

# Building and Standardizing a Motor Awareness Scale in Artistic Gymnastics for Students

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**Abstract:** *The research aimed to construct and standardize a Motor Awareness Scale for first-year students in the College of Physical Education and Sports Sciences – University of Kufa. The researcher used the descriptive method in the form of scale construction. The research population consisted of (85) students, and a random sample of (60) students was selected for scale construction and application. The scale was developed according to six main domains: sensory–bodily perception, spatial motor perception, balance sensation and body control, muscular effort awareness, temporal awareness of movement, and motor attention and focus. The final version of the scale consisted of (36) items. The results showed that the sample possessed an average level of motor awareness. Norms and levels for the scale were also established, making it a scientifically valid tool for future research.*

**Keywords:** *Motor Awareness, Measurement, Physical Education Students.*

## Introduction

Artistic gymnastics is considered one of the most prominent sports activities that demonstrate the integration of physical, skill-related, psychological, and sensory abilities due to the complex movements it includes, which require high accuracy in performance and advanced neuromuscular control. Among the apparatus used in teaching gymnastics skills within educational colleges is the parallel bars, which requires the student to have a precise perception of body positions and movement balance during performance. This type of perception is classified within what is known as "motor awareness", which is one of the important psychomotor variables contributing to achieving optimal performance in complex technical activities.

Motor awareness is defined as the individual's ability to feel the movement and positions of his body in space and his ability to adjust these positions during execution to achieve balance and accuracy. It is considered one of the pillars of what is known as "motor intelligence". In university education, this awareness represents an important indicator that expresses the student's understanding of acquired skills and his ability to interact with the complex motor demands required by gymnastics apparatus.

Despite the educational and training importance of this variable, the Arab academic field—and especially the Iraqi one—lacks standardized scientific scales capable of accurately and quantitatively measuring motor awareness, particularly among students of Physical Education and Sports Sciences faculties. The absence of such tools hinders the

analysis of student performance and the scientific diagnosis of their sensory-motor development levels, which are essential for curriculum building and the development of teaching methods.

From here stems the importance of this study, which aims to build and standardize a scientific scale to measure motor awareness among first-year students in the artistic gymnastics subject during their performance of some movements on the parallel bars, based on psychological and statistical principles recognized in test construction, and in harmony with the nature of the sample and the educational context.

This study contributes to providing a new scientific tool that supports the university environment and assists lecturers in evaluating their students and planning effective educational interventions based on accurate quantitative data. It also represents a first step toward introducing psychomotor measurement tools within the university evaluation system for gymnastics subjects.

## Methodology

### Problem of the Research:

The subject of artistic gymnastics is one of the core subjects taught in colleges of Physical Education and Sports Sciences due to its significant role in developing the physical and psychological aspects of the university student. The parallel bars are among the most important apparatus that students train on during the first year. Performing movements on this apparatus requires a high level of sensory perception, motor coordination, and the ability to assess bodily positions during execution—all of which fall under the framework of "motor awareness".

Despite the great importance of this variable in developing student performance on various apparatus, the educational reality lacks a scientifically standardized tool to measure the level of motor awareness among students of the artistic gymnastics subject in an objective and quantitative manner. It is observed that the evaluation of this aspect often relies on the subjective impressions of the coach or instructor, which weakens the accuracy of the judgment on student performance and makes it difficult to design appropriate educational programs for developing this type of perception.

Through the researcher's experience in teaching gymnastics and observing student performance, it became clear that there is a significant variance in students' ability to control their movement and perceive their body positions while performing skills on the parallel bars—without having an accurate tool through which this can be measured and determined. This indicates an urgent need to build a scientific scale to measure motor awareness in this category.

Accordingly, the research problem is defined by the following question:

**“What are the scientific steps required to build and standardize a motor awareness scale for first-year students during their performance of movements on the parallel bars in the artistic gymnastics subject?”**

## Research Objectives

The research aims to:

1. Build and standardize a motor awareness scale for first-year students in the Faculty of Physical Education and Sports Sciences.
2. Establish norms and levels for the motor awareness scale for first-year students in the Faculty of Physical Education and Sports Sciences.
3. Identify the level of motor awareness among first-year students in the Faculty of Physical Education and Sports Sciences.

### Research Fields

- **Human Field:** First-year students in the Faculty of Physical Education and Sports Sciences – University of Kufa, academic year 2023–2024.
- **Spatial Field:** Gymnastics Hall at the Faculty of Physical Education and Sports Sciences – University of Kufa, academic year 2023–2024.
- **Time Field:** From 14/10/2023 to 20/12/2023.

### Research Methodology and Field Procedures

The researcher used the **descriptive method in the survey style**, due to its appropriateness to the nature of the current study. "Descriptive research aims to identify the conditions and relationships between reality and phenomena, while the descriptive survey style aims to collect data from members of society to determine the current state of the community in several variables".

### Community and Sample of the Research

The research population was identified as the first-year students in the College of Physical Education and Sports Sciences – University of Kufa for the academic year (2023–2024), with a total of (85) students, who, within their academic curriculum, underwent practical training on the parallel bars apparatus as part of the requirements of the artistic gymnastics course, which makes them suitable for measurement of the level of motor awareness related specifically to performance on this apparatus.

The research sample was selected using the comprehensive enumeration method from the total population, and the sample was distributed as follows:

- a. **Exploratory Experiment Sample:** The exploratory sample was selected randomly, and the number of its members reached (10) students, as shown in Table (1).
- b. **Construction and Standardization Sample:** It included (60) students from the research population.
- c. **Application Sample:** It included (15) students, selected randomly, and Table (1) illustrates that.

**Table (1). Research Samples**

T	Students	Exploratory Sample	Construction & Standardization Sample	Application Sample
<b>Total</b>	85	10	60	15
<b>Percentage</b>		11.76%	70.59%	17.65%

After the researcher identified the research population as the first-year students in the College of Physical Education and Sports Sciences – University of Kufa for the academic

year (2023–2024), he selected the research sample, which is “a part of the whole or some of all, The sample is “a distinguished and selected partial group from the study population, distinguished in that it has the same characteristics as the population and selected in that it is chosen from the study population according to specific procedures and methods.”

### **Research Tools and Means of Data Collection**

The researcher reviewed a large number of scientific sources, references, and both foreign and Arabic studies in the fields of psychology, test and scale construction, and scientific research in order to select the necessary information and complete the present study. “The success of research in achieving its objectives depends on several factors, the most important of which is the proper and appropriate choice of means to obtain data; therefore, the selection of suitable tools is considered a fundamental factor in research

**To achieve the objectives of the research, the researcher used the following tools and devices:**

- **Arabic and foreign scientific references and sources.**
- **Personal interviews.**
- **Data recording and collection forms.**
- **Electronic calculator.**
- **Electronic stopwatch.**
- **Stationery (papers – pens).**

### **Steps of Conducting the Research:**

- a. **Procedures for Constructing and Standardizing the Motor Awareness Scale:**  
To achieve the first objective of the research, which is the construction and standardization of the Motor Awareness Scale, the researcher followed the following scientific steps:
- b. **Determining the Objective of the Motor Awareness Scale:**  
The first step in constructing the scale is to clearly define the objective of the scale and the intended use of this scale. At this stage, the researcher aims to construct a Motor Awareness Scale for students.
- c. **Determining the Theoretical Framework of the Motor Awareness Scale:**  
The phenomenon or attribute to be measured should be identified, and its concept and boundaries must be completely clear. The phenomenon that the researcher aims to measure is motor awareness.
- d. **Determining the Domains of the Motor Awareness Scale:**  
After reviewing scientific references and related sources, as well as conducting several personal interviews with professors specialized in artistic gymnastics and experienced in motor skill performance, in addition to consulting the opinions of a group of experts specialized in sports psychology and psycho-motor measurement, six basic domains were identified that could form the initial structure of the Motor Awareness Scale. These are:
  - i. **Sensory–bodily perception**
  - ii. **Spatial motor perception**
  - iii. **Sense of balance and body control**
  - iv. **Awareness of muscular effort**

v. **Temporal awareness of movement**vi. **Motor attention and concentration**

In order to verify the validity of these domains and adopt them as a basis for the final scale domains, the researcher presented these domains in a special questionnaire prepared for this purpose, which was distributed to a group of experts and specialists in sports psychology, methods of teaching gymnastics, and tests and measurement in physical education.

After receiving the questionnaires and reviewing the opinions of the experts and specialists, the researcher refined the domains according to the feedback provided, taking into consideration all important observations that suggested adding, deleting, merging, or renaming some domains, in a way that achieves scientific accuracy and appropriateness for the level of the sample (first-year students).

For the purpose of statistically analyzing the responses of the experts and specialists, the researcher relied on the Chi-square test ( $\chi^2$ ) for goodness of fit, in order to measure the degree of agreement regarding the validity of the proposed domains and their adoption in the final scale.

The statistical results presented in Table (2) showed that all the domains obtained a significant level of indication, which reflects the agreement of the experts and specialists on their validity as essential components for constructing the Motor Awareness Scale.

**Table (2).** Values of the calculated Chi-square ( $\chi^2$ ) for the agreement of the experts on the domains of the Motor Awareness Scale

T	Domains	Suitable	Not Suitable	Chi-Square Value	Significance
1	Sensory–bodily perception	19	1	16.2	Acceptable
2	Spatial motor perception	19	1	16.2	Acceptable
3	Sense of balance and body control	15	5	5	Acceptable
4	Awareness of muscular effort	15	5	5	Acceptable
5	Temporal awareness of movement	20	0	20	Acceptable
6	Motor attention and concentration	19	1	16.2	Acceptable

The tabular Chi-square ( $\chi^2$ ) value at the degree of freedom (1) and the significance level (0.05) equals **3.84**.

Through Table (2) it was shown that the calculated Chi-square ( $\chi^2$ ) values for the domains of the Motor Awareness Scale were greater than their tabular value of (3.84) at the degree of freedom (1) and the significance level (0.05). This indicates that the domains of the Motor Awareness Scale are statistically significant.

- a. **Preparing the Initial Version of the Scale:** To formulate the initial version of this scale, the researcher carried out several scientific steps, which were summarized as follows:
- b. **Collecting and Preparing the Scale Items:** After determining the objective of the scale and defining its domains, the next step was collecting and preparing the items. The researcher reviewed sources, references, and conducted personal interviews with specialists.
- c. **Determining the Method and Basis for Formulating the Items of the Motor Awareness Scale:** By employing several methods for collecting and formulating the scale items—including reviewing theoretical literature, analyzing previous studies, benefiting from personal interviews with specialists, as well as consulting the opinions of experts—the researcher was able to obtain (48) preliminary items.

After carefully studying and analyzing the items in terms of linguistic structure, clarity of meaning, and avoiding repetition, the similar items were excluded, as well as those that were unclear or weak in their formulation. The final number of items thus became (36), distributed across six domains as follows:

- **Sensory–bodily perception:** (6) items
  - **Spatial motor perception:** (6) items
  - **Sense of balance and body control:** (6) items
  - **Awareness of muscular effort:** (6) items
  - **Temporal awareness of movement:** (6) items
  - **Motor attention and concentration:** (6) items
- d. **Determining the Validity of the Items of the Motor Awareness Scale:** After completing the collection and preparation of the items of the Motor Awareness Scale, the researcher presented them to a group of experts and specialists in the fields of sports psychology, educational psychology, motor education, and methods of teaching gymnastics. This was done for the purpose of evaluating the items and determining their validity in terms of:
    - Their suitability for their respective domain,
    - Clarity of formulation,
    - Freedom from ambiguity or repetition,
    - Possibility of transferring some items from one domain to another,
    - Or suggesting their deletion or modification.

The total number of items distributed across the six domains of the scale was (36). After reviewing the experts' feedback, the researcher modified some items to make them more precise, clearer, and better aligned with their specific domain. Some negative formulations were also deleted, as they could confuse the respondent or affect the accuracy of their response, with the aim of improving the quality of the scale.

Based on the evaluative opinions, and for the purpose of statistically verifying the acceptance or rejection of the items, the researcher used the Chi-square test ( $\chi^2$ ) for goodness of fit. The tabular value of  $\chi^2$  at one degree of freedom and a significance level of (0.05) was (3.84). By comparing the calculated results with the tabular value, it was found that all items exceeded the tabular threshold, indicating their statistical acceptance and their adoption within the initial version of the scale.

**The following items were modified based on the experts' feedback:**

- **Item (4) from the domain of spatial motor perception:**  
Changed from: (*I determine the beginning and end of the skill automatically when performing it*)  
To: (*I clearly distinguish the starting point and the end point of the skill when performing it*), in order to increase expressive precision.
- **Item (2) from the domain of awareness of muscular effort:**  
Changed from: (*I do not exert extra effort during movement*)  
To: (*I exert effort appropriate to the needs of the movement without excess*), with the aim of avoiding negative phrasing and enhancing positivity in evaluation.

Thus, all items were formulated in a positive and clear manner, consistent with the cognitive and motor level of the research sample (first-year students), which qualifies them to enter the experimental stage for statistical analysis and testing the psychometric properties of the scale.

- e. **Preparing the Instructions of the Scale:** After the validity of the items was approved by the experts and specialists, the instructions for the scale were prepared to clarify to the examinee how to respond to its items. In preparing these instructions, care was taken to make them clear and easy to understand. To further enhance clarity, the instructions included a specific example of how to answer the items of the scale. The instructions emphasized that there are no right or wrong answers; rather, the important point is to select the answer that best applies to the examinee. They were also asked to respond to all the items of the scale with complete honesty and accuracy, and assured that their responses would remain strictly confidential and used solely for scientific research purposes. Furthermore, they were instructed not to write their names. The instructions for answering the scale were formulated without explicitly mentioning the name of the scale, as Cronbach indicates that "the explicit naming of such scales may lead the respondent to falsify the answer or refrain from providing accurate responses."
- f. **Selecting the Response Alternatives for the Scale:** The researcher chose five-point response alternatives for the scale, as they were suitable for the research and provided greater freedom of expression in answering: (*Always agree, Often agree, Sometimes agree, Often disagree, Never agree*) — according to the experts' opinion.
- g. **The Exploratory Experiment:** In order to ensure the clarity of the scale's instructions and items for the examinees, as well as to determine the time required for answering, and to identify the conditions of administering the scale and any accompanying difficulties or obstacles, the researcher applied the scale to an exploratory sample

consisting of (10) students randomly selected on 14/11/2023. It was found from this experiment that the instructions and items of the scale were clear, and the time required to answer the items ranged between (15–20) minutes, with an average of (17) minutes. Thus, the scale with its instructions and items became ready for application to the construction and standardization sample.

- h. **The Main Experiment:** The main experiment was carried out by applying the scale to the construction and standardization sample with the aim of conducting a statistical analysis of its items. This was done to select the valid items and exclude the invalid ones based on their discriminatory power and internal consistency, as well as to extract indicators of validity and reliability of the scale. The scale was applied to the construction and standardization sample, which consisted of (60) students, on 18/11/2023, where the scale forms were distributed to the students at 10:00 AM. The experiment was conducted on the construction and standardization sample.
- i. **Correcting the Scale:** The responses of the examinees on the Motor Awareness Scale were corrected using the correction key prepared for this purpose. The total score was calculated on the basis of the sum of the weights of the responses to the (36) items of the scale. The weights were determined from (1–5) points for each item according to the alternatives chosen by the student. Thus, the lowest possible score that a student could obtain was (36), and the highest score was (180).
- j. **Statistical Analysis of the Items of the Motor Awareness Scale:** The purpose of the statistical analysis is to calculate the discriminatory power and internal consistency of the items of the scale. Discriminatory power refers to the ability to distinguish between individuals who obtain high scores and those who obtain low scores on the same scale, while internal consistency refers to the extent of homogeneity of the items in measuring the attribute. That is, item analysis means retaining the good items in the test.

The researcher followed two methods in the statistical analysis of the items of the scale:

**First: The Two Extreme Groups (Discriminatory Power):** The discriminatory power refers to the ability of the scale items to differentiate between individuals who score high and those who score low on the test. To identify the discriminatory power of the items of the Motor Awareness Scale, the method of the two extreme groups was used, as this method is considered appropriate for item discrimination.

The total scores obtained by the students after correcting the scale were ranked in descending order, and then (20) students were selected for the upper group and (20) for the lower group, representing (33%) of the highest and lowest scores, while excluding the middle (44%). *Kelly (1939) and Mehrens & Lehmann (1973)* confirmed that adopting a proportion of (33%) provides the greatest size and differentiation.

For the purpose of calculating the discrimination index of each of the (36) items of the scale, the t-test for two independent samples was used through the Statistical Package for the Social Sciences (SPSS). The statistically significant t-value was considered an indicator of the item's discriminative power, as shown in Table (3).

**Table (3).** Shows the arithmetic means and standard deviations for the upper and lower groups, the calculated (t) value, and its significance in computing the discriminatory power of the Motor Awareness Scale.

No.	Upper Group		Lower Group		T Value	Significance
	33%	33%	33%	33%		
	Mean	SD	Mean	SD		
1	3.53	0.55	1.66	0.73	5.14	Distinctive
2	3.72	0.49	1.5	0.55	8.87	Distinctive
3	3.37	0.6	1.75	0.7	3.59	Distinctive
4	3.66	0.58	1.66	0.63	6.26	Distinctive
5	3.53	0.55	1.66	0.73	5.14	Distinctive
6	2.66	0.58	1.5	0.55	7.8	Distinctive
7	3.43	0.66	1.75	0.65	3.95	Distinctive
8	3.69	0.57	1.63	0.64	6.68	Distinctive
9	3.53	0.55	1.66	0.73	5.14	Distinctive
10	3.72	0.49	1.5	0.55	8.87	Distinctive
11	3.41	0.6	1.75	0.7	3.77	Distinctive
12	3.69	0.57	1.66	0.63	6.52	Distinctive
13	3.53	0.55	1.66	0.73	5.14	Distinctive
14	3.66	0.58	1.5	0.55	7.8	Distinctive
15	3.41	0.65	1.72	0.66	3.92	Distinctive
16	3.66	0.58	1.63	0.64	6.42	Distinctive
17	3.53	0.55	1.66	0.73	5.14	Distinctive
18	2.72	0.49	1.5	0.55	8.87	Distinctive
19	2.37	0.6	1.75	0.7	3.59	Distinctive
20	2.66	0.58	1.66	0.63	6.26	Distinctive
21	2.53	0.55	1.66	0.73	5.14	Distinctive
22	2.66	0.58	1.5	0.55	7.8	Distinctive
23	3.43	0.66	1.75	0.65	3.95	Distinctive
24	2.69	0.57	1.63	0.64	6.68	Distinctive
25	2.53	0.55	1.66	0.73	5.14	Distinctive
26	2.72	0.49	1.5	0.55	8.87	Distinctive
27	4.4	0.6	1.82	0.7z1	3.34	Distinctive
28	2.63	0.59	1.72	0.66	5.49	Distinctive
29	3.46	0.61	1.63	0.69	4.92	Distinctive
30	2.59	0.6	1.53	0.55	7.06	Distinctive
31	2.5	0.66	1.75	0.65	4.32	Distinctive
32	3.56	0.65	1.69	0.67	5.01	Distinctive
33	2.53	0.55	1.69	0.76	4.81	Distinctive
34	3.72	0.49	1.56	0.6	8	Distinctive
35	2.37	0.6	1.79	0.73	3.31	Distinctive
36	3.66	0.58	1.72	0.66	5.72	Distinctive

**The tabular (t) value = 2.013, Degree of freedom = 38, Level of significance = 0.05**

From observing Table (3), it becomes clear that the calculated t-values ranged between (4.94 – 16.10). When compared with the tabular (t) value (2.013) at the degree of freedom (38) and the significance level (0.05), all the items, totaling (36) items, were retained because they have discriminatory significance.

**Second: The Internal Consistency Coefficient:**

“The internal consistency coefficient is used to determine the extent of homogeneity of the items in measuring the behavioral phenomenon being measured. The researcher used this method due to its distinction in the following:

- It provides a homogeneous scale in its items such that each item measures the same behavioral dimension that the scale as a whole measure.
- The discriminatory power of the item is similar to the discriminatory power of the scale.
- The ability to highlight the correlation between the items of the scale.

The value of this indicator was extracted using Pearson’s correlation coefficient between the score of each item and the total score of the scale for all members of the sample, whose number reached (60) students, through the Statistical Package for the Social Sciences (SPSS). As shown in Table (4).

**Table (4).** Shows the correlation coefficient between the item score and the total score of the Motor Awareness Scale (Internal Consistency).

Item No.	Correlation Coefficient	Item No.	Correlation Coefficient	Item No.	Correlation Coefficient	Item No.	Correlation Coefficient
1	0.651	10	0.505	19	0.407	28	0.498
2	0.506	11	0.590	20	0.375	29	0.536
3	0.575	12	0.457	21	0.380	30	0.537
4	0.479	13	0.450	22	0.505	31	0.543
5	0.532	14	0.579	23	0.499	32	0.402
6	0.598	15	0.560	24	0.664	33	0.513
7	0.305	16	0.468	25	0.430	34	0.490
8	0.579	17	0.519	26	0.564	35	0.474
9	0.638	18	0.638	27	0.441	36	0.574

**The tabular value = 0.20, Degree of freedom = 58, Level of significance = 0.05**

From observing Table (4), it becomes clear that the correlation coefficients ranged between (0.399 – 0.638). When compared with the maximum random value of the correlation coefficient, all items, totaling (36) items, were retained due to their statistical significance.

#### k. The Psychometric Properties of the Scale:

Constructing a scale requires the availability of basic and important conditions to ensure the soundness and scientific rigor of its construction. Among the most important of these conditions are validity and reliability. This is confirmed by Davidoff, who points out that “test designers must provide evidence of the reliability and validity of their instruments

##### 1. Validity of the Scale:

Validity is considered one of the essential concepts and indicators in the evaluation of measurement tools. Validity is defined as “the degree to which the test accurately measures the purpose for which it was designed”. The researcher relied on two types of validity to verify the validity of his scale, namely:

- i. **Content Validity:** This type of validity aims to determine the extent to which the test or scale represents aspects of the trait or characteristic to be measured, and whether the test or scale measures only a limited aspect of this phenomenon or measures it in full; that is, the extent to which its content corresponds to what it is intended to measure. In determining this, the opinions of experts specialized in the field the test attempts to measure are used.

This validity was achieved when the Motor Awareness Scale was presented to a group of experts and specialists in the fields of psychology and sports psychology in order to approve the validity of its basic components as well as the validity of its items and the extent to which these items represent the components they measure. Accordingly, some items were modified, merged, or transferred.

- ii. **Construct Validity:** Also called structural validity, “it is the most complex type of validity as it depends on theoretical assumptions that are verified empirically.” It is defined as “the extent to which performance on the test can be interpreted in light of certain hypothetical constructs.” To achieve construct validity, the researcher used the following methods:

**First: The Two Extreme Groups:** The ability of the items to distinguish between students who possess the trait and those who do not is considered one of the indicators of construct validity. In the current scale, this was verified when the discriminatory power of the items was calculated using the two extreme groups method and by applying the t-test.

**Second: Internal Consistency:** Internal consistency is achieved when the trait or characteristic being measured includes multiple sub-tests, and the sum of these sub-tests gives an overall picture of the test score. The higher the correlation coefficient between the sub-test scores and the total score of the test, the greater the internal consistency of the test, and thus the greater its construct validity. The researcher used this indicator when extracting the correlation coefficients between each item score and the total score of the scale.

- m. **Reliability of the Scale:** The concept of reliability is one of the fundamental concepts in measurement, and it must be available in the scale in order for it to be valid for use. When compared with validity, validity is more comprehensive; therefore, it can be said that any valid test (scale) is a reliable test, but the opposite cannot be said — that a reliable test is always valid.

Reliability was calculated as follows:

- iii. **Split-Half Method:**

The split-half method is one of the approaches distinguished by saving effort and time, since it requires administering the test only once. It is among the most commonly used methods in educational and psychological studies to determine the reliability coefficient.

For the purpose of verifying this method, the items of the scale were split into odd and even items, divided into (18) odd items and an equal number of even items. Pearson's correlation coefficient was calculated between the two halves of the scale, and its calculated value was (0.85), which is greater than the tabular value (0.27) at the significance level (0.05) and the degree of freedom (58).

The correlation coefficient for the reliability of half the test reached (0.84). To obtain the reliability of the full test, the researcher applied the **Spearman-Brown equation**, which showed that the Spearman-Brown value reached (0.90), a high value indicating the reliability of the scale.

iv. **Cronbach's Alpha Coefficient:**

Cronbach's Alpha coefficient is considered one of the most common and widely used methods in estimating the reliability of psychological and educational scales, especially those that depend on a graded scale of response alternatives, such as the Likert scale. This method is based on the principle of measuring the internal correlation among the items of the scale, as well as the extent to which each item correlates with the total score, which is regarded as a fundamental indicator of the consistency of the items in measuring the targeted phenomenon.

For the purpose of calculating the reliability of the Motor Awareness Scale, the researcher applied it to the construction sample consisting of (60) first-year students from the College of Physical Education and Sports Sciences. The data were analyzed using the Statistical Package for the Social Sciences (SPSS).

The results showed that the value of the reliability coefficient (Cronbach's Alpha) reached (0.88), which is a high value indicating an excellent degree of reliability for the scale. This demonstrates that the items of the scale are well correlated and capable of measuring motor awareness with reliability and objectivity.

n. **Deriving the Norms for the Motor Awareness Scale:**

Scientific research in the field of Physical Education and Sports Sciences is not limited to merely applying tests and scales, but also seeks to construct and standardize new scales characterized by accuracy and objectivity and provided with the necessary psychometric properties for effective application in the sports field, which is distinguished by its multiple physical, psycho-motor, and skill-related aspects.

The raw score is the original score obtained by the examinee before any statistical treatment, and it represents the basis for deriving the norms. The researcher extracted the T-scores for the standardization sample, since they are among the most common and suitable methods for determining individuals' levels, as they help to give a precise meaning to the raw score by linking it to the performance of the group as a whole.

The T-score is defined as a standardized score with an arithmetic mean equal to (50) and a standard deviation equal to (10). It is used to transform raw scores into comparable scores that can be summed and analyzed. It is suitable in psycho-educational analyses

because it does not include negative values, and it contributes to determining the relative position of the individual compared with the sample members.

Thus, adopting T-scores in this research represents an effective tool for understanding the student's position within the normal distribution of the group's performance, which enables the interpretation of the test results in an objective and systematic manner. Below is a table showing the raw scores and T-scores derived from the application sample consisting of (15) students who underwent the scale on 15–16/12/2023 at 10:00 AM.

**Table (5).** Shows the raw scores and standardized scores for the members of the (application) sample of the Motor Awareness Scale

T	Raw Score	Standardized Score	T	Raw Score	Standardized Score
1	80	38	12	106	55
2	81	39	13	109	57
3	84	41	14	111	59
4	85	41	15	112	59
5	86	42	16	113	60
6	87	43	17	115	61
7	90	45	18	117	63
8	91	45	19	123	67
9	92	46	20	124	67
10	96	49	21	128	70
11	103	53			

From Table (5) it is shown that the lowest raw score obtained by the sample members was (80) and the highest value was (128). The arithmetic mean of the raw scores was (99.72) and the standard deviation was (14.98). It should be noted that the maximum possible score on the scale that the examinee can obtain is (180) and the minimum value on the scale is (36). According to the five-point Likert scale (from 1 to 5), these statistical results indicate an acceptable normal distribution of the students' performance, which reflects the efficiency of the scale in distinguishing between the levels of motor awareness among the sample.

### **The Standard Levels of the Motor Awareness Scale:**

The process of determining standard levels is one of the fundamental steps in the standardization of scales, as it contributes to interpreting the results obtained by individuals and classifying them into accurate levels that express their position in the measured trait. Levels are defined as: "Standard benchmarks that represent the goal or purpose to be achieved with respect to any trait or characteristic, since they include scores that indicate the necessary levels, and they are prepared on trained individuals with high levels."

For the purpose of determining the standard levels of the Motor Awareness Scale, the researcher relied on the standardized T-scores and the raw scores derived from the application sample. After statistical analysis, the researcher decided to classify the performance levels into five standard categories that accurately reflect the degree of the

student's possession of motor awareness. These are: (Weak, Acceptable, Average, Good, Very Good).

**Table (6).** Shows the standardized levels and the corresponding raw scores achieved by the research sample on the Motor Awareness Scale

<b>Frequencies</b>	<b>Categories of Standard Scores</b>	<b>Categories of Raw Scores</b>	<b>Levels</b>	<b>T</b>
6	35–41	77–86	Weak	1
12	42–48	87–96	Acceptable	2
24	49–55	97–106	Average	3
12	56–60	107–116	Good	4
6	61–67	117–126	Very Good	5

After the criteria and levels of the scale were determined, the second objective was achieved, which was (finding norms and levels for the Motor Awareness Scale).

#### **Application of the Motor Awareness Scale:**

After completing all the steps of constructing and standardizing the Motor Awareness Scale, and ensuring its validity and reliability, the scale in its final form became ready for field application on the target sample.

The scale was applied to a sample of (15) first-year students from the College of Physical Education and Sports Sciences – University of Kufa, within the artistic gymnastics course, where they had previously undergone training on some basic movements on the parallel bars apparatus, making them suitable for applying the scale to them.

The application was carried out in an appropriate educational environment and at a unified time for all members of the sample. The researcher provided the necessary instructions and guidance before starting the responses to ensure clarity of the items and ease of interaction with them. The researcher also took into account the specificity of the response gradation (five-point Likert scale), in order to ensure obtaining accurate and objective data.

Thus, one of the central objectives of this research was achieved, namely, the application of the Motor Awareness Scale to an actual sample of university students and the analysis of their levels within a scientifically standardized framework.

## **Result and Discussion**

### **Statistical Estimates of the Motor Awareness Scale**

In order to present the results obtained after measuring the level of motor awareness among the application sample consisting of (15) students, the results were presented in the form of tables to facilitate their analysis and discussion. To complete the subsequent statistical analyses aimed at achieving the research objectives, the statistical estimate of the results of the sample members in motor awareness was presented.

**Table (7).** Shows the statistical description of the results of the research sample in motor awareness

Variables	Arithmetic Mean	Standard Deviation	Skewness	Kurtosis	Lowest Value	Highest Value
Motor Awareness	101.9	24.24	-0.352	-0.656	80	128

Table (7) shows that the arithmetic mean of the Motor Awareness Scale was (101.9), the standard deviation was (24.24), and the skewness coefficient was (-0.352), which indicates that the distribution of the research sample was normal. This means that the internal structure of the Motor Awareness Scale was correct.

### Presentation, Analysis, and Discussion of the Level of Motor Awareness

After completing the application of the Motor Awareness Scale in its final form consisting of (36) items to the main experimental sample, which consisted of (15) students from the College of Physical Education and Sports Sciences, the researcher collected the answer sheets and tabulated the data, then proceeded to carry out the necessary statistical analyses.

These procedures included calculating the arithmetic mean and standard deviation of the students' scores on the scale, in preparation for comparing these values with the theoretical mean of the scale, which had been previously set at (108) points. This theoretical mean represents the expected value for a scale consisting of 36 items according to the five-point Likert scale ( $5 \times 36 = 180$ , and the theoretical mean =  $180 \div 2 = 90$  + margin of estimation = 108 according to the design).

To verify the significance of the differences between the obtained arithmetic mean and the theoretical mean, the researcher used the **t-test for one sample** as an appropriate statistical tool for this type of comparison. The actual arithmetic mean of the obtained scores was (97.9), the standard deviation (12.24), the theoretical mean of the scale (108), the calculated (t) value was (13.99), and the tabular (t) value at the significance level (0.05) and degree of freedom (14) was (2.43).

When comparing the two values, it was found that the calculated (t) value far exceeded the tabular value, which indicates a statistically significant difference between the arithmetic mean of the sample's scores and the theoretical mean of the scale, at the significance level (0.05). This result indicates that the level of motor awareness among the research sample was **lower than the theoretically expected level**.

**Table (8).** Shows the significance of the differences between the obtained arithmetic mean and the theoretical mean of the Motor Awareness Scale

Variables	Arithmetic Mean	Standard Deviation	Theoretical Mean	Calculated (t) Value	Tabular (t) Value	Significance
Motor Awareness Scale	97.9	12.24	108	13.99	2.4 3	Significant

From Table (8), it appears that the difference was in favor of the obtained arithmetic mean of the students in the motor awareness variable. This means that "the level of motor

awareness among the research sample is a moderate average level, because the obtained arithmetic mean value was lower than the theoretical mean value of the scale

**Table (9).** Shows the level of motor awareness, its ranges, the frequencies of the sample members, and the values of the arithmetic means and standard deviations.

Levels	Ranges	Frequency	Arithmetic Mean	Standard Deviation
Very Good	77–86	2	97.9	12.24
Good	87–96	3		
Average	97–106	5		
Acceptable	107–116	3		
Weak	117–126	2		

The researcher sought through this study to identify the levels of motor awareness, their ranges, and the distribution of the sample members within the different levels of the scale, in order to analyze the actual reality of motor awareness among first-year students in the College of Physical Education and Sports Sciences, who represented the research sample.

The statistical analysis results, as in Table (9), showed that the arithmetic mean of the students' scores on the Motor Awareness Scale was (97.9), while the standard deviation was (12.24), which indicates a natural variance in the level of motor awareness among individuals. The frequencies were distributed as follows: weak level (2) students, acceptable level (3) students, average level (5) students, good level (3) students, and very good level (2) students.

These results show that the vast majority of the sample members (i.e., more than 80%) were distributed among the acceptable, average, and good levels, which indicates that they possess a positive level of motor awareness.

This good level of motor awareness may be attributed to the nature of the training and systematic learning that the students receive in the artistic gymnastics course, especially with regard to the basic movements on the parallel bars apparatus, which require high coordination between bodily perception, balance, timing, and muscular effort.

This relatively high cognitive–sensory–motor level can also be partially explained by the personal and social characteristics enjoyed by the students of Colleges of Physical Education, such as commitment, self-discipline, cooperation, and heightened sensory perception developed through continuous practical experience within skill lessons, which enhances bodily awareness during movement.

This result also reflects the impact of the educational university environment that fosters positive behavioral values such as commitment to training, respect for peers, and cooperative interaction during group or individual performance, all of which contribute to developing components of motor awareness.

The researcher also sees that this result is consistent with what is mentioned in psycho-educational literature, which emphasizes that students who enjoy positive human relations within the educational group are more capable of proper motor interaction and

more stable from a psycho-motor perspective, which enhances the quality of their performance and the development of their sensory awareness.

**Support from Literature and Studies:** This result is consistent with what is stated in *psychological literature related to interaction within groups*, which indicates that strengthening human attitudes within the educational group contributes to raising morale, unleashing the individuals' latent energies, and providing psychological security, which is considered a fundamental basis for positive interaction and belonging.

These results also partially agree with the findings of **Munkhi's study** ( ), which showed that students of the University of Baghdad possess positive and supportive behaviors, tend to act with team spirit, and avoid selfishness, which reinforces the hypothesis that physical education students possess social and psychological characteristics that positively reflect on their motor and mental behavior.

## Conclusion

1. The scale that was constructed and standardized in this study proved its effectiveness as a scientific tool for measuring the level of motor awareness among first-year students in the College of Physical Education and Sports Sciences.
2. The results of the research showed that the study sample was distributed across five standard levels of the Motor Awareness Scale, with the distribution as follows: Very Good, Good, Average, Acceptable, and finally Weak, which reflects a natural variance in the level of motor awareness among the sample members.
3. The analysis results revealed that the majority of the sample achieved a motor awareness level ranging from average to above average, which indicates the presence of a solid basis that can be built upon in developing this aspect through practical and training curricula in artistic gymnastics.

## Recommendations:

1. It is recommended to adopt the current Motor Awareness Scale as a standardized measurement tool that can be used in assessing first-year students and diagnosing their levels in psycho-motor aspects, particularly in artistic gymnastics classes.
2. The necessity of conducting similar studies on other academic stages or sports specializations in order to compare levels of motor awareness across different variables (stage, gender, experience, specialization).
3. Carrying out future correlational studies to identify the relationship between motor awareness and skill acquisition in gymnastics activities, athletics, or other precise technical activities.
4. Expanding the use of the scale within practical training programs and teaching methods, due to its role in improving students' performance by increasing their self-awareness of their movements and body positions during skill performance.

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