

ATTENTION MEASUREMENT IN BASKETBALL: A BRIEF REVIEW

MEDICIÓN DE LA ATENCIÓN EN EL BALONCESTO: UNA BREVE REVISIÓN

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Abstract

Basketball is a team sport that demands the athlete's attention due to the situational demands present during its development. Attention is a mediating factor that, combined with cognition and activation, allows the athlete to achieve maximum performance. However, in the field of sports psychology, evidence on attention measurement is scarce. The present work aims to perform a brief review through an electronic search of the most commonly used instruments for the measurement of attention in basketball players. A total of 768 articles were reviewed in the open-access electronic databases: REDALYC, ProQuest, Scielo, and the ResearchGate network of researchers. Nine publications were relevant to this study, according to the inclusion and exclusion criteria. The results show that the Toulouse-Piéron test is the most widely used instrument to measure attention in basketball. However, it is important to highlight that the Assessment of Declarative Knowledge and Attentional Capacity is presented as the most specific tool to assess attention in this sport, as it focuses on the technique-tactics of basketball players.

Keywords: Sports psychology, psychometric test, training, concentration.

Resumen

El baloncesto es un deporte de conjunto que demanda la atención del deportista debido a las exigencias situacionales presentes durante su desarrollo. La atención es un factor mediador que, combinado con la cognición y la activación, permiten al atleta lograr su máximo rendimiento. No obstante, en el ámbito de la psicología del deporte la evidencia en medición de la atención en el baloncesto es escasa. El objetivo del presente trabajo consiste en realizar una breve revisión a través de una búsqueda electrónica de los instrumentos más utilizados en la medición de la atención en jugadores de baloncesto. Se revisaron un total de 768 artículos en las bases de datos electrónicas de acceso abierto: REDALYC, ProQuest, Scielo y la red de investigadores ResearchGate. Nueve publicaciones fueron relevantes para este estudio de acuerdo con los criterios de inclusión y exclusión. Los resultados muestran que el test Toulouse-Piéron es el instrumento más utilizado para medir la atención en el baloncesto. No obstante, es importante resaltar que la Evaluación del Conocimiento Declarativo y la Capacidad Atencional se presenta como la herramienta más específica para evaluar la atención en este deporte, al enfocarse en la técnica-táctica de los jugadores de baloncesto.

Palabras clave: Psicología deportiva, test psicométrico, entrenamiento, concentración.

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Introduction

Attention is a necessary capacity to direct cognitive resources in the face of a relevant event in the environment, maintaining it for a certain period of time, which allows modifying the direction of the cognitive focus voluntarily depending on the needs of the environment and the goals that are set (Weinberg & Gould, 2019).

Sánchez and León (2012) define attention as the psychological process that allows the individual to establish contact with the most relevant stimuli in the situation at the present moment, discarding those that are not, except when the situation requires it. Atwi et al. (2018) consider that attention is a cognitive process that allows a person to perceive, understand, remember, and use information to solve problems and make decisions, essential for human functioning, and a priority in current scientific research.

Attention has been the subject of much research in sports sciences, evidencing its relevance for competitive performance in different disciplines and skills (Ducrocq et al., 2016).

Hernández (2007) states that the main component of concentration is the ability to focus attention on a task that is being performed and not to be distracted by irrelevant stimuli whether internal or external, that trigger cognitive and emotional change in the athlete, causing a loss of concentration on the objective.

Pérez and Crobu (2018) associate attention to selecting the relevant external stimuli resulting in successful sports performance, however, sometimes, it is affected by mood, tension, training loads, pain, fatigue, negative thoughts and self-worth; factors that contribute to the athletes' sports performance (Del Monte, 2017).

Sansone (2023) points out that, to obtain useful and efficient information about the athlete's conditions, tools such as questionnaires and scales are used, which are individually applied to athletes to obtain information on different perceptual factors, such as fatigue, recovery, pain, stress, sleep quality, mood, among others. These results provide information on the athlete's condition at different stages of their training and competition cycles. However, it is not possible to predict athletic performance by carefully designing training and recovery plans alone. This is especially relevant in team sports, where interindividual differences, group dynamics, contextual factors and opponents interact in complex ways.

Morillo (2014) comments that in a sport such as basketball, where the actions are very fast, the field is very small and the dynamics of the game very complex, attention span and concentration are skills that can determine who will be successful or not. Castelnau-Díaz and León (2013) indicate that two of the most frequent pressure situations that affect the focus of attention are, from an external point of view, exclamations and the presence of family members in the audience.

In recent years, there has been an increase in the number of tools used to evaluate various cognitive functions in basketball, as it is a team sport that demands the attention of the athlete due to the situational demands present throughout the game. Therefore, attention is fundamental in the sports scenario that allows the athlete to function properly (Monsma et al., 2017). Activity demands and physiological data vary based on playing position, level of play, and geographic location, however, players competing at the same level experience similar demands. During a match, basketball players run approximately 5-6 km at average physiological intensities above the lactate threshold and 85% of the maximum heart rate, at the end of the matches, a reduction in activity demands and a high dependence on the rapid glycolysis for energy supply, which can be attributed to the mechanisms associated with fatigue, which increase during periods of inactivity can be observed (Stojanović et al., 2018).

Some of the instruments used to measure attention contemplate various dimensions, including performance and concentration evaluation (Gimeno et al., 2001), spatial perception and intelligence (Thurstone & Yela, 2021), resistance to attentional fatigue and selective attention (Maureira et al., 2019). Attention is a key factor in sports performance, allowing athletes to focus on the task at hand and respond quickly and accurately to relevant stimuli in the court; its measurement provides the coaches with information about the players' level of attention, identifying their strengths and weaknesses in order to design specific training strategies.

The goal of the present study is to carry out a brief review through an electronic search of the most used instruments in measuring attention in basketball players.

Method

Selection of Studies

To meet the objective of this work, a search was conducted in English and Spanish, using the terms: attention/atención, basketball/baloncesto, "focus of attention" / "foco atencional" and concentration/concentración, with the Boolean descriptor AND in the electronic databases REDALYC, ProQuest, Scielo and the ResearchGate network of researchers. The search dates spanned from January 23 to March 15, 2023, the review of the information was completed using the bibliographic references found in the previous searches.

The guidelines of the PRISMA Statement (Sarkis-Onofre et al., 2021) were used.

The inclusion criteria for the bibliographic search were the following: a) original articles, b) open access, c) without date constrains, d) descriptive and/or experimental that mention the tests or assessments used, e) female and male basketball players over 11 years of age, f) from teams in competitive leagues.

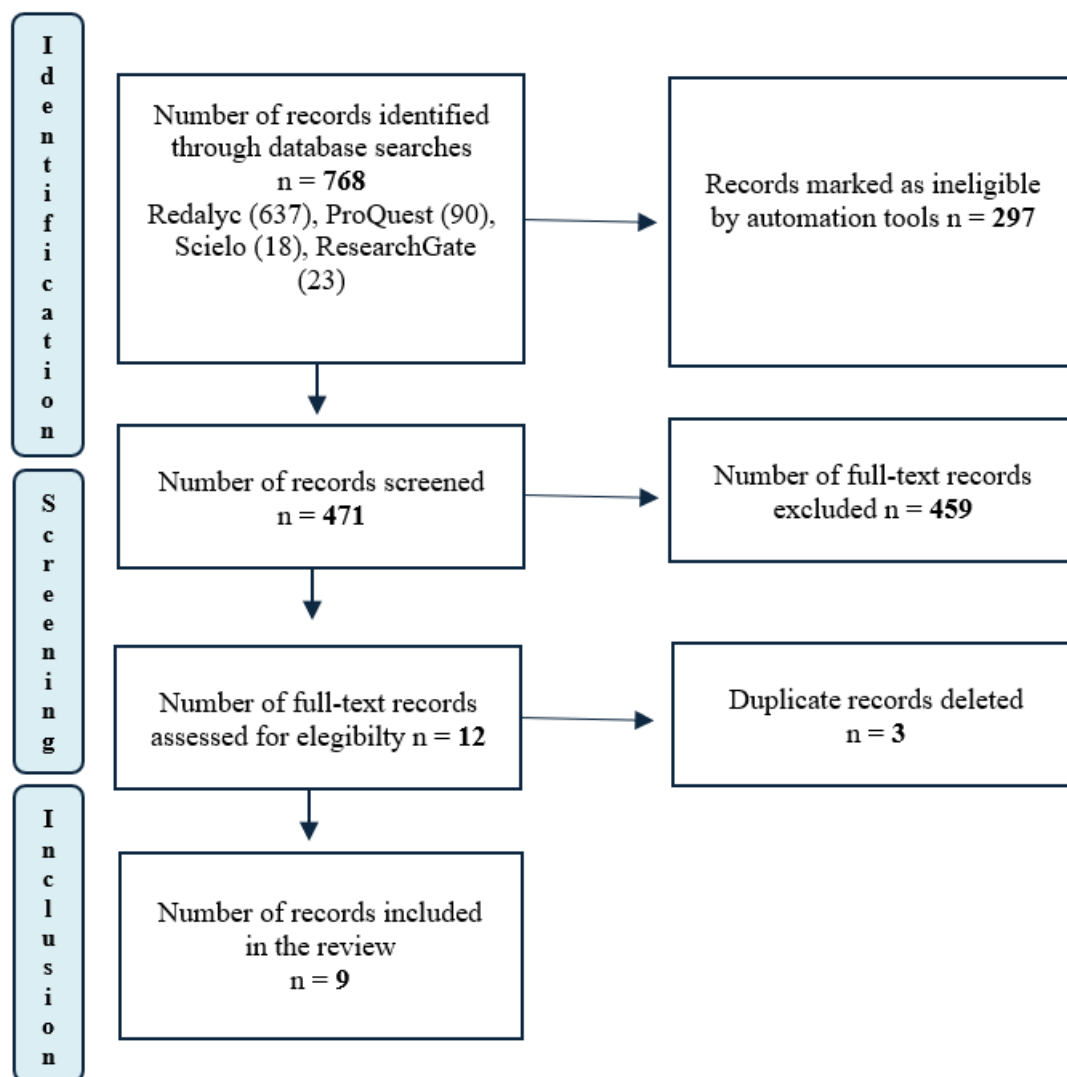
As exclusion criteria: a) doctoral theses, b) reviews, c) book chapters c) posters, d) presentations, e) studies of players with disabilities.

Results

The search parameters that were employed, a total of 768 articles were identified. After eliminating 297 by title and abstract, those that, although their title contained some of the key words, their content did not address the objective of this study, were also discarded, 471 articles were revised according to the inclusion criteria, (duplicates were identified) of which 459 were eliminated for not meeting search criteria, leaving 12 articles, subsequently three3 duplicate articles were eliminated, leaving nine publications selected for this study.

The selection process is specified in "Figure 1".

Figure 1
Flow chart of the studies obtained



"Table 1" summarizes the assessments instruments that were found in the revision of articles indicating the sample, age range, dimensions or factors, number of items, response format and reliability of the questionnaire, as well as the relationship with the variables and the type of study.

Table 1
Characteristics and psychometric properties of assessment instruments

Author and Year	n	Age	Instrument	Number of Items/ actions	Response form	Dimensions/ component	Reliability	Dimension-related variables	Study type
Alarcón López et al. (2010)	10	18 to 26	Instrument for the assessment of declarative knowledge and attentional capacity	40	Semi-structured interview 2 answers	NR	$\alpha = .95$	Constructivist methodology	Unique case quasi-experimental, without control group. Cross-sectional and longitudinal comparison
Cong and Endozo (2022)	30	NR	Comparative mathematical statistics	NR	Qualitative and mathematical assessment	1. Mental training 2. Enhanced physical training 3. Ball sense 4. Shooting speed 5. Angle shooting	Significant change	Free-throw effectiveness and physical capabilities training methods	Comparative study
Enríquez-Molina et al. (2023)	1,038	20 to 29	Computerized numerical crossing out test	Per time	Crossed out number on 5X5 matrix.	1. Selective attention	NR	1. Individual sports 2. Collective and combat sports Measuring execution time and errors.	Research with associative, comparative and correlational strategy.
Fradejas and Espada (2016)	816	12 to 18	CPRD	55	Likert scale 6 options	1. Stress control 2. Influence of Performance Evaluation 3. Motivation, 4. Mental ability 5. Team Cohesion	$\alpha = .85$ I.P.E. $\alpha = .72$	Sports modality. R. Gymnastics Handball Basketball Football Soccer Swimming Athletics Judo Futsal Tennis	Test application
López-Roel and Dosil (2019)	327	11 to 54	CNPD-15	15	Likert scale	1. Activation 2. Concentration 3. Confidence 4. Motivation	$\alpha = .87$	Instrument reduction and validation that evaluates psychological variables	Investigation research
Pinto et al. (2019)	18	18 to 34	Toulouse Pieron	460	Figure Identification	1. Concentration 2. Resistance to monotony 3. Visual perceptive concentration	NR	Free-throw effectiveness	Exploratory, descriptive and inferential
Ponce (2018)	15	18 to 27	Toulouse Pieron	460	Figure Identification	1. Concentration 2. Resistance to monotony 3. Visual perceptive concentration	NR	Free-throw effectiveness	Descriptive correlational, non-experimental

Rodríguez and Sáez (2009)	10	22 + / -	Excel Average	NR	NR	Attention	NR	Free-throw effectiveness	Explanatory
Rodríguez and Montoya (2006)	36	16 to 35	Caras	60	Determine differences	1. Perceptive and attentional skills.	$\alpha = .95$	Sports Performance	Cuasi exp. Pre-test post-test
Rodríguez and Montoya (2006)	36	16 to 35	Toulouse Piéron	460	Figure Identification	1. Ability to concentrate 2. Attentional fatigue resistance 3. Perceptual speed and persistence	NR	Sports Performance	Cuasi exp. Pre-test post-test

In total, nine instruments applied to basketball players were located, and they are described below.

In the study by Fradejas and Espada (2016) it was observed that the researchers compared the attention of the players according to the different sports modalities in which each of them participate, using the test of Psychological Characteristics related to Sports Performance. It could be seen that there was greater control of attention-concentration among athletes who practiced rhythmic gymnastics and handball, despite having included basketball in this study, no differences were shown.

Rodríguez and Montoya (2006) used two instruments to measure attention: the “Caras” difference perception test and the Toulouse Piéron test. The authors found no differences; a slight increase in their level of attention was observed in the experimental group one, it is important to note that this is the group that received training with distractors in the applied intervention program.

Continuing with the Toulouse Piéron test, Ponce (2014) attempted to relate the effectiveness of free throws to the concentration of attention; it is relevant to mention that, to determine it, a scale of percentages was used, with 0-20% being very low, 21-40% low, 41-60% medium, 61-80% high and 81-100% very high level of attention; the team had an average effectiveness of 58.19% in free throws, which according to the scale used is considered a “low” percentage individually, only one player achieved a qualitative evaluation of “good” with a percentage of 76.47%, in contrast, eight players were evaluated as “bad” and the last six as “regular”, when calculating the results of attention concentration, a general average of 41.47% was obtained, which indicates a “medium” qualitative value. At the individual level, only one player obtained a “high” level, while seven players achieved a “medium” level and the remaining seven obtained a “low” level.

Continuing with this instrument, Pinto et al. (2019) used it with the purpose of identifying the level of concentration in a female basketball team, in which the quality of visual perceptual concentration was established at 81.78%, resulting in good quality of attention in the athletes and demonstrating a moderate positive linear correlation between the level of concentration and the effectiveness of free throws. It is concluded that the time spent executing basketball free throws, attention and concentration, have a normally positive linear influence at a low and moderate level on the percentage effectiveness of the sports technique; regarding the “Caras” difference perception test, when performing the analysis, the improvement in attention was attributed to the training using distractors that was applied to experimental group one, however, there were no differences between the groups.

López-Roel and Dosil (2019) carried out the reduction and validation of the Athlete’s Psychological Needs Questionnaire (APNQ-15), which evaluates psychological variables and consists of four factors: concentration, activation, confidence and motivation. Items 12 to 15 specifically measure the concentration factor, which allows us to focus on this variable more precisely: A correlational analysis was performed between the CNPD-15 scales and the Athletic Coping Skills Inventory (ACSI), finding a significant correlation of .526 ($p < .01$), which indicates a moderate positive relationship between both measures. In addition, a Cronbach’s Alpha value of .809 was obtained, which indicates high reliability and internal consistency in the items that measure concentration.

These results suggest that the CNPD-15 scales and the ACSI test are consistent and reliable measures to evaluate concentration in sport.

Through a qualitative evaluation supported by statistics and throwing averages, both before and after the training program which the experimental groups underwent, it was possible to analyze the effectiveness of different training methods to improve the throwing percentage in basketball players, as was carried out in the study by Cong and Endozo

(2022), who used Comparative Mathematical Statistics to measure variables such as psychological attention, physical fitness, coordination, speed, launch angle and feel of the ball.

Enriquez Molina et al. (2022) determined the differences in selective attention between athletes who practiced individual, team and adversary sports, taking as reference the execution time and the errors presented in a Numerical Cross-Out Test (5x5 matrix), the interest of this review was focused on the measurement of basketball, differences were observed between the groups in terms of the time of execution of the test, those who they practice adversary and collective modalities performed the test more quickly and with fewer errors, the explanation that the authors provide of these results is that in basketball, due to the demands in technical-tactical training and selective attention, the decision making is more complex which helps the player develop this type of cognitive abilities.

Alarcón López et al. (2010) sought to test a methodology based on constructivist learning theories to improve the capacity for selective attention of Basic Collective Tactical Means (BCTM) and Declarative Knowledge in 10 basketball players. To assess attention, an instrument was designed based on the exhibition of a video of match sequences.

The program was divided into three phases for the improvement of MTCB. In the first part, the athletes were taught what the objectives of the game were in general; in the second, what the specific principles were, and in the last or improvement phase, emphasis was placed on the performance of the opponents, taking into account the previously established effectiveness criteria.

The results showed that, after the intervention program, all the athletes were able to improve attention towards the role of the defenders in 70.5% of the scenes, in relation to the pretest in which the players did not perceive what the defenders were doing; the post-test showed that they improved by 89.3% when it came to perceiving the defenders, while for the attackers the perception obtained was 96.5%.

Rodríguez and Sáez in 2009 wanted to evaluate if attention was reduced during games, to the point of being a key factor in the decrease in performance, which was measured in 30 free throws, ten alone, in maximum attention conditions ten during training with the entire team present and the first ten of the following games. The results showed higher percentages of success obtained during training than during matches. However, the minimal difference between training with the presence of other players or alone is due to the fact that they did not experience the tension, the nerves of the match and the level of distractions that must be greater than the simple presence of several people to affect the concentration of the players.

Discussion

In this review, the studies that have been published regarding the most widely used instruments in measuring attention in basketball players were analyzed, highlighting the scarcity of studies on this topic. Sansone et al. (2023) used different instruments to assess the well-being of young basketball players and found that those who have less recovery time on the court show a more constant intensity in the rhythm, which allows them to remain active throughout the training session or match, denoting that the players focus their attention on carrying out the activity, putting fatigue, muscle pain, stress or some other factor that could distract them from their objective.

As González Hernández (2007) mentions in his article to Guallar and Pons (1994), in order to help an athlete train his attention span, with the aim of improving his sports performance, it is necessary to start with an evaluation of the attentional level, thus the importance of the assessment of attention in basketball.

Among the most widely used instruments to measure attention in basketball players, the Toulouse Piéron test stands out (Pinto et al., 2019; Ponce, 2004; Rodríguez & Montoya, 2006), this test was mentioned in three of the nine selected articles. It focuses on evaluating both selective attention and sustained attention, with a duration of two and 10 minutes respectively, it can be applied both individually and collectively (Maureira et al., 2010); when analyzing the test, we agree with Yela (2009) that it would be beneficial to include the instrument's statistical values to provide greater clarity to the reader when choosing a measurement tool, since it has a certain reliability, it is important to use it appropriately in conjunction with other instruments and evaluation techniques, keeping in mind that the interpretation of the results must be carried out by a professional with training and experience in their use in order to guarantee a correct application and avoid possible interpretation errors.

There are some studies that have analyzed the reliability and validity of the Toulouse-Piéron test, each of these documents have addressed different aspects, establishing various methodologies, contexts and populations. In general, studies have found that the test has acceptable test-retest reliability, which means that the results obtained at different times are stable and consistent, also identifying some limitations and recommendations for its use (Fernandes Lopes et al., 2015; Gómez & Morales, 2006; Hilde, 2018).

The computerized Numerical Strikethrough test (5x5 matrix) by Hernández and Ramos (1995) is similar to the identification of images that measures selective attention. Its advantage is the remote application, it belongs to the Attentional Processes software on the MenPas 1.0 evaluation platform, this tool is recommended because of its easy access and for measuring six types of selective attention.

González-Guirval et al. (2020) report that specifically in the case of athletes, this type of software is interesting due to its versatility, its ability to create attractive tasks for the participating population and its potential to generate data that can later be used in the analysis and improvement of cognitive ability in this type of samples, in turn, González-Ruiz et al. (2018) comment that some advantages of technology in research are the speed of obtaining and analyzing results, ease of use, compatibility of various devices and lower margin of error; as disadvantages, it is mentioned that it could hinder the relationship between the researcher and the participants.

The reduction of the CNPD-15 test gave good results in terms of confidence, significant correlation and fulfilling the purpose of collecting data more quickly and efficiently on these 4 factors, reflecting positive psychometric data, however, the inconvenience of subtracting some items is that it also reduces each scale and that affects its reliability. These authors also observed that people who practiced open sports had better results in cognitive processes such as attention (Vestberg et al., 2017), understanding that the longer they practiced their sport, attentional functioning is positively affected.

The CPRD is considered a useful instrument, since it interacts with the information from other evaluation procedures, this helps the sports psychologist in detecting needs and resources, proposing explanatory hypotheses, carrying out functional analysis, making decisions. on the objectives of the intervention and the observation of the athletes' progress (Gimeno et al., 2001).

Conclusions

According to the analyzed literature and responding to the objective of this brief review, we can establish that the most widely used instrument is the Toulouse-Piéron test due to its effectiveness in measuring the athlete's attentional system; and although in the scientific literature there is no specific test to measure attention in basketball, this test can play a relevant role in the assessment of attention in this sport, however, by measuring only sustained and selective attention it is advisable to use the application of other batteries that complement the measurement of attention to obtain a complete and accurate evaluation.

Of the nine instruments that were analyzed in this systematic review for measuring attention, the psychometric quality of five of them is questioned, Toulouse Piéron (Pinto et al., 2019; Ponce, 2018; Rodríguez & Montoya, 2006), a computerized test of Numerical Crossing Out (Enríquez Molina et al., 2022) and the test to measure Free Throws by Rodríguez and Sáez (2009).

However, it is important to highlight that the Evaluation of Declarative Knowledge and Attentional Capacity is presented as the most specific tool to evaluate attention in this sport, by focusing on the technique-tactics of basketball players.

Evaluating attention with data-based methods from an early age allows for improvement of the quality of sports training, contributing efficiently and effectively to the training of basketball players (Xuexiang, 2024); it is advisable to investigate how different recovery methods influence the players' attention in order to identify how mental recovery impacts the improvement of concentration and decision-making within this sport (Calleja-González, 2021).

It should be noted that the field of attention evaluation in sports continues to evolve, it is recommended for future research the creation of a specific test in basketball focused on key aspects of attention during the game, measurement of the ability to concentrate in situations high pressure, selective attention to relevant stimuli in the field and shifting attention between different game actions to name a few.

Ethics Committee Statement

This study did not include research with human data.

Conflict of Interest

The authors declare no conflict of interest.

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Authors' Contribution

Conceptualization Q.G. & E.B.; Methodology M.O.; Software C.J.; Validation Q.G., V.B. & C.J.; Formal Analysis C.J.; Investigation Q.G. & E.B.; Resources E.B.; Data Curation M.O.; Writing – Original Draft E.B.; Writing – Review & Editing Q.G. & E.B.; Visualization E.B.; Supervision C.J. & M.O.; Project Administration Q.G. & E.B.; Funding Acquisition Q.G., C.J. & M.O. All authors have read and agreed to the published version of the manuscript.

Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author (ebenavides@uach.mx).

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