



# Cerebral Control and its Relationship to Skillful Performance among.

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## Abstract:

*This study aimed to identify the relationship between cerebral control and its relationship to skillful performance among basketball course students in the Department of Physical Education at Al al-Bayt University. The researchers employed the descriptive approach to align with the study's characteristics in order to attain their objective. In order to gather data, the researchers employed Diane's cerebral control scale (Diane, 2005) which was translated by Qaddumi (2010) and comprised of 21 questions designed to evaluate basketball skills. The study was conducted among 50 male and female students who were enrolled in the basketball course during the academic year 2021-2022. According to the study's findings, the integrative pattern was the most common cerebral control pattern among the basketball course students in the Department of Physical Education at Al al-Bayt University, with a percentage of 83.9%. This was followed by the left pattern at 10.7% and the right pattern at 5.4%. Additionally, the study identified a statistically significant relationship between the cerebral control pattern and skillful performance at a significance level of ( $\alpha \leq 0.05$ ). The researchers suggested that there is a need to focus on selecting basketball players and enhancing their skills by incorporating mental abilities and integrative cerebral control into their development plans during training programs.*

**Keywords:** (Cerebral Control, Skillful Performance, Basketball Course, Physical Education)

## Introduction:

The abundance of research on the nervous system, especially cerebral control research, is a critical topic that has influenced the overlap and integration of various scientific disciplines. This has recently gained attention from educators as an individual's behavior and life orientation are influenced by the type of cognitive preferences they use in different aspects of their lives, which are linked to their thinking and learning approaches [3].

The neurological perspective has emerged as a crucial factor in interpreting cognitive behavior, which has been relied upon by many scholars in the fields of education, psychology, curriculum development, and teaching methodologies. These disciplines are interrelated because they deal with the human being whose life is governed by the nervous system [4].

Yagbasan [5] highlighted that the brain is the primary center responsible for learning and all other psychological functions in the body. The brain is divided into two halves: the left hemisphere and the right hemisphere. Each hemisphere is responsible for a unique set of mental, cognitive, and physical functions. Although they have different roles, these hemispheres are interconnected during the processing of mental tasks. The brain carries out tasks as an integrated whole, and various parts of the brain work together to facilitate effective learning. Hence, teachers should engage both hemispheres in diverse learning activities to enhance the learning process.

Jensen [6] pointed out that the study of cerebral control in individuals is among the most critical trends in recent times. An individual's success and excellence in life are dependent on the cognitive preferences they use in different aspects of their lives, which are influenced by the circumstances they face, requiring them to find a path and ways to solve them, such as adapting their learning style.

The left hemisphere of the brain is commonly used by individuals to process information. Springer and Deutsch [7] categorized cerebral control into three patterns. The first pattern is the right cerebral control pattern, where an individual tends to use the right hemisphere of their brain in information processing. This individual is primarily interested in emotional responses, mental imagery, art, and music, and is inclined towards comprehending universals, thinking holistically, and being more creative in problem-solving. They tend not to focus on details and primarily use their left hand for motor activities. The second pattern is the left cerebral control, where the individual is predominantly interested in analytical and logical skills, mathematical operations, and tends to use their motor skills more effectively. They are often non-emotional towards human relations and care about details and particles, making it difficult for them to form a comprehensive picture of events and problems they face. They primarily use their right hand for motor skills. The third pattern is complete cerebral control, where an individual tends to use the functions of both hemispheres of their brain in a balanced manner to process information, using the distinct thinking and

learning methods of both hemispheres according to different situations. They are likely to use both hands for motor skills.

Herman [8] suggests that individuals who learn and train using methods that match their dominant cerebral control pattern tend to achieve better results in the learning and teaching process. Similarly, Kamel and Al-Safi [9] note that individuals tend to have a preference for using one hemisphere of the brain more than the other when processing information. As a result, educators are interested in understanding students' preferred learning and thinking styles, as well as the functions performed by the two hemispheres of the brain.

Skillful performance is an essential aspect of achieving success in any sport as it plays a vital role in the process of mastery and the way a player performs. According to Al-Fateh and Al-Sayed [10], skillful performance can be defined as a unique system of movements that are performed simultaneously, in succession, and in response to internal and external forces affecting the athlete. The skillful performance system helps the player to exploit these forces effectively to achieve the best sports results, and it is an indication of the level of players and their mastery of the game's skills. It is also considered the ideal image for technical performance and an effective way to execute a specific movement task.

Basketball is a sport that requires a combination of physical and mental abilities to perform well. It involves technical skills such as dribbling, shooting, and passing, as well as strategic and tactical decisions in team play. To improve the level of the game, it is important to address any problems or obstacles that may hinder the development of these skills and abilities in players [11].

#### **The study Problem:**

It is important for teachers to pay attention to all factors in the educational process in order to develop and achieve high levels of skillful performance. However, according to the researchers, there is a lack of interest in employing research on the nervous system and its connection to learning basic basketball skills. Additionally, there is a lack of attention to understanding students' thinking patterns, whether they are right-brained, left-brained, or integrative, which can help players master skills and improve their performance.

Different students may have different thinking patterns and cerebral control, with some being more logical and verbal and having better problem-solving skills, while others may struggle with planning and comprehension. These differences can affect how students learn and acquire skills, and teachers should take them into consideration when designing their teaching strategies. This suggests that different students may have different preferred learning styles or modalities, and teachers should consider this when designing and delivering their lessons. For example, some students may learn better through visual aids, while others may prefer hands-on activities or verbal explanations. By identifying and catering to these individual differences,

teachers can help their students better understand and retain the information being taught.

Due to the scarcity of research on the connection between cerebral control and skillful performance in basketball, the researchers opted to investigate this relationship among students enrolled in the basketball course.

#### **Importance and Objectives of the Study**

The study focuses on the importance of examining cerebral control patterns among students who are enrolled in the basketball course at Al al-Bayt University's Department of Physical Education. Its primary objectives are to understand the significance of cerebral control and its potential application in sports. The study aims to collect crucial information about cerebral control patterns among students, which can offer valuable insights to teachers and trainers regarding dominant thinking patterns in basketball.

By analyzing cerebral control patterns, the study intends to provide meaningful feedback that can facilitate adjustments in game plans, teaching methods, and training techniques. These adjustments aim to optimize the utilization of latent brain energies for integrated cerebral control. Ultimately, the study strives to achieve optimal results at both the physical and skill levels by harnessing the contribution of cerebral control in basketball.

The study also seeks to investigate the following research questions:

-What is the prevalent pattern of cerebral control among students enrolled in the basketball course at the Department of Physical Education, Al al-Bayt University? Specifically, is it predominantly left, right, or complementary?

-Is there a statistically significant correlation, at a significance level of  $\alpha=0.05$ , between cerebral control patterns and the level of skillful performance displayed by students in the basketball course at the Department of Physical Education, Al al-Bayt University?

#### **Previous Studies:**

- Saadeh [12] conducted a study exploring the correlation between cerebral control and physical and coordination abilities in young soccer players and runners. The findings indicated a clear association between integrative cerebral control patterns and sprint speed, as well as other harmonious abilities in both soccer players and runners. These results suggested that selecting players based on their integrative cerebral control and implementing training programs to enhance these abilities could be beneficial.
- Similarly, Shaalan [13] conducted a study focused on identifying the thinking patterns of boxers at different levels of achievement. The study revealed that the integrative thinking pattern in cerebral control was dominant among boxers, particularly in the semi-final and final rounds.
- Al-Tirawi et al. [14] investigated the dominant brain control and problem-solving strategy among students of the specialized security diploma. The study

identified the integrative pattern as the dominant control pattern among the security diploma students. The researchers recommended developing training programs based on brain control and problem-solving strategies.

- Supporting this recommendation, a study by Whitman et al. [15] in the United States explored the cooperation between the two hemispheres of the brain during creative activities. The results indicated that individuals with high scores in creative thinking exhibited a higher level of cooperation between the two hemispheres, supporting the model of cooperation in creative thinking.
- Al-Qaddoumi [2] conducted a study to identify the prevalent pattern of cerebral control among soccer players in Palestine. The study revealed that the integrative pattern was the dominant cerebral control pattern among soccer players, followed by the left and right patterns.
- Lindell [16] conducted a study analyzing physiological and psychological studies to understand the role of brain hemispheres in the creative process. The results emphasized the importance of interaction between the brain's hemispheres in creativity.
- Mansour [17] focused on the relationship between brain control and the performance level of ballet dancers. The study revealed a preference for performing the bar phrase using the left side of the brain, suggesting the importance of considering cerebral control when selecting dancers for specialization.
- Azril [18] investigated the relationship between brain control and positivity levels among volleyball players. The study found that the complementary pattern was the dominant brain control pattern among Palestinian volleyball players.
- Al-Quraan and Al-Hamouri [19] aimed to identify brain dominance patterns among high-achieving and ordinary students. The study indicated a significant difference in the use of the integrated style between outstanding and ordinary students, favoring the outstanding students.
- Abdul-Haq and Al-Ajli [20] focused on identifying cerebral control patterns and their relationship to creative thinking among university students in Jordan. The study revealed that the left hemisphere dominated among the university students, followed by the integrated and right patterns.
- Al-Mohammadi [21] investigated the patterns of brain control and their relationship with learning styles and academic levels among female university students. The results showed statistically significant differences in learning styles based on the pattern of brain control.
- Al-Qaddoumi [22] conducted a study among Palestinian police officers to identify the level of emotional intelligence and cerebral control. The study found a high level of emotional intelligence and the

prevalence of the integrative pattern of brain control among police officers.

#### **Reviewing the previous studies:**

It becomes evident that they have explored different aspects of cerebral control patterns and their correlations with creativity, performance in sports, academic achievement, emotional intelligence, and learning styles. The studies emphasized the importance of considering cerebral control patterns in training programs and curriculum development in various fields. It is noteworthy that no previous studies have specifically examined the pattern of cerebral control among basketball course students in universities, making the present study unique in its focus.

In conclusion, the studies discussed have shed light on the importance of investigating cerebral control patterns and their relationships with various factors such as performance in sports, creativity, academic achievement, emotional intelligence, and learning styles. The findings consistently highlight the prevalence of the integrative pattern of cerebral control, followed by the left and right patterns in different contexts.

These studies have provided valuable insights into the significance of considering cerebral control patterns in selecting athletes, designing training programs, and developing curricula. The findings suggest that optimizing cerebral control patterns can enhance performance, problem-solving abilities, and cognitive functions across different domains.

Furthermore, the studies emphasize the need for further research and the implementation of training programs that foster integrative cerebral control, as it appears to be associated with positive outcomes in sports, creativity, and academic achievement.

Overall, the understanding of cerebral control patterns has the potential to revolutionize approaches to teaching, training, and skill development by harnessing the power of the brain. By integrating these findings into educational and sports settings, we can enhance individuals' cognitive abilities, optimize learning experiences, and unlock their full potential.

#### **The study limitations:**

The study encountered certain limitations that should be acknowledged. Firstly, it was confined to a specific time frame, focusing solely on the first semester of the academic year 2019/2020. This temporal constraint may have limited the generalizability of the findings to other time periods. Secondly, the study was geographically limited to the basketball court situated in the gymnasium at Al al-Bayt University. The results may not be applicable to students in other basketball courses or institutions, potentially limiting the broader implications of the findings.

Furthermore, the study sample exclusively consisted of students enrolled in the basketball course during the first semester of the academic year 2019/2020 at the Department of Physical Education at Al al-Bayt University. This sample restriction may affect the representativeness of the findings and limit their applicability to a more diverse population.

These limitations highlight the need for future research endeavors to address these constraints and provide a more comprehensive understanding of cerebral control patterns among basketball students. Expanding the study's scope to include multiple semesters, diverse basketball courses, and a broader range of educational institutions would enhance the generalizability and robustness of the findings.

**Study Methodology:**

The researchers chose to utilize the descriptive survey method due to its suitability for the nature of the study. The

target population for the research consisted of both male and female students enrolled in the basketball course during the first semester of the academic year 2019/2020, totaling 63 students.

To select a representative sample, the researchers employed the intentional sampling technique. This approach enabled them to carefully choose 50 male and female students from the academic year 2019/2020. For more information regarding the study sample, refer to Table 1, which provides a comprehensive description.

*Table (1)  
means and standard deviations of the mass, height, and age of the study sample individuals n = 50*

Variable	Mean	STD
Height	1.71	0.08
Mass	70.40	3.15
Age	20.20	1.11

Table (1) presents the mean and standard deviation for the height (1.71 meters), mass (70.40 kg), and age (20 years) of both male and female students who participated in the basketball course at the Department of Physical Education in Al al-Bayt University during the first semester of the academic year 2019/2020.

The researchers employed two instruments to collect data for the study. The first instrument was used to measure cerebral control, while the second instrument was utilized to assess basketball dribbling, passing, and shooting skills. For measuring cerebral control, the researchers utilized the Diane scale. This scale consists of 21 questions, each offering two alternatives (A or B) for the respondents to choose from. Each question carries one point, and the highest attainable score on the scale is 21, while the lowest is zero. The score distribution is as follows:

If the respondent selects alternative A for questions numbered 21, 20, 19, 15, 14, 13, 9, 8, 7, 4, 3, 2, 1, they receive a point. Choosing alternative B does not grant any points.

If the respondent selects alternative B for questions numbered 18, 17, 16, 12, 11, 10, 6, 5, they receive a point. Choosing alternative A does not grant any points.

Based on their total score on the scale, the respondents are categorized as follows:

Scores between 0-8 indicate left hemisphere control.

Scores between 9-13 indicate an integrative pattern of dominance.

Scores between 14-21 indicate right hemisphere control.

For further details on the scale, please refer to Appendix No. (1).

**Validity of the cerebral control scale**

To ensure the validity of the scale, the researchers calculated the Pearson correlation coefficient between the questions and the total score. A separate sample of 13 male and female students, not included in the original sample, was used for this purpose. The correlation coefficient was determined to be 0.78, which was found to be statistically

significant at the significance level of  $\alpha \leq 0.05$ . This positive correlation indicates that the scale is a valid tool for measuring its intended construct.

**The reliability of the cerebral control scale:**

To verify the reliability of the scale, a test/retest method was employed on a validity sample consisting of 13 male and female students. The two applications of the scale were administered with a time difference of two weeks. The Pearson correlation coefficient was computed, resulting in a reliability coefficient of 0.89, which indicates that the scale is suitable for the study and exhibits good reliability. Skill Performance Test: For assessing skillful performance in basketball, the researchers explored various sources, practical references, magazines, and periodicals. They discovered multiple test models that measure different skills, including dribbling, the zigzag axial test with direction changes, passing accuracy using chest passes towards the goal, and shooting skills using shooting tests from the bottom of the basket. The researchers selected relevant models and made appropriate modifications to align them with the research sample and the students' abilities. Please refer to Appendix (3) for further details

**Reliability of the Skill Performance Test:**

To evaluate the reliability of the skill performance test variables, the researchers employed the Test-Retest method and calculated the Pearson correlation coefficient. The test was administered twice, with a six-day interval, on a separate exploratory sample of 13 male and female students whose results were not included in the main study. The tests were conducted under identical conditions. Table (2) presents the reliability coefficients of the utilized tests.

**Table (2)**  
**The reliability coefficient for the study variables**

<i>Variables</i>	<i>Reliability coefficient</i>
<i>Dripping (zigzag test by changing direction)</i>	<i>0.75 *</i>
<i>Passing (testing the accuracy of a chest pass toward the goal)</i>	<i>0.79 *</i>
<i>Shooting (Shooting test from the bottom of the basket)</i>	<i>0.77</i>

\*Significant at the  $\alpha$  level  $\geq 0.05$

Table (2) shows that the tests used in the study have reliability values, which are acceptable and appropriate for conducting this study.

#### **Study Tools:**

The following tools were used to conduct the study tests:

- Rotameter devices for measuring length (Detector).
- Medical scale for measuring weight (Weight watchers).
- Stopwatch.
- Whistle.
- Large cones.
- Colorful cones.
- Measuring meter.
- Basketball.
- Basketball court.

#### **Pilot Study:**

A pilot study was conducted from (5/11/2019-15/12/2020) on a sample of (13) male and female students from outside the study sample. This study aimed to:

- Ensuring the efficiency of the assistants in conducting the tests.
- Calculation of scientific transactions for tests in terms of reliability and objectivity.
- Identify the tests' suitability for the sample's nature and the time it takes to complete the tests for each player.
- Know the appropriate rest period and the proper order of conducting the tests so that the results of one test do not affect the next test.

To ensure the smooth implementation of the main study, a pilot study was conducted from November 5, 2019, to December 15, 2020, involving a separate sample of 13 male and female students.

The objectives of the pilot study were aimed at ensuring the Efficiency of the Assistants: One of the key objectives of the pilot study was to assess the efficiency of the assistants responsible for conducting the tests. Their

competence and proficiency in administering the tests accurately were evaluated during this phase. This assessment helped ensure that the assistants were well-prepared and capable of effectively carrying out their roles in the main study. Furthermore calculation of Scientific Transactions: In order to ascertain the reliability and objectivity of the tests, scientific transactions were calculated during the pilot study. This involved analyzing the consistency and accuracy of the test results. By determining the reliability and objectivity, the researchers could evaluate the scientific soundness of the tests and make any necessary adjustments to enhance their validity. Also suitability of Tests for the Sample's Nature: The pilot study aimed to assess the suitability of the chosen tests for the characteristics and abilities of the sample. This evaluation helped determine whether the selected tests effectively measured the desired skills within the specific sample population. Additionally, the pilot study provided insights into the time required for each player to complete the tests accurately, ensuring that the tests were suitable and feasible for the participants. Finally determining Rest Periods and Test Order: Another objective of the pilot study was to identify the appropriate rest periods between tests and establish the proper order for conducting the tests. It was crucial to design a testing protocol that minimized any potential carry-over effects from one test to another. By determining the optimal rest intervals and test sequence, the researchers aimed to ensure the independence and accuracy of each test's results.

The pilot study addressed these objectives, allowing for valuable insights and adjustments to be made prior to the main study. This preparatory phase helped optimize the efficiency, reliability, and suitability of the tests, ultimately contributing to the success and validity of the subsequent research.

**Table (3)**  
**The arithmetic means and standard deviation of the prevailing cerebral control pattern among basketball course students at Al al-Bayt University**

<b>Mean</b>	<b>SD</b>
<i>10.84</i>	<i>3.18</i>

It is clear from Table (3) that the pattern of cerebral dominance prevalent among students of the basketball University course is the integrative pattern according to Dayan's scale of cerebral dominance, where the arithmetic average reached (10.84) degrees.

Frequencies, percentages, and Chi-square (K2) were also extracted, and the results of Table (4) illustrate this.

**Table (4)**

***The frequencies and percentages of the prevalence of cerebral control patterns (left, right, integrative) and chi-square value (Ka2) among students of the basketball course at the Department of Physical Education at Al al-Bayt University***

<i>control pattern</i>	<i>Frequency</i>	<i>Percentage (%)</i>	<i>Chi-square value (ka2)</i>	<i>Sig</i>
<i>Left</i>	<i>6</i>	<i>12.0</i>	<i>53.560</i>	<i>*0.00</i>
<i>Integrative</i>	<i>41</i>	<i>82.0</i>		
<i>Right</i>	<i>3</i>	<i>6.0</i>		
<i>Total</i>	<i>50</i>	<i>100.0</i>		

\*Statistically significant at the significance level ( $\alpha \leq 0.05$ ).

It appears from Table (4) that the integrative pattern of brain control among basketball students in the Department of Physical Education at Al al-Bayt University was the most common, as the percentage reached (82.0%), followed by the left pattern (12.0%). Finally, the right pattern came (6.0%), and there was a statistically significant difference between the three patterns at the significance level ( $\alpha \leq 0.05$ ), as the calculated chi-square value reached (53.560).

The reason behind this phenomenon observed by the researchers is attributed to the specific demands of performance in the field of sports. In this context, efficient coordination between the brain's two hemispheres is essential. The left hemisphere is responsible for encoding and storing information, whereas the right hemisphere translates this information into motor skills. Shamoun [23] supports this idea by noting that the left hemisphere functions as an analyzer, involved in learning new skills, error correction, and providing players with information. On the other hand, the right hemisphere is described as complementary, controlling the execution of skills by implementing them step by step based on the information received from the left hemisphere. Individuals with dominant right brain control tend to take a holistic approach, possessing strong visual communication skills and the ability to analyze and understand relationships between different elements. The right brain is inclined to search for patterns and solve problems by considering the entire picture. Those with right brain dominance often rely on intuition in their beliefs and opinions, as it is one of their primary strategies. It should be noted that both hemispheres of the brain play distinct roles in various functions related

to learning, facilitating the development of cognitive abilities [5]. The left-brain is characterized by sequential thinking, analyzing information, performing logical tasks, and excelling in verbal skills. It adheres to a methodical approach in cognitive tasks, relying less on intuition. In addition to analysis, planning, and problem-solving by breaking down problems into smaller parts and considering the partial picture, sequencing is crucial for individuals who predominantly use the left hemisphere [24]. This aligns with Qaddoumi's [2] findings, which indicate that an integrative pattern of cerebral control prevails among soccer players in Palestine.

To answer the second question, is there a statistically significant relationship at the level ( $\alpha \leq 0.05$ ) between the pattern of cerebral control and the level of skill performance among basketball course students in the Department of Physical Education at Al al-Bayt University? the Pearson Correlation coefficients were extracted between the pattern of cerebral dominance and the level of skill performance among basketball course students at the Department of Physical Education at Al al-Bayt University. Table (5) shows this.

**Table (5)**

***the values of the correlation coefficient between the pattern of cerebral control and the level of skill performance among basketball course students in the Department of Physical Education at Al al-Bayt University***

<i>N</i>	<i>Variable</i>	<i>The value of the Pearson correlation coefficient between the variables and the pattern of cerebral control</i>	<i>Sig</i>
<i>1</i>	<i>Dripping</i>	<i>0.46</i>	<i>0.00</i>
<i>2</i>	<i>Scroll</i>	<i>0.43</i>	<i>0.00</i>
<i>3</i>	<i>Shooting</i>	<i>0.48</i>	<i>0.00</i>

According to the findings presented in Table (5), a statistically significant relationship at a significance level of  $\alpha \leq 0.05$  was observed between the pattern of cerebral control and the level of skill performance among basketball students in the Department of Physical Education at Al al-Bayt University. The correlation coefficients between cerebral control and the level of skillful performance were all statistically significant at this significance level. The researchers attribute this relationship to the fact that learning basketball skills involves the nervous system, necessitating the integrated use of the

brain rather than relying solely on one side. Brain control plays a crucial role in translating motor skills into action and is directly associated with academic and educational achievement in sports. Basketball is a game that requires a range of coordinated abilities, comprehension of complex and demanding situations, and mastery of intricate skills that rely on the high readiness of the central nervous system and neuromuscular coordination. Such tasks necessitate brain control to process information in an integrated manner. This finding aligns with the viewpoint of Al-Obaidat and Abu Smaid [25] that exceptional achievers, innovators, and talented individuals utilize both hemispheres of the brain (integrated) in their endeavors.

#### Conclusion:

Based on the study's findings, the researchers reached the following conclusions regarding basketball course students in the Department of Physical Education at Al al-Bayt University:

Firstly, the prevailing pattern of cerebral dominance among these students corresponds to the integrative pattern, as identified by Dayan's scale of cerebral control.

Secondly, a statistically significant relationship was observed, at a significance level of  $\alpha \leq 0.05$ , between the pattern of cerebral control and the level of skillful performance among the basketball course students in the Department of Physical Education at Al al-Bayt University. In particular, all correlation coefficients demonstrated a connection between brain control and the students' skillful performance levels in the mentioned department.

#### Recommendations:

Based on the study's findings, several recommendations emerge. Firstly, it is advisable to prioritize the development of thinking skills and the creation of educational programs that specifically target the enhancement of integrative brain control. By emphasizing this aspect in training programs, it is believed that the effective utilization of the brain in teaching basketball skills can be achieved. Secondly, it is

recommended to nurture the physical and coordination abilities of young football players and runners in accordance with the integrative and proportional brain control required in their respective sports. Taking a holistic approach to their training and skill development is expected to have a positive impact on their overall performance.

Furthermore, organizing training courses for basketball instructors with a focus on optimizing brain utilization is recommended. These courses should incorporate diverse activities and methods that facilitate effective student engagement and guide them in maximizing their brain's potential during basketball training.

Additionally, it is proposed that follow-up studies be conducted to examine brain control patterns and identify the prevailing pattern within specific sports and individual athletes. Such ongoing research endeavors aim to deepen our understanding of brain control dynamics and its implications across different games.

Overall, these recommendations aim to support the advancement and optimization of brain control in sports training, ultimately enhancing the overall performance and skill acquisition of athletes.

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