Evaluation of Competitive Performance Ability of Basketball Players Based on Hybrid Model

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Abstract

Competitive performance ability is the on-the-spot performance of basketball players’ comprehensive use of technical and tactical, physical, and psychological abilities. Because basketball players’ competitive performance includes many evaluation contents and influencing factors, it is difficult to comprehensively and objectively use a single qualitative analysis or quantitative statistics for evaluation and measurement. Based on the analytic hierarchy process (AHP) and intelligent fuzzy comprehensive evaluation, this research establishes a hybrid model, which is applied to evaluate the performance of basketball players. Based on the actual needs, this research uses the relevant theories in the discipline of sports training, with abundant empirical data materials, combined with the specific practice of basketball players’ training and competition, starting from the concept of clear sports intelligence, to further determine the indicators of the basketball players’ sports intelligence evaluation system and weights, construct a set of evaluation system about basketball players, and use this as a standard to evaluate and judge the current situation of basketball players’ sports intelligence.

1. Introduction

The competitive ability and athletic level displayed by basketball players in the game are not only an important embodiment of the charm of basketball competition but also the basic guarantee for winning the game. From the analysis of system theory, basketball competition is a complex system with many influencing factors, in which the player’s ability to play on the spot is an important part of the system. For athletes’ performance in competition, qualitative methods are generally used to evaluate and judge, and the evaluation methods are relatively rough and subjective. At the end of the last century, the United States took the lead in using the technical statistics of athletes as the basis, combined with the actual situation of basketball games, and used a simple method of adding and subtracting weights to reflect the competition performance of athletes [1–3]. With the vigorous development of modern information technology, technical concepts such as big data and cloud computing are widely used in the analysis of basketball players’ technical statistics and behavioral efficiency, providing a feasible technical method for quantitative analysis of basketball players’ competitive performance in competitions. The scientific nature of evaluation theories and methods is further strengthened.

Athletes with a high level of sports intelligence have a clear understanding and grasp of the technical characteristics, tactical characteristics, and supporting laws of special projects and have a deeper understanding of the methods and approaches of special training. It can be seen that in the process of training, athletes can accurately and effectively grasp the intention of the coach and can meet the relevant requirements of the coach through their own training or competition practices, which is an intuitive manifestation of good sports intelligence. Athletes achieve an ideal state of sports intelligence, which means that athletes have more ideal training and competition thinking, and the ability to understand techniques and tactics is stronger. Under the
influence of this kind of understanding and thinking ability, athletes will greatly shorten the time for mastering and quantity of techniques and tactics, and at the same time, the accuracy of mastery and understanding of techniques and tactics will also be greatly improved. Under the influence of higher sports intelligence, athletes can more efficiently implement corresponding technical and tactical arrangements in training and competition and can more effectively adjust their competition status, so as to ensure the full play of their high-level special competition ability [4–7].

Basketball is a physical confrontational sport in the form of a team, which requires relatively high technical ability, tactical ability, and thinking ability of athletes. These factors together constitute the special competitive ability of athletes and affect the performance of the game [8–11]. At the same time, basketball is a confrontational project on the same field. How can athletes exert their technical and tactical advantages at a high level under high-intensity confrontation conditions, and how can they ensure the team’s competitive advantage through their own competitive ability? An important criterion for measuring the comprehensive ability of athletes is necessary. Therefore, the exercise of basketball players’ sports intelligence can ensure the performance of the players’ physical skills and tactical literacy, enhance the players’ ability to understand game problems and solve game problems, and promote the players to more fully and accurately understand the coach’s tactical intentions in the game, so as to effectively implement the game plan and win the game [12]. All in all, sports intelligence has become an important factor affecting the comprehensive competitive ability and competition ability of athletes, which needs to be paid attention to in daily training.

The evaluation of basketball players has become an important issue in the field of basketball training, but the evaluation index system needs to point to the basketball technical and tactical ability of the players, and some evaluation index systems also point to the evaluation of basketball players’ special physical fitness. However, the evaluation of basketball players, especially basketball players’ thinking ability, innovation ability, control ability, understanding ability, cognitive ability, and other fields of sports intelligence is extremely limited. Through the preliminary field investigation, it was learned that many basketball players did not understand the training tasks assigned by the coaches, and the use of relevant techniques and tactics was extremely rigid, lacking flexible combinations and innovative optimization of existing techniques and tactics. Although many athletes have certain advantages on the basis of physical fitness and techniques and tactics, they are extremely slow in understanding new knowledge and skills and innovating existing knowledge and skills, resulting in the inability to effectively exert their original advantages. According to the relevant theories of sports training, the lack of sports intelligence is an important reason for the above-mentioned bad phenomena in athletes. Based on this problem, this study starts from the perspective of sports intelligence in the field of sports training, trying to construct a basketball player’s sports. The intelligent evaluation index system can more accurately and objectively evaluate the sports intelligence of high-level basketball players in colleges and universities, find out the problems and deficiencies, and further propose targeted improvement and optimization strategies, so as to improve the overall competition of basketball players [13–17].

In evaluation research, both qualitative analysis and quantitative statistics have their own irreplaceable advantages and characteristics [18, 19]. Modern systems science believes that a comprehensive and effective evaluation method is to emphasize the combination of qualitative and quantitative, gather subjective experience and objective information, learn from each other, and promote each other. Finally, the comprehensive evaluation of the evaluation object is completed. The performance ability and level of basketball players are not only components of the open complex system of a basketball game but also a complex system with various levels, complex structure, and rich content. This paper follows the thought of systematic science, according to the working idea of the comprehensive integration method, and builds a hybrid model based on the analytic hierarchy process (AHP) and intelligent fuzzy comprehensive evaluation to comprehensively and objectively evaluate the performance of basketball players.

2. Background

2.1. Sports Intelligence of Basketball Players. To clarify the concept of sports intelligence of basketball players, we should first clarify the concept of sports intelligence. By combining and studying the relevant literature, it is found that domestic and foreign scholars have first conducted a certain degree of research on the concept of “intelligence.” American psychologist Howard Gardner analyzed the concept of intelligence, and the research pointed out that intelligence is the ability of social individuals to solve their own problems and create some additional thinking or ideological products under a certain social background. Howard Gardner also regards sports intelligence as an essential part of human intelligence, and he believes that sports intelligence is the ability of human individuals to use body movements to achieve certain goals. Lingbo defined the concept of sports intelligence in combination with water polo and pointed out in his research that sports intelligence is the ability to ensure that level athletes have a correct understanding of level training and competition. The ability to use correct thinking and stable psychological emotions to control one’s own physical movement is very important for the improvement of the special competition ability of horizontal events. The ability to process, recognize, and translate information into practical sports behaviors in various training competitions is important for basketball players.

Sports intelligence refers to the athlete’s multidisciplinary theoretical knowledge of sports and the comprehensive ability to control the body to complete sports technical movements through thinking consciousness and participate in sports training and sports competitions. The sports intelligence of basketball players refers to the ability of
basketball players to control them to complete sports training and sports competition under specific conditions with the help of various subject knowledge, acceptance ability, ideological concepts, and thinking consciousness that they have mastered. However, it should be noted that there is a big gap between basketball players in terms of cultural literacy, competitive ability, and thinking consciousness as professional or professional athletes. It can be seen that there are obvious differences between the two in terms of special competitive ability, training background, competition environment, and personal characteristics. Sports intelligence is not simply sports intelligence. Intelligence is the ability to use the knowledge learned to recognize and solve problems. Intelligence not only includes intelligence but also manifests itself in the form of an ability. At the same time, there are differences between sports intelligence and sports awareness. In basketball, the choice of techniques and tactics by athletes reflects a kind of sports intelligence and sports awareness. And basketball sports intelligence is improved. The basis of basketball awareness is an expression level of sports intelligence.

Through the definition of the concept of sports intelligence and the identification of a series of related concepts, sports intelligence can be regarded as an organic combination of knowledge and ability. The concept of basketball player’s kinesiology proposed in this study is analyzed by comprehensive literature data, and through consultation with many experts and scholars in related fields, the concept is defined as: or in the game, on the basis of combining their own characteristics, they can use their own special knowledge theory and special basketball skills and tactics, and in the combination of mind and body, effectively use their own mental cognitive ability to control the ontology to complete training and competition. The mental and cognitive ability of athletes can be reflected and exerted to the greatest extent in training and competition through the reasonable adjustment of basketball-specific cultural knowledge and skills. Therefore, the improvement of basketball players’ special competitive ability largely depends on the mental and cognitive ability of the players. Sports intelligence is another important factor that determines the level of special competitive ability of basketball players in addition to the theory of physical fitness, special skills, tactics, and special knowledge.

2.2. Analytic Hierarchy Process. Analytic hierarchy process (AHP) is an index system construction method that has a wide range of applications in the field of social science research in recent years, especially in the comprehensive evaluation of a social phenomenon or behavior. The evaluation of the basketball player’s sports intelligence in this study is to evaluate several goals and attributes contained in the basketball player’s sports intelligence. Therefore, the analytic hierarchy process is more suitable for the purpose of this research from the method characteristics. This research uses the analytic hierarchy process to analyze the importance of each index between different levels in the basketball player’s sports intelligence evaluation system, forms a corresponding judgment matrix, and scientifically evaluates the weight of various indicators at all levels in the basketball player’s sports intelligence index system. After considering the group characteristics of basketball players and the connotation of sports intelligence, a three-layer target structure model is established. The first layer is the target layer, which is the research goal that this research hopes to achieve basketball players’ sports intelligence. The second layer is the criterion layer, which mainly decomposes the sports intelligence of basketball players. The high-level indicators can analyze different levels of sports intelligence and have a certain generality. The third layer is the program layer. The specific evaluation index obtained from the analysis is also an operational test and method for improving the sports intelligence of basketball players.

2.3. Fuzzy Comprehensive Evaluation Method. After using the AHP to construct the basketball player’s sports intelligence evaluation index system, it needs to be further verified whether this index system is operable. Therefore, this study uses the fuzzy comprehensive evaluation method to verify the operability of the constructed index system. In the verification, this study selects the athletes of Shanxi University men’s basketball team as the verification object of the sports intelligence evaluation index system and uses the fuzzy comprehensive evaluation method to scientifically and reasonably evaluate the sports intelligence of the selected athletes.

3. Competitive Performance Evaluation Index

3.1. Questionnaire Design. According to the needs of this research, on the basis of fully reviewing the relevant literature, combined with the suggestions of some experts and scholars, the first round of expert questionnaires for the primary indicators of basketball players’ sports intelligence evaluation was formulated. Questionnaires are distributed to experts in basketball research direction and sports statistics research direction. The main purpose is to determine the relevant components of basketball players’ sports intelligence evaluation indicators and the formulation of evaluation indicators.

This study mainly adopts the methods of expert questionnaire survey and interview to determine the indicators of the basketball player’s sports intelligence evaluation index system. It is found in the expert’s questionnaire that some ideal indicators can directly and clearly reflect the true nature of the evaluation object. However, some indicators are ambiguous and cannot clearly evaluate the evaluation object, so the evaluation effect is relatively limited. At the same time, through the questionnaire data, it is found that there are contradictory relationships, cross-relationships, causal relationships, and other adverse relationships that affect the evaluation effect among some indicators. Therefore, it is necessary to classify and integrate the preliminary proposed three-level indicators and conduct effective and reasonable screening at the same time, so as to achieve the
purpose of objective and accurate evaluation. More importantly, this screening procedure can ensure that we can effectively evaluate each indicator, combined with the purpose of this study and the principle of primary indicator screening, and on the basis of fully considering the role of different indicators and evaluation orientations, we can appropriately evaluate them. The indicators with unsatisfactory evaluation effects in the whole three-level indicators are eliminated, thereby reducing the corresponding workload.

In the first round of expert questionnaires, a total of 100 experts were distributed with questionnaires, 95 points were recovered, and all the recovered questionnaires were valid questionnaires, with an effective recovery rate of 95%. In the expert questionnaire, a total of one first-level indicator, 6 second-level indicators, and 49 third-level indicators were designed, and the total number of candidate indicators was 56. According to the basic principles of index selection and statistical analysis of expert questionnaire data, it was found that there were five tertiary indicators that did not meet the standards required by the study and were therefore eliminated. These five indicators were the level of flexibility, body shape, action stress response ability, ability to solve daily problems, mastery of fake movements, and ability to use them. Although the remaining 51 indicators meet the relevant evaluation requirements, there is also overlap in the meaning of different indicators, so the indicators with similar meanings are also eliminated, and 45 indicators are finally determined as the construction after integration.

3.2. Evaluation of Sports Intelligence Index System by AHP. After constructing the basketball player’s sports intelligence index evaluation model, in order to further clarify the importance of different indicators in the evaluation process, it is necessary to compare the indicators at different levels in the model, so as to more clearly understand the role of each index in basketball players’ sports. To express importance of intelligent evaluation, the scheme establishes a comparison matrix of basketball players’ sports intelligence evaluation index system.

\[
R = \begin{pmatrix}
    r_{11} & r_{12} & \cdots & r_{1m} \\
    r_{21} & r_{22} & \cdots & r_{2m} \\
    \vdots & \vdots & \ddots & \vdots \\
    r_{n1} & r_{n2} & \cdots & r_{nm}
\end{pmatrix}
\]

(1)

The element \(r_{ij}\) in the \(i\)-th row and the \(j\)-th column in the membership relationship matrix \(R\) represents the membership of the evaluation object from the fuzzy subset of the \(x_j\) level corresponding to the evaluation factor (indicator) \(a_i\). The characteristics of an evaluation object or object in the \(i\)-th evaluation factor (indicator) \(a_i\) are expressed according to the membership relationship matrix \(R\). In this step, this research establishes the expert evaluation questionnaire of the index weight coefficient and uses the calculation formula of the geometric mean to calculate the importance scores of different indexes in the whole evaluation model, that is, the weight coefficient. The scores of experts are summed and normalized. In the normalization process, the numbers 1–9 and their reciprocals are used as scales, and 1–9 indicates that the importance of indicators is increasing; for example, the indicator basketball training years are 1 pair. The number of entries, that is, the importance level of entry level 2 is 4, it is marked as \(A12 = 4\), and the reverse importance is \(1/5\), that is, \(A21 = 1/5\).

3.3. Calculating Weight Indicators. According to the criteria of the constructed judgment matrix indicators, the first-level indicators in the basketball player’s sports intelligence index system, basketball players’ sports intelligence and second-level indicators, basic competition ability, special technical and tactical ability, game confrontation ability, cognitive characteristics, on-the-spot reaction ability, and ability to solve offensive and defensive problems are compared, and the corresponding comparison matrix is established, as shown in Table 1.

The comparison data of the secondary indicators of basketball players shown in Table 1 are obtained by the method of obtaining the geometric mean and are calculated by the software of AHP.

As can be seen from the data shown in Table 2, for the basic competition ability, special technical and tactical ability, competition confrontation ability, cognitive characteristics, on-the-spot reaction ability, and ability to solve offensive and defensive problems, there are a total of 6 constructions. The weight coefficients corresponding to the six secondary indicators are 0.1314, 0.2053, 0.1531, 0.1715, 0.1825, and 0.1563, respectively.

4. Fuzzy Comprehensive Evaluation of Basketball Players’ Sports Intelligence

For the same basketball player, the difference in the evaluation index system will also lead to different evaluation conclusions. Therefore, how can a scientific and reasonable evaluation system for sports accurately evaluate the athlete, so that the evaluation results conform to the actual situation of high-level basketball players in colleges and universities, and the question of who the evaluation subject has also restricted the construction. In the research, the main objects of investigation are the first-line coaches engaged in basketball training and the research experts and scholars in this field. After two expert questionnaires, the basketball player’s sports intelligence was finally formed. Then, according to this evaluation index system, several groups of teammates, coaches, and team managers who have a close relationship with basketball players are investigated. These groups constitute the main body of evaluation of basketball players’ sports intelligence. The first subject is teammates. From a professional point of view, the sports intelligence of basketball players is mainly reflected in the daily training and competition of the players. The basic performance of the players in training
and the abilities and characteristics they have in the game are best known by the same ball. As far as the game is concerned, the basketball project requires five players to cooperate with each other, so most of the techniques and tactics of basketball players need to be completed through the cooperation of teammates. The second subject is the coach. Coaches are the coaches of basketball players’ training and competition, and they are the most authoritative party to evaluate the training and competition level of players. With the continuous improvement of the current basketball players’ comprehensive competitive ability and the improvement of the CUBA competition level, most teams have higher requirements for the employment of coaches. Therefore, this group’s evaluation of athletes’ sports intelligence is not only objective but also scientific. The third subject is team managers. In each basketball team, its managers often have rich team management experience or sports training management experience. The managers are mainly responsible for various affairs except training, so they have more problems with the team or players. Moreover, as a manager, he is also the coordinator between coaches and athletes, so he has a deep understanding of the individual characteristics of each athlete, which creates ideal conditions for team managers to evaluate the sports intelligence of basketball players. Make a comprehensive evaluation on the evaluation of the three subsystems of teammates, coaches, and managers, and set the result set of the comprehensive evaluation as $R_{\text{total}}$, which is composed of $B_x$, $B_y$, and $B_z$, namely,$$
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and the abilities and characteristics they have in the game are best known by the same ball. As far as the game is concerned, the basketball project requires five players to cooperate with each other, so most of the techniques and tactics of basketball players need to be completed through the cooperation of teammates. The second subject is the coach. Coaches are the coaches of basketball players’ training and competition, and they are the most authoritative party to evaluate the training and competition level of players. With the continuous improvement of the current basketball players’ comprehensive competitive ability and the improvement of the CUBA competition level, most teams have higher requirements for the employment of coaches. From this point of view, the current basketball team coaches are generally those who have many years of front-line training experience and good basketball knowledge and skills. Therefore, this group’s evaluation of athletes’ sports intelligence is not only objective but also scientific. The third subject is team managers. In each basketball team, its managers often have rich team management experience or sports training management experience. The managers are mainly responsible for various affairs except training, so they have more problems with the team or players. Moreover, as a manager, he is also the coordinator between coaches and athletes, so he has a deep understanding of the individual characteristics of each athlete, which creates ideal conditions for team managers to evaluate the sports intelligence of basketball players. Make a comprehensive evaluation on the evaluation of the three subsystems of teammates, coaches, and managers, and set the result set of the comprehensive evaluation as $R_{\text{total}}$, which is composed of $B_x$, $B_y$, and $B_z$, namely,

$$R_{\text{total}} = \begin{pmatrix} B_x \\ B_y \\ B_z \end{pmatrix},$$

and the data are $0.573 \ 0.564 \ 0.311 \ 0.084$.

In the evaluation scale for basketball players’ sports intelligence issued by experts, the statistical analysis shows that the weight relationship of the evaluation of the three types of evaluation subjects is $A = (0.6, 0.25, 0.15)$.

5. Conclusion

The training of basketball players’ sports intelligence is a long-term and lasting process, and the basics of sports intelligence of different athletes are also quite different. Therefore, coaches should adopt the principle of step-by-step and individualized teaching in the training process. According to the age characteristics of different athletes,
educational background characteristics, personality characteristics, technical and tactical characteristics, the scheme carries out targeted training and improvement. In the training process, in addition to the indicators with relatively high weight values in the indicator system, coaches should also pay enough attention to indicators with low weight coefficients. These indicators often play a crucial role in the competition process. In a word, the training of basketball players’ sports intelligence needs to be systematic, and on the basis of realizing the optimization of various indicators, the sports intelligence level of athletes should be maximized.

Data Availability
The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Conflicts of Interest
The authors declare that they have no conflicts of interest regarding this work.

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