, 66, 86–95. https://doi.org/10.47197/retos.v66.113271
- Khamis, A. & Alwan (2007). Level of Split Attention and Precision of Decisions of Volleyball Referees in Iraq. Journal of Physical Education, University of Baghdad. Iraq.
- Khatib, R. & Matatala, M. (2023). The Problem of Validity and Reliability in Psychological and Educational Research. Journal of Measurement and Psychological Studies, 2 (2), 176-188.
- Khatr, A. M. & Al-Beeg, A. F. (1978). Measurement in Athletic Field (3rd ed.). Dar Al-Maarif. Cairo.
- Knecht, S. et al (2000). Handedness and Hemispheric Language Dominance in Healthy Humans. Brain, 123 (12), 2512-2518.
- Kobus, N. (2005). Understanding Your Whole Brain. NBI Publisher.
- Langner, R. et al (2023). Evaluation of the Reliability and Validity of Computerized Tests of Attention. PLoS One, 18 (1). https://doi.org/10.1371/journal.pone.0281196
- Mohammed, M. I. (1994). Defense as a Means of Offense in Football. Dar Al-Fikr Al-Arabi. Cairo, Egypt.
- Mohammed, M. K. (2013). Efficiency of Counselling Program to Ease Learning Swimming for Freshmen at College of Physical Education. Unpublished M.A. Thesis. College of Basic Education, University of Mosul. Iraq.
- Muqqadam, A. (2011). Statistics and Psychological and Educational Measurement with Models of Scales and Tests (2nd ed.). Office of University Publications. Algeria.
- Perez-Romero, N., Reigal, R.E., Franquelo, M.A. Montiero, D. Castillo, L, Hernandez-Mendo, A. Morales, Sanchez, V. (2022). Testing Psychometric Properties and Measurement Invariance of

Psychological Needs in the Digital Version of the Spot Scale. Sustainability, 14, 12126. https://doi.org/10.3390/su141912126

- Radwan, M. N. (2006). Introduction to Measurement in Physical Education and Sports (1st ed.). Markaz Al-Kitab Publishing. Cairo.
- Saleh, M.Y., Abdullah, A.M. & Taha, A.A. (2024). Effects of Tapering of Three Different Percentages on Physiological Variables Among Futsal Players. Int J. Disabil Sports Health Sci, 7 (4), 877-855. https://doi.org/10.33438/ijdshs.1485960
- Sami, M. M. (2016). Research Methods in Education and Psychology (6th ed.). Dar Al-Masirah for Publishing and Distribution. Amman.
- Sarawi, A. & Sarawi, M. (2023). Basic Concepts to Handle Psychometrical Features of Measurement Tools in Psychological and Pedagogical Researches. Assiraj Magazine for Educational and Social Issues, 7 (1), 245-261.
- Shaker, S. (2014). Foundations of Constructing Psychological and Educational Tests and Measures (2nd ed.). De Bono for Teaching Thinking, 4 (1), 104.
- Shamoun, M. A. (1996). Mental Training in Sports. Dar Al-Fikr Al-Arabi. Cairo, Egypt.
- Sharif, A. J. (2020). Building and Validating Attention Deficit and Hyperactivity Disorder Scale in the Saudi Environment According to Diagnostic and Statistical Manual of Mental Disorders. AJSRP, 4 (29), 123-139.
- Springer, S.P. & Duetsch, G. (2013). Left Brain, Right Brain Perspectives from Cognitive Neurosciences.
- Tariq, N.M. (2016). The Factorial and Neurological Structure of the Brain Dominance Scale (EBDS) in Light of the Variables of Brain Dominance and Gender Among Students of the Faculty of Education in Sohag. Scientific Journal of the Faculty of Specific Education, 6 (1), 645-674.
- Wahab, I. (2014). A Study of Brain Control Patterns as an Indicator for Selecting Recreational Activities for Alexandria University Students. Ph.D. Thesis, Faculty of Physical Education, Alexandria University.