P-ISSN: 1992-0091
E-ISSN: 2708-3454

Modern Sport
Vol.22 No.2 ,2023

Published 30/06/2023 Open Access

DOI: https://doi.org/10.54702/ms.v22i2.1106

Constructing and standardizing a spatial orientation test for skydiving

Maysam Abdul Rahim Abdul Hassan [1], Ghusoon Natiq Al-Wadi [2]

E-mails: maysam.abdulraheem1104@copew.uobaghdad.edu.iq [1],
ghusoon@copew.uobaghdad.edu.iq [2]

1&2 Physical Education and Sport Sciences college for women, University of Baghdad

Received: 02/02/2023, Accepted: 21/02/2023

Abstract

The science of testing and measurement, alongside other sports sciences, plays a crucial role in the objective evaluation of all aspects. It is a vital tool for evaluating the level that an athlete, whether a learner or a player, can reach. The importance of testing has emerged in paving the way for diagnosing strengths and weaknesses in players, as well as for guidance, classification, selection, and setting standards and levels to monitor positive aspects and maintain and develop them, while also addressing negative aspects. The importance of this research lies in constructing and regulating the measurement tool that can assess the quick response forces' ability to orient spatially towards a specific target during landing. This suits their training level and also evaluates the forces' level to identify their weaknesses. This enables trainers and relevant individuals to address these weaknesses and elevate them to the best levels to achieve positive and successful results from airdrop operations. The study aims to construct a test for the spatial orientation of skydiving and to determine standard criteria and levels for the spatial orientation of skydiving. The researchers used the descriptive method with a survey approach, based on the results, the researchers concluded that they were able to provide a measurement tool for assessing the spatial orientation of skydiving. The level of the sample members in the spatial orientation test ranged between (acceptable and average). The researchers recommend the necessity of increasing the training units that involve diverse landing environments. They also suggest including exercises that improve the level of spatial orientation for skydiving.

Keywords | **Skydiving, Spatial Orientation**

Introduction:

The science of testing and measurement, along with other sports sciences, is an important factor in enabling objective evaluation of all aspects. It is considered an important tool for assessing the level achieved by athletes, whether they are learners or players. The importance of testing has emerged in preparing the means to diagnose the strengths and weaknesses of players. It also plays a role in guidance, classification, selection, and setting standards and levels to monitor positive aspects, preserve them, and develop them on one hand. On the other hand, testing helps address negative aspects and work on improving them. Skydiving is considered one of the most thrilling and exciting sports. However, it requires great courage as it involves taking a single step to jump from an aircraft in mid-air. Additionally, skydiving necessitates the athlete to possess various abilities, including mental, physical, psychological, and visual skills. Skydiving training is considered essential for rapid response forces due to the diverse missions they undertake. One of these missions includes conducting airdrops operations, making it necessary for these forces to undergo skydiving training. This training enables the skydiver to land in specified areas according to the mission as quickly as possible. This requires the parachutist to steer the parachute at the specified time through the handles on the

P-ISSN: 1992-0091
E-ISSN: 2708-3454

Modern Sport
Vol.22 No.2 ,2023

Published 30/06/2023 Open Access

parachute in order to land at the designated location for the purpose of executing the mission. In order to determine the level reached by the rapid response forces in their ability to orient spatially towards the designated landing point, and to know their strengths and weaknesses, there must be a test able of measuring this spatial orientation ability of the forces. Through the researchers' personal interviews with the specialists and those involved in training the forces, it was found that there is no existing test for this spatial orientation ability. This is a significant problem that requires finding solutions. Hence, the importance of conducting research to construct and standardize a measurement tool for assessing the spatial orientation ability of rapid response forces during landing that suits the training level. Additionally, evaluating the forces' proficiency level helps identify their weaknesses, enabling trainers and those concerned can address them and reach the best levels to achieve positive and successful results from airdrops operations, as the study aims to achieve the following: Constructing a test for spatial orientation of skydivers in rapid response units, as well as to determine standard degrees and levels for the spatial orientation of skydivers.

As for the research fields are divided into: Human field: Personnel of the rapid response unit of skydiving. Temporal field: The research period spans from 1-3-2022 to 1-6- 2022. Spatial field: The research is conducted at the training school members of the rapid response team, the skydiving section in Baghdad.

Definition of terms:

Spatial Orientation of the skydiving: It is "the process of guiding the parachute along a specific landing path after the process of jumping from the aircraft. It enables the skydiver to reach the final landing site, which is predetermined as the target before the landing process." (Al-Fishawy, 2018) (1).

As for the methodology and field procedures of the research: The selection of the research methodology is aligned with the research problem and how to solve it. Therefore, the researchers used the descriptive method with the survey style. The research population was defined as the members of the rapid response team who took part in the skydiving section training course, with ages ranging from (18-22) years. The total number of participants was (20). The researchers conducted the experiment on the entire population at a rate of 100% using the comprehensive enumeration method. This is because the intended sample refers to the participants specifically chosen by the researcher to generalize the results to the entire population.

The devices and tools used include the following: Arabic and foreign sources and references, personal interviews, tests and measurements, questionnaire form, helicopter, flat ground measuring 10x10 meters, legal parachutes.

As for the field research methodology and procedures, they were represented as follows:

• Constructing the spatial orientation test: After reviewing the sources, references, and conducting interviews with experts, the researchers designed the spatial orientation test. This involved determining the performance method, required tools, and how to evaluate the test score. Then, the test was presented in the form of a questionnaire to a group of experts and specialists in the field of testing, measurement, and skydiving. The test's name, objective, tools, performance method, and recording were explained. After collecting and analyzing the data, it was found that the validity of the test reached (95%), with some minor modifications made to the test.

• The pilot study: It is a miniature version of the main experiment, the purpose of which is to identify the pros and cons that may hinder the

P-ISSN: 1992-0091
E-ISSN: 2708-3454

Modern Sport
Vol.22 No.2 ,2023

Published 30/06/2023 Open Access

researcher's work" (2). The researchers conducted the pilot study on 15/3/2022 at 10:00 AM with a sample consisting of three members who were not part of the research sample, with the assistance of the research team, the purpose of conducting the pilot study was to determine the duration of the test and ensure the efficiency of the research team while overcoming any difficulties that the researchers may encounter during the main experiment. The main experiment was then re-conducted on 19/3/2022.

As for the scientific principles of the test, they were represented by:

• Validity: The researchers adopted the content validity method by presenting the questionnaire form to experts and specialists gather their opinions on the test's ability to measure what it was designed to measure. The test was found to be valid in measuring what it was designed for, with an agreement rate of 95%.

• Reliability: It means "the degree of accuracy with which a test measures the phenomenon being measured (Alawi, 2000) (3). To verify the reliability coefficient, the researchers conducted a test-retest method and calculated the Pearson correlation coefficient between the two tests. The results showed that the test has a high degree of reliability, as the reliability coefficient reached 89.5.

• Objectivity: It is defined as 'the extent to which the examiner or judgment is assured of personal factors (Farahat, 2001) (4). To assess objectivity in the test, the researchers relied on ratings from two judgments during the re-test. The simple correlation coefficient between the ratings of the judgments was calculated, and the results showed that the test has a high level of objectivity, with a coefficient of 0.982.

Skydiving: It is an air sport where the player jumps from a helicopter or from a high summit of the Earth's surface using a parachute and relying solely on gravitational forces. In this sport, the player can jump solo while competing with other players in a dual formation using a single parachute. The concept of skydiving originated in the late 18th century, specifically in 1797, by the French aviator André-Jacques Garnerin, who initially used hot air balloons for the jumps. Later, the American Leslie L. Irvin continued the progression in skydiving in 1919 by conducting the first free-fall jump. In this technique, the skydiver accelerates gradually during the fall until reaching maximum speed, and then deploys a parachute at the end of the jump.

Final Spatial Orientation Test:

Test Name: Skydivers' Spatial Orientation Test

Test Purpose: Measuring the spatial orientation of Skydivers.

Tools: Helicopter, a flat landing area measuring 10x10 m, legal parachutes, drawing on the ground five concentric circles. The central circle has a diameter of (1 m), followed by the second circle with a diameter of (2 m), the third circle with a diameter of (3 m), the fourth circle with a diameter of (4 m), and the fifth circle with a diameter of (5 m). Each circle is marked with degrees ranging from (2-10).

Procedure: The performance involves jumping from the aircraft at a height of (1500m) and landing on the designated area. The first area that the skydiver's foot touches is considered the area that determines the skydiver's score.

Scoring: The score of the area where the skydiver's foot first touches the ground is counted.

Note:

1- In the case of landing outside the circles, the score is zero.

2- If the perimeter of a circle is touched, the higher score is awarded.

P-ISSN: 1992-0091
E-ISSN: 2708-3454
Modern Sport
Vol.22 No.2 ,2023
Published 30/06/2023 Open Access

3- Two attempts are given, and the best attempt is counted.

The Main Experiment: The researchers conducted the main experiment for the research on 25/3/2022, with the main study sample of (20) participants. The experiment included the application of the Spatial Orientation Test with the help of the assisting teamwork, and the data was recorded according to the predetermined conditions and specifications. After two months, on 25/5/2022, the researchers applied the test to the same sample for the purpose of determining the standard levels.

Statistical Analysis of the Test: The analysis included assessing the level of difficulty and ease of the test.

For the purpose of ensuring the dispersion of the sample from its mean and confirming the validity of the test, it is necessary to determine the difficulty and ease coefficients. Therefore, the researchers used logical analysis of the test through the use of the chi-square. The researchers compared the results of the construction sample with the probable normal distribution as an indicator of the level of difficulty.

The results showed a match between the distribution of the sample and the probability distribution, as indicated in Table (1).

The results showed that the distribution of the individuals in the sample matched the probability distribution, as showed in the Table (1).

Table (1)
It shows the nature of the distribution of sample individuals.

Test	Degrees Of Freedom	Calculated Value	Critical Value	Distribution
Spatial Orientation	6	7,255	12,6	Normal

Discriminatory Ability of the Test:

It means the test's ability to differentiate between high-performing and low-performing individuals in the sample. The researchers adopted a strategy of considering 50% of the highest scores and 50% of the lowest scores after arranging them in ascending order. Then, they used tests for independent samples between the means of the two groups, after the statistical analysis, it was found that the test is able to discriminate between the scores of the two groups. The test was calculated to be (18.805) with an error level of (0.000), which is lower than the level of (0.05).

Results

The results are as follows: -

• Constructing the standards for the spatial orientation test:

Testing and measurement provide raw scores for the tests. However, these scores are meaningless and cannot be compared between individuals unless a standard is established to determine the meaning of these scores. This standard allows us to infer an individual's position relative to the group and describe their characteristics compared to their peers. Standards are "the basis of judgement from within the phenomenon, not from outside it. They are determined in light of the actual characteristics of this phenomenon. Standards represent one of the main objectives of the standardization process in testing. The source of the standards is the raw scores that establish a person's position relative to the group and how they compare to their peers. Thus, standards are the basis of judgement from within the phenomenon of applying tests to the application sample." (Khaldoun, 2009) (5)

P-ISSN: 1992-0091
E-ISSN: 2708-3454

Modern Sport
Vol.22 No.2 ,2023

Published 30/06/2023 Open Access

Furthermore, standards are considered "a means of determining the relative status of raw scores, and these scores can be interpreted and their results evaluated"

For the purpose of extracting the standard scores for the Spatial Orientation Test, the researchers applied the test to the standardization sample. They obtained raw scores and then calculated the mean, standard deviation, and coefficient of skewness; this was to indicate whether the data was distributed normally, as this is one of the conditions for constructing standards. and Table (2) shows the normal distribution of the data.

Table (2)

Table 3 shows the normal distribution of the data

Variables	Arithmetic Mean	Median	Standard Deviation	Skewness Coefficient
The spatial orientation test	7,12	7	0,952	0,378

Table (2) shows that the coefficient of skewness did not exceed (±1), indicating that the scores of the research sample followed a normal distribution. Thus, the requirement for constructing standards, which is the normal distribution of data, has been met. After confirming the normality of the distribution, the researchers proceeded to use the percentile rank method to construct the standards, which would be derived from the mean as a constant value. "This method is considered one of the best methods used to extract standard scores." (Barry, 1987) (6)

• Constructing standard levels for the spatial orientation test:

After converting the scores into standard scores, the researchers proceeded to complete their work to find the standard levels. They used the method of drawing the standard levels according to normal distributions using the normal curve (Gaussian curve). "It is considered one of the objective methods for estimating scores, especially when large-scale measurements are conducted on the group" (7). In order for the researchers to translate the test results conducted on the sample individuals and transform them into objective values with meaningful significance, the researchers derived the ideal standard levels. These levels were defined as six levels along the base of the curve, with each level representing one standard deviation, as showed in Table (3).

Table (3)

It shows the raw scores, their ranges, and their corresponding percentages for the standard levels of the spatial orientation test.

Variables	Very Good		Good		Average		Acceptable		Poor		Very Poor	
	80- 71		70-61		60-51		50-41		40-31		30-21	
	2,145%		13,585%		34,135%		34,135%		13,585%		2,145%	
The spatial orientation test	Raw scores, their ranges, and percentages											
	8,54- 8,18		8,07-7,7		7,6-7,13		7,12-6,65		6,64-6,17		6,16-5,69	
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
	0	0%	2	10%	7	35%	8	40%	3	15%	0	0%

P-ISSN: 1992-0091
E-ISSN: 2708-3454

Modern Sport
Vol.22 No.2 ,2023

Published 30/06/2023 Open Access

Discussion:

Through table (3), it is evident that there are variations in the percentages of the levels achieved by the research sample. The highest percentage was achieved in the acceptable and average level. This indicates that the level of the research sample is generally acceptable, but it aspires to reach the level that individuals of the research sample should achieve. “The inability of the skydiver to reach the specified landing spot prevents the achievement of the goal of the skydiving. This necessitates trainers to focus on this ability during training in order to improve and develop it. Consequently, this has a positive impact on achieving the desired goal. It is one of the important matters that skydiver should possess, requiring a high level of attention and concentration to select the most suitable solutions" As Muna Abdul Sattar (1989) affirms, "it is important to consider performance in relation to mental abilities. Neglecting mental abilities can result in a reduced sense of spatial awareness and a lack of precision in performance." (Abdul Sattar, 1989), a previously mentioned source.

The researchers attribute this achieved level to the lack of attention from trainers to both physical and mental abilities provided during training units, which they consider insufficient to reach the desired level of performance which leads to mastery of performance. As "repetition leads to more mastery, competitiveness, and precision in motor skills performance" (8).

The researchers attribute these results to the fact that training operations do not take place in different and diverse situations, which would enable the skydiver to reach correct responses despite differing training situations and landing places. As a result, the skydiver will achieve mastery in spatial orientation regardless of the diversity of locations. This is consistent with the findings of Abdul-Monem Sulaiman (1995), who stated that "the process of repeating correct responses to various educational situations leads individuals to achieve a high degree of mastery and overcome errors associated with performance, enabling them to maintain the correct aspects" (9). Performance should "include both the motor and visual aspects effectively, which leads skydivers to reach a higher level of performance and achieve success (10). Skydiving requires "high mental abilities such as attention, concentration, and motor response, which are fundamental skills that should be developed in skydivers" (11). In addition, the trainers should focus on motivating the skydivers and increasing their motivation. "Motivation is considered a fundamental condition that affects good performance in any training field, and directing performance positively is essential" (12). Furthermore, "mastering skillful performance leads to making the performance more efficient" (12:65). It also requires "overcoming resistance, including air resistance, i.e., it requires a high ability of spatial orientation control" (13). Additionally, it enhances the skydiver's endurance and the optimal use of his abilities and potentials"

Conclusion:

The researcher has reached the following conclusions:

•The validity test used to measure the spatial orientation of

•The level of individuals in the sample in the spatial orienta

The researchers recommend the necessity of increasing the training units that involve diverse environments for parachute landings. These units should include exercises to improve the spatial orientation level of the skydivers.

It is necessary to standardize the training units and include them in the visual skills that work on improving spatial orientation among skydivers. Additionally, introducing this sport as an elective course in physical education and sports science colleges is recommended.

Author's declaration:
Conflicts of interest: None

We confirm that all tables and figures in this article are ours and written by the researchers themselves.

Ethical-Clearance: this manuscript approved by local ethical committee of physical education and sport sciences college for women on (March /2023)

Author's contributions:
All contributions of this study were done by the researchers (M.A. and G.N.) who give the main idea and make all procedures and conclusions with number of experts, Warda Ali in Statistics, Huda Shamil in revision, Inaam Ghalib in translating, Huda Shihab in proofreading

Facilitate of Task: this study was supported by Ministry of Interior / Rapid Response / Skydiving– Baghdad – Iraq

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P-ISSN: 1992-0091
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Modern Sport
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بناء وتقنين اختبار التوجه المكاني لقافزي المظلات الجوية (sky diving)

ميسم عبد الرحيم عبد الحسن [1]، غصون ناطق الوادي [2]
2&1 جامعة بغداد/ كلية التربية البدنية وعلوم الرياضة للبنات

مستخلص البحث

ان علم الاختبارات والقياس الى جانب علوم الرياضة الاخرى تشكل عاملا مهما في امكانية التقويم الموضوعي لكل النواحي، فهو يعد من الوسائل المهمة لتقويم المستوى الذي يصل الرياضي سواء كان متعلم او لاعب وقد ظهرت اهمية الاختبارات في تهيئة السبل لتشخيص نواحي القوة والضعف لدى اللاعبين وكذلك التوجيه والتصنيف والانتقاء ووضع المعايير والمستويات لرصد الجوانب الايجابية والمحافظة عليها وتطويرها من ناحية ومعالجه النواحي السلبية من جهة اخرى .حيث جاءت اهمية البحث في بناء وتقنين اداة القياس قدرة القوات الرد السريع على التوجه المكاني نحو هدف محدد اثناء الهبوط يلائم المستوى التدريبي وكذلك تقييم مستوى القوات لتحديد نقاط الضعف لديهم ليتمكن المدربين والمعنيين من معالجتها والوصول بهم الى افضل المستويات لتحقيق نتائج ايجابية وناجحه من عمليات الانزال الجوي. وتهدف الدراسة الى بناء اختبار للتوجه المكاني لقافزي المظلات الجوية (sky diving)، و تحديد درجات ومستويات معيارية للتوجه المكاني لقافزي المظلات الجوية ، حيث استخدمت الباحثتان المنهج الوصفي بالأسلوب المسحي ، ومن خلال النتائج استنتجت الباحثتان الى توفير اداه القياس التوجه المكاني لقافز المظلات الجوية، وان مستوى افراد العينة في اختبار التوجه المكاني انحصر بين المستويين (مقبول – متوسط)، وتوصي الباحثتان بضرورة زيادة الوحدات التدريبة التي تتضمن في تنوع البيئة التي يتم الانزال بها وتضمين هذه الوحدات تمرينات تحسن مستوى التوجه المكاني لقافزي المظلات

الكلمات المفتاحية | **التوجه المكاني ، قافزي المظلات**