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Research Article

Evaluation Model of Youth Basketball Training Performance Based on PSO Algorithm

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In order to effectively evaluate the performance of juvenile basketball training, an evaluation model of juvenile basketball training performance based on the PSO algorithm is proposed. According to the construction principle of the juvenile basketball training performance evaluation index system, this paper constructs the juvenile basketball training performance evaluation index system and uses analytic hierarchy process to determine the weight of the juvenile basketball training performance evaluation index. Using the PSO algorithm, this paper constructs the evaluation model of teenagers' basketball training performance, optimizes its objective function, and obtains the optimal solution of the model, so as to realize the evaluation of teenagers' basketball training performance. The experimental results show that the proposed method can effectively evaluate the juvenile basketball training performance, and the evaluation results have good training effect. It can effectively improve the authenticity of juvenile basketball training performance evaluation and shorten the time required for juvenile basketball training performance evaluation.

1. Introduction

Basketball is one of the important components of mass sports and competitive sports. It has a broad mass base and is widely popularized and carried out all over the world [1–3]. Including the jump, run, such as basketball movement forms, in the process of participation in basketball, participants not only in physical quality and function of the human body can get plenty of exercise and have played an important role to the vitality of the life, laying a solid foundation for body, for other life activities reached a positive role to improve the quality of people's life. Adolescent basketball players are reserve talents for national basketball players. Only by effectively realizing adolescent basketball training can we ensure the sustainable development of basketball, which is also the prerequisite for the revitalization of basketball [4–6]. Basketball training regards "physical fitness" and "technology" as two "metafactors," and it is "physical fitness" first and "technology" training. It is urgent to change the concept of youth basketball training, change the thinking of youth basketball training, and grasp the youth basketball training. Training results are fundamentally produced by the combination of "physical quality" and "special skills" [7–9]. The evaluation of training results is an important part of youth basketball training. Whether the evaluation is correct or not will affect the improvement of youth basketball training level and training enthusiasm. Therefore, it is of great significance to evaluate the performance of youth basketball training.

At present, scholars in related fields have studied the evaluation of basketball training performance and made great progress. Reference [10] proposed a basketball player value evaluation method based on wireless network and improved Bayesian algorithm. Firstly, wireless sensor networks are used to perceive the performance of basketball players on the court and record various evaluation indicators. Secondly, the player value evaluation model is established by improved Bayesian algorithm and fuzzy comprehensive evaluation method. Finally, the evaluation model showed better evaluation results and a more equitable distribution of values through relevant tests and comparisons with coaches' results. Reference [11] proposed evaluation methods for basketball players and team performance. A review of the background and advanced basketball metrics used in the National Basketball Association and European Union competitions is designed to be used to evaluate existing performance analyses of teams and players and to analyze strategies by minimizing unpredictability. This study provides valuable information for analyzing the basketball performance of teams and players. Although the above methods have made some progress, there are still some problems such as low authenticity of evaluation and long time required for evaluation.

In view of the above problems, this paper proposes an evaluation model of youth basketball training results based on the PSO algorithm. By constructing the evaluation index system of youth basketball training achievement, the weight of evaluation index of youth basketball training achievement is determined. By using the PSO algorithm, the evaluation model of teenagers' basketball training results is constructed, and its optimal solution is carried out to realize the evaluation of teenagers' basketball training results. The model constructed by this method can effectively evaluate the scores of youth basketball training with high authenticity and short evaluation time.

2. Establishment of Evaluation Index System of Youth Basketball Training Performance

2.1. Establishment Principles of Evaluation Index System of Youth Basketball Training Performance

(1) Scientific principle: the establishment of the youth basketball training performance evaluation index system must be supported by scientific theoretical basis. Be sure to accurately, objectively, and correctly reflect the actual performance level and basic characteristics of youth basketball players. At the same time, the evaluation of indicators should be carried out under fair and reasonable conditions, so as to reflect the rationality of the indicator system

(2) The principle of objectivity: when selecting the evaluation indicators of youth basketball training performance and formulating evaluation standards, it is necessary to avoid using absolute indicators as much as possible. The design and selection of indicators should conform to the underlying essential characteristics of basketball projects and can objectively reflect the actual level of training performance of young basketball players. It should reflect the requirements of comprehensiveness and objectivity to ensure comparability in the evaluation of training performance

(3) Principle of relative independence: the relative independence of evaluation indicators is an inevitable requirement for establishing a scientific evaluation system. In the specific description of the development of training performance of individual youth basketball players, the meanings of the indicators cannot overlap. When selecting indicators, it is necessary to formulate classification standards with clear boundaries according to the essential characteristics of the project, so that the indicators do not interfere with each other and do not overlap with each other. It is important that each evaluation metric accurately and independently provides complete information about training performance

(4) The principle of measurability: the theoretical analysis of youth basketball training performance is the basis for establishing the evaluation index system of youth basketball training performance. At the same time, the quantitative characteristics and operability of the test indicators must be considered, and whether they can be supported by data in reality. Existing data should be used as much as possible to guide the index setting. In the actual measurement experiment evaluation process, the index data should have the characteristics of being easy to operate

2.2. Components of the Evaluation Index System of Youth Basketball Training Performance

(1) Evaluation index: according to the goal of youth basketball training performance evaluation, it is deconstructed and analyzed by the designer of the evaluation index, which can reflect the specificity of the essential characteristics of the training performance of the evaluation object. The main factor of behavioralization is the connotation of the evaluation index in this paper, which is the basis for the value judgment of the evaluation object [12–14]

(2) Index weight: the index weight in this article refers to the importance of each evaluation index in the youth basketball training performance evaluation index system. Assigning different weights to each indicator is to enable each indicator to play its due role. This value is called the weight of the corresponding indicator [15–17]

(3) Evaluation standard: the evaluation standard in this paper is to measure the degree to which young basketball players meet the requirements of the evaluation index, which is mainly composed of three elements: scale, intensity, and frequency. The scale represents the grade of the evaluation results of the youth basketball training performance; the intensity refers to the specific degree to which the evaluation index of the youth basketball training performance meets the evaluation requirements; the frequency refers to the relative times that the youth basketball players achieve standardized behavior

2.3. Construction of the Evaluation Index System for Youth Basketball Training Performance. Through the primary selection of relevant indicators, combined with expert screening and statistical optimization, the evaluation index

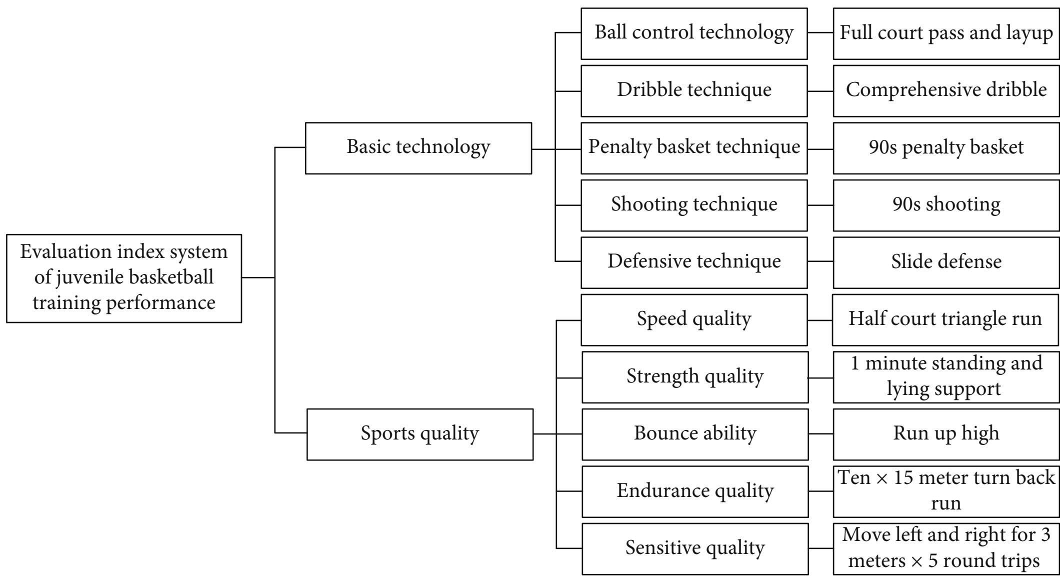

Figure 1: The construct course of evaluation index system of youth basketball training performance.

system of youth basketball training performance is determined as shown in Figure 1.

As can be seen from Figure 1, in terms of basic technology, these five indicators also reflect the characteristics of basketball training sports with high exercise intensity and dominant basketball skills. In terms of sports quality, 5 quality indicators correspond to 5 major qualities, respectively. At the same time, in the process of quality evaluation, the nature of this index can help to better observe the sports performance of basketball trainers in the process of sports, so as to make a corresponding qualitative evaluation for comprehensive consideration. It can be said that the establishment of this system can more accurately reflect the training performance of this group.

2.4. Determination of Weight of Evaluation Indicators for Youth Basketball Training Performance. Analytic hierarchy process (AHP) is one of the most widely used multi-index evaluation methods, and its usage and environment are relatively mature. It has a solid theoretical foundation, a complete operation method, and process, and in practical work, it has created a variety of variant processing methods. Therefore, this study defines the weight of evaluation indicators for of youth basketball training performance based on AHP. The basic steps for calculating the weight of youth basketball training performance evaluation index based on AHP are as follows:

(1) Establishing a hierarchical structure: this study takes the youth basketball training performance as the target layer, the body shape, physical function, and athletic quality as the middle layer, and the subordinate 10 indicators as the bottom layer

(2) Establish judgment matrix: AHP compares each index on the same level with each other and lists the comparison matrix according to the relative importance level table of AHP, as shown in Table 1

The evaluation indicators determined in this study will be made into a questionnaire based on a 9-point scale according to the relative importance scale. Relevant experts, professors, and coaches were asked to rate the importance of each indicator, calculate the average score of each indicator, and then construct the judgment matrix in combination with the index score, as shown in Table 2.

(3) Calculate the weight: there are generally four calculation methods to determine the weight by the AHP [18–20]. In this study, the square root method (the matrix is first multiplied by rows and then raised to the power) is used to calculate the indicator weights. The specific methods are as follows.

Calculate the product Z_x of the elements of each row of the judgment matrix:

$$Z_x = \prod_{y=1}^{n} C_{xy}, x = 1, 2, 3, \cdots, n. \quad (1)$$

Calculate the n root of the product of each row (n is the order of the judgment matrix):

$$V_x = \sqrt[n]{Z_x}, x = 1, 2, 3, \cdots, n. \quad (2)$$

Calculate the weight of each indicator:

$$\psi_x = \frac{V_x}{\sum V}, x = 1, 2, 3, \cdots, n. \quad (3)$$

According to the above formula, the weight of evaluation index of youth basketball training performance, also known

Table 1: AHP relative importance level table.

Relative importance	Definition	Remark
1	Equally important	Both contribute equally to the target
2	The importance is between 1 and 3	The contribution rate is between 1 and 3
3	Slightly important	One contributes slightly more than the other
4	The importance is between 3 and 5	The contribution rate is between 3 and 5
5	Basically important	One contributes more than the other
6	The importance is between 5 and 7	The contribution rate is between 5 and 7
7	Very important	One contributes a lot more than the other
8	The importance is between 7 and 9	The contribution rate is between 7 and 9
9	Absolutely important	One contributes more than the other

Table 2: General form of judgment matrix.

Q	W_1	W_2	…	W_N
W_1	1	W_{12}	…	W_{1N}
W_2	W_{21}	1	…	W_{2N}
…	…	…	…	…
W_N	W_{N1}	W_{N2}	…	1

as weight coefficient, is the proportion of each index in the overall index system. In the evaluation process of youth basketball training results, the evaluation of an athlete's ability is often through the comprehensive investigation of many indicators, but according to the different ability, the importance of the test indicators is not the same. Therefore, the weight coefficient can more clearly reflect which item is more important. In the actual sports performance evaluation, generally comprehensive evaluation, not only need to evaluate the results of each indicator but also need to integrate the results of each indicator into the overall result.

3. Evaluation Model of Youth Basketball Training Performance under PSO Algorithm

3.1. PSO Algorithm. Particle swarm optimization (PSO) is a population-based stochastic optimization technique that mimics the swarm behavior of insects, herds, birds, and schools of fish. These groups search for food in a cooperative way, and each member of the group constantly changes its search mode by learning its own experience and that of other members [21–23].

Take the birds as an example. Assuming that the position coordinate of the valley is (a_0, s_0), the position of a bird is (a, s), and the velocity coordinate is (va, vs), and the distance from the current position to the valley is used:

$$d = \sqrt{(a - a_0)^2 + (s - s_0)^2}. \tag{4}$$

When measuring the "goodness or badness" of flying speed and position of a bird, the following standards should be referred to the closer the bird is to the valley, the more "good," and vice versa, the "bad." Inspired by this model, an evolutionary optimization algorithm was designed, and through continuous trial and error, the basic type of the algorithm was finally fixed a:

$$va = va + 2 \times \text{rand} \times (\text{pbest}a - a) + 2 \times \text{rand} \times (\text{gbest}a - a), \tag{5}$$

$$a = a + va. \tag{6}$$

In formula (5), rand is a random number between [0, 1], pbest is the best position that the individual can remember once reached, and gbest is the best position that the individual can remember the entire group so far. The particle swarm optimization algorithm regards the individual as an abstract particle, that is, it has only position and velocity, but no volume and mass. The procedure flow of this algorithm is shown in Figure 2.

A more complete formalized representation of the PSO algorithm is given below. The following is the application of the PSO algorithm in continuous space optimization problem. If M is used to represent the size of the particle group. Then, in the L dimensional space, the coordinates of every particle vector are $\vec{P}_i = (p_{i1}, p_{i2}, \cdots, p_{il}, \cdots, p_{iL})$, the velocity vector is represented as $\vec{O}_i = (o_{i1}, o_{i2}, \cdots, o_{il}, \cdots, o_{iL})$, the best position of particle is represented as $\vec{U}_i = (u_{i1}, u_{i2}, \cdots, u_{il}, \cdots, u_{iL})$, and the best position of the group is represented as $\vec{Y}_i = (y_{i1}, y_{i2}, \cdots, y_{il}, \cdots, y_{iL})$. Based on the general principle, when the POS algorithm is used to solve the minimization problem, the optimized iterative operation of individual position is as follows:

$$u_{i,t+1}^{l} = \begin{cases} p_{i,t+1}^{l}, \text{if } F(P_{i,t+1}) < F(U_{i,t}), \\ u_{i,t}^{l}, \text{otherwise}. \end{cases} \tag{7}$$

For a group, its optimal position is the set of optimal position of different individuals. The velocity and position iteration formulas are

$$v_{i,t+1}^{d} = v_{i,t+1}^{d} + \sigma_1 \times \text{rand} \times \left(u_{i,t}^{l} - p_{i,t}^{l}\right) + \sigma_2 \times \text{rand} \times \left(u_{i,t}^{l} - p_{i,t}^{l}\right), \tag{8}$$

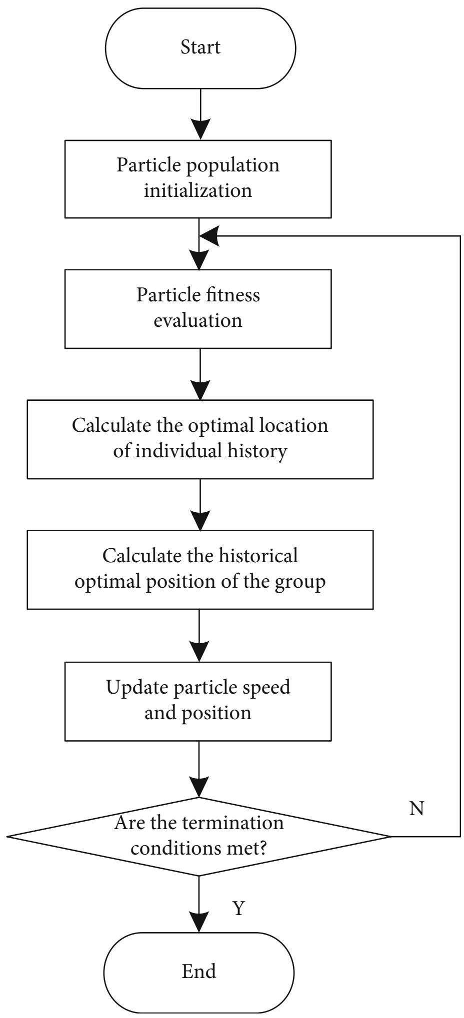

Figure 2: PSO algorithm flow chart.

$$a_{i,t+1}^{d} = a_{i,t}^{d} + v_{i,t+1}^{d}. \tag{9}$$

In Equation (8), σ_1 and σ_2 are denoted as acceleration factors. The weight obtained from the above formula reflects the important position of the PSO algorithm in realizing the goal, and the weight is also a reflection of the recognition degree of the value of this index. The PSO algorithm is widely used in various fields. In the field of sports, it involves the selection of athletes, the monitoring of the national system, the selection of athletes, the results of sports examinations, and the quantitative evaluation of coaches. Due to the comprehensive investigation of youth basketball players physical and technical level of training and the ability of an item, so in the need to make the corresponding weights of each index, in order to better evaluate every levels of the teenager athletes for the future focus on the development of competitive ability and make up for weak technology provide a reference basis. The process of iteration of any particle in each generation of the PSO algorithm is shown in Figure 3.

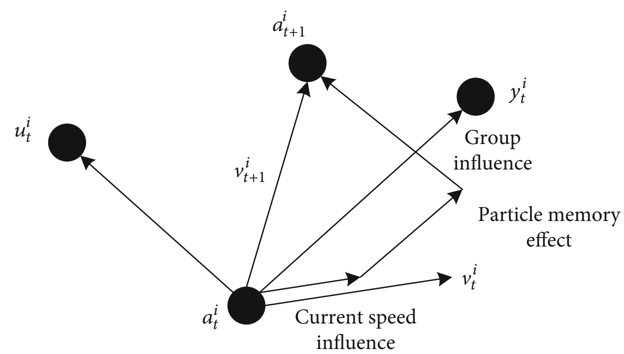

Figure 3: Particle iterative process.

According to Figure 3, from the perspective of sociology, the velocity iteration formula, the first represents the particle's trust in the current state of its motion, which is affected by the previous speed. The position of the particle and its distance from the optimal position jointly affect the second part. The second part can be classified into the category of cognition, which can reflect the thinking of the particle, that is, the part where the particle's motion comes from its own experience. The distance between the particle's current position and its local or global optimal position determines the third part, and is the "Social" part, which represents information sharing and mutual cooperation between particles. That is, the motion of a particle is derived from the part of the experience of other particles in the group.

3.2. Building a Youth Basketball Training Performance Evaluation Model. In order to realize the evaluation of youth basketball training performance, this paper uses the PSO algorithm to build a youth basketball training performance evaluation model. The construction environment of the model is as follows: basketball evaluation system is a yardwork to measure athletes' training results in a certain period of time, which plays an important role in improving athletes' level. Therefore, the establishment of high-quality performance evaluation model has important guiding significance for coaches and young athletes' daily training. The theoretical basis is that the improvement of teenagers' basketball training results is a repeated and long-term cycle process, and teenagers can only improve their own ability through continuous diagnosis and improvement. The establishment of youth basketball training performance evaluation model is an accelerator in the process of performance improvement, which plays a role of diagnostic feedback in the whole process. Feedback is proposed through diagnosis, and then diagnosis feedback, and so on. The training evaluation model based on the real scores of youth years plays an important role in the improvement of scores. In addition, the evaluation model is also of great significance to the coaching ability of coaches and the management of decision makers.

The optimization problem of youth basketball training performance evaluation is a combinatorial optimization problem with nonlinear constraints. The specific formula is as follows:

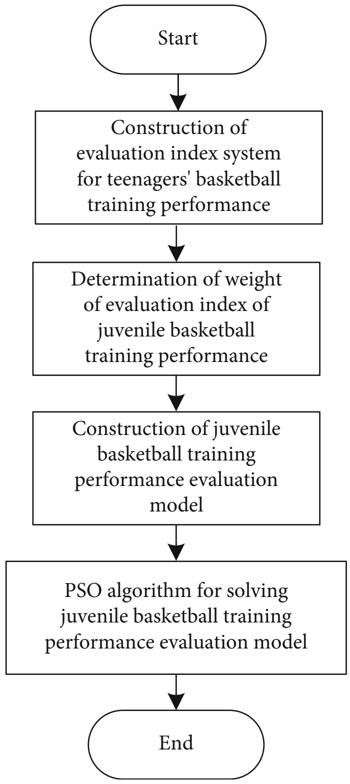

Figure 4: Flow chart of youth basketball training performance evaluation.

Table 3: The parameter values of the particle swarm optimization algorithm.

Parameter	Value
Acceleration factor	2
Particle size	20
Maximum speed	0.01
The maximum number of iterations	100

Table 4: Weights of youth basketball training performance evaluation index system.

First-level indicator	Weights
Basic technology	0.54
Athletic quality	0.46

$$\min_{k\in K} f(k) \quad s.t.\begin{cases} g_i(k) \le 0, i = 1, 2, \cdots, \alpha \\ h_j(k) \le 0, j = 1, 2, \cdots, \beta. \end{cases} \tag{10}$$

Of which,

$$k = (k_1, k_2, \cdots, k_m)^T \in R^m. \tag{11}$$

In formulas (10) and (11), k is a m-dimensional vector, $f(k)$ is a function of k, and the optimization problem is the solution when the objective function $f(k)$ takes a minimum value. Inequality constraints and equality constraints can be expressed by $g_i(k)$ and $h_j(k)$, respectively, and their specific quantities can be expressed as α and β.

The optimization problem of youth basketball training performance evaluation is a quantitative optimization, allowing constraint deviation within a certain range, and the equation constraint can be transformed into an inequality within a certain deviation for processing:

$$\left|h_j(k)\right| - \chi_j \le 0. \tag{12}$$

In formula (12), χ_j is the constraint offset of the j equality constraint. Therefore, the optimization problem can be further transformed into the following formula:

$$\min_{k\in K} f(k) \quad s.t. g'_\delta(k) \le 0, i = 1, 2, \cdots, 2\beta + \alpha. \tag{13}$$

The vector $G = (G_1, G_2, \cdots, G_\iota)$ represents the standard deviation rate of the ι youth basketball training performance evaluation index. Let $H(g), g = (g_1, g_2, \cdots, g_\iota) \in R^m$ be the joint distribution function of the random vector G, and let $\varepsilon = IG = (IG_1, IG_2, \cdots, IG_\iota)$ be the mean vector of G. $(\phi_{ij})^\iota_{i,j=1}$ is the variance-covariance matrix of G, where $\phi_{ij} = I(G_i - \varepsilon_i)(G_j - \varepsilon_j)$ is the covariance of G_i and G_j. The distribution of various youth basketball training performance evaluation indicators is a vector $S = (s_1, s_2, \cdots, s_\iota)$, and the mean-variance optimal evaluation combination model is proposed:

$$\min I(SG) = S\varepsilon \quad s.t. \mathrm{Var}(SG) = S\sum S \le \varphi \quad s_\iota^{(\eta)} \ge 0, \sum_{\iota=1}^{\omega} s_\iota^{(\eta)} = 1, \iota = 1, 2, \cdots, 10. \tag{14}$$

In the youth basketball training performance evaluation model, $G_\iota^{(\eta)} = \gamma_\iota^{(\eta)}/\gamma'^{(\eta)}_\iota - 1$ is used to represent the deviation rate of reaching the standard of item ι in year η. The data of the η year is used for analysis, and the vector $G^{(\eta)} = (G_1^{(\eta)}, G_2^{(\eta)}, \cdots, G_{10}^{(\eta)})$ is used to represent the deviation rate of the 10 youth basketball training performance evaluation indicators in the η year. Estimate the mean vector and variance-covariance matrix [24–26]:

$$\kappa = \frac{1}{\lambda}\sum_{\eta=1}^{\lambda} G^{(\eta)}, \tag{15}$$

$$\mu = \frac{1}{\lambda}\sum_{\eta=1}^{\lambda}\left(G^{(\eta)} - \kappa\right)\left(G^{(\eta)} - \kappa\right). \tag{16}$$

In formula (15), λ is the estimated value of the mean vector. Let G_ι be the standard deviation rate of item ι, the youth basketball training performance evaluation model can be expressed as follows:

$$\min f(k) = \sum_{i=1}^{10} G_\iota \times s_\iota$$
$$s.t. S\phi = \sum_{\iota=1}^{10}\sum_{j=1}^{10} s_\iota s_j \phi_{ij} \le \varphi \tag{17}$$
$$s_\iota^{(\eta)} \ge 0,\ \sum_{\iota=1}^{\omega} s_\iota^{(\eta)} = 1, \iota = 1, 2, \cdots, 10.$$

In formula (17), the risk threshold φ is calculated through historical data analysis, and $\varphi \in [0.088, 0.14]$ can be obtained. The objective function is optimized by using the PSO algorithm, and the evolution is stopped until the end condition is satisfied, and the optimal distribution ratio relationship s_ι of the evaluation of youth basketball training performance is obtained. Then, use the following function to get the youth basketball training score that can guarantee the quality of the evaluation, expressed by the following function:

$$\max \nu(s) = \left(\sum_{\iota=1}^{\omega} \frac{\gamma_\iota^{(\eta)} + sum^{(\eta)} \times s_\iota}{\nu_\iota^{(\eta)}} \times \xi_\iota - (\nu - \nu_1) \right). \tag{18}$$

In formula (18), the independent variable is s_ι, that is, the decision variable, and the function $\nu(s)$ is the score of youth basketball training. ι is the evaluation index of $W\iota$ youth basketball training performance, and $\gamma_\iota^{(\eta)}$ is the original basic performance value of the youth basketball training performance evaluation index of item ι in year η. $\text{sum}^{(\eta)}$ is the total score of youth basketball training in the η year, and s_ι is the ratio of the performance value assigned to the ι youth basketball training performance evaluation index obtained by optimizing the objective function through the PSO algorithm to the total youth basketball training score $\text{sum}^{(\eta)}$. ξ_ι is the weight of the influence of the ι youth basketball training performance evaluation index on the excellent results of performance evaluation. $\nu_\iota^{(\eta)}$ is the number of standard scores a teenager should have in item ι in year η. The number of youths is represented as ν, and the number of youths that join in basketball training is represented as ν_1.

Aiming at the actual distribution of the actual youth basketball training numbers and various youth basketball training performance evaluation indicators, the optimization problem of youth basketball training performance evaluation is formally described. The main constraint functions of the comprehensive youth basketball training performance evaluation optimization problem include the following:

$$s.t. S\phi = \sum_{\iota=1}^{10}\sum_{j=1}^{10} s_\iota s_j \phi_{ij} \le \varphi. \tag{19}$$

Proportional constraints for various youth basketball training performance evaluation indicators are as follows:

$$s_\iota^{(\eta)} \ge 0,\ \sum_{\iota=1}^{\omega} s_\iota^{(\eta)} = 1, \iota = 1, 2, \cdots, 10. \tag{20}$$

3.3. *Solving the Evaluation Model of Youth Basketball Training Performance.*

On the basis of constructing the youth basketball training performance evaluation model above, the particle swarm optimization algorithm can be used to find the optimal solution of the model. Combined with the characteristics and advantages of particle swarm optimization algorithm, it is a swarm intelligence algorithm that is very suitable for solving the above problem.

First, a random training performance parameter is used as the dimension of each particle in the PSO algorithm, and the value range of each dimension is determined according to the constraint relationship formula (20) in the actual situation. Then, with reference to the determined number of dimensions and the range of each dimension, the position and speed of every particle can be initialized and set randomly. Then, the global or local extremum gbest and individual extremum pbest can be obtained, respectively, based on the fitness function determined by the actual problem, and then, the particles are updated according to the evolution formulas (5) and (6) of the PSO algorithm, respectively. The POS algorithm can be terminated when the number of population iterations is fixed or the fitness function meets the lower limit condition. Among them, the global extremum gbest is the optimal solution, and the optimal value is the value of the fitness function.

The specific execution steps of the PSO algorithm are as follows:

Step 1. Initialize the random speed and position of particle swarm. A particle has 10 dimensions, and each dimension represents an evaluation index of youth basketball training performance.

Step 2. Combined with the location of the particle and the fitness function, the fitness function value of each particle can be calculated, and the new position of the particle can be defined by POS algorithm.

Step 3. Using the previous step, the fitness value of each particle and the fitness value of u_i optimal position are compared and analyzed. If the former is better, the particle fitness value can be regarded as the current optimal position pbest.

Step 4. The fitness values of each particle and the global optimal position y_i are compared and analyzed. If the former is better, it can be regarded as the location gbest of global optimal solution of particle swarm optimization.

Step 5. Evolve the velocity and position of the particle according to the evolution equation.

Table 5: The evaluation level standard of youth basketball training performance.

First-level indicator	Grade standard A <10%	B 10%-25%	C 25%-75%	D 75%-90%	E >90%
Basic technology	6.28-7.74	4.73-3.96	3.35-2.76	2.75-1.38	<1.38
Athletic quality	3.72-1.26	3.27-3.04	2.65-2.24	1.75-0.62	<0.62
Total score	10-9	8-7	6-5	4-2	<2

Table 6: The results of evaluation level of youth basketball training performance.

Subject	Basic technology	Athletic quality	Overall review
1	A	A	A
2	B	B	B
3	B	A	A
4	A	A	A
5	A	C	B
6	C	A	B
7	A	B	A
8	A	B	A

Step 6. The iteration can be ended when the adaptive value is good or achieved the maximum algebraic D_{max}. If the ending requirements are not met, it need to return to Step 2 and perform operations in sequence.

Combined with the above operation process, it can effectively evaluate the performance of youth basketball training. The evaluation process of youth basketball training performance is shown in Figure 4.

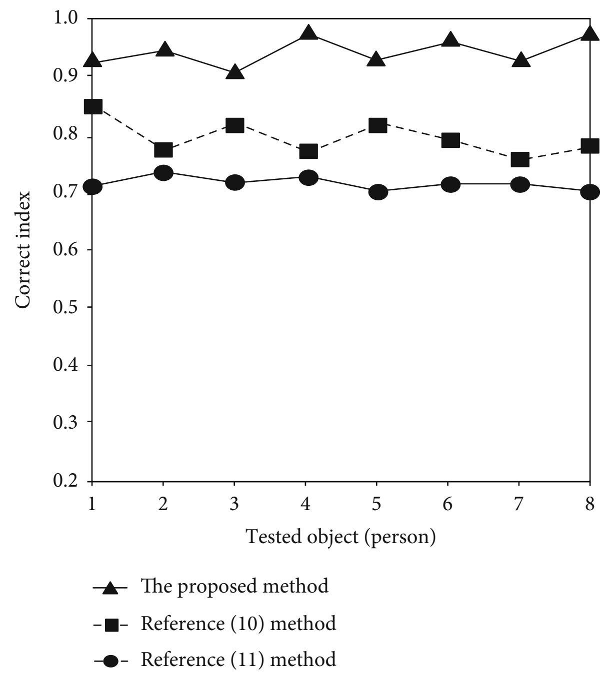

Figure 5: Comparison results of correct indices for youth basketball training performance evaluation with different methods.

4. Experimental Analysis

The following mainly verifies the effectiveness and practicability of the algorithm in this research. According to the above evaluation model, taking a youth basketball team as the research object, the expert consultation questionnaire was implemented to verify the application effect of the PSO algorithm in the evaluation model of youth basketball training performance. The MATLAB simulation software is used as the experimental platform, and Windows 7 is used as the operating system. In the PSO algorithm, the number of iterations is specified and a threshold is given. Once the solution within the standard range is reached, the iteration stops automatically; otherwise, the number of iterations is completed to avoid falling into the local optimum problem. After many experiments and comparisons, the parameter values of particle swarm optimization algorithm are shown in Table 3.

According to the statistical results of the expert consultation questionnaire, it can finally get the weight of the evaluation index system of youth basketball training performance by using the analytic hierarchy process to calculate the process and calculating and analyzing through the mathematical method. The weight calculation results are shown in Table 4.

In this study, the percentile method was used to establish a grading standard for the evaluation of youth basketball training performance, as shown in Table 5.

In this study, a total of 8 members of the youth basketball team were set as the test and evaluation objects, the evaluation data of youth basketball training performance was collected by on-site measurement. According to the evaluation standard of youth basketball training performance, the grades were divided and scored, and finally, the evaluation results of youth basketball training performance were obtained. The specific results are as follows.

According to Table 6, among the 8 subjects, 5 were rated as A, 2 were rated B, and only 1 was rated C. There are 4 people who are rated A for sports quality performance, 3 people are B, and only 1 person is C. There are 5 students who are rated as A and 3 who are rated as B in their overall youth basketball training performance. To sum up, the test results show that youth basketball training has good training results and should continue to be maintained, while continuing to seek breakthroughs in explosive power and bounce.

On this basis, this study also verifies the validity of the training performance evaluation of the proposed algorithm

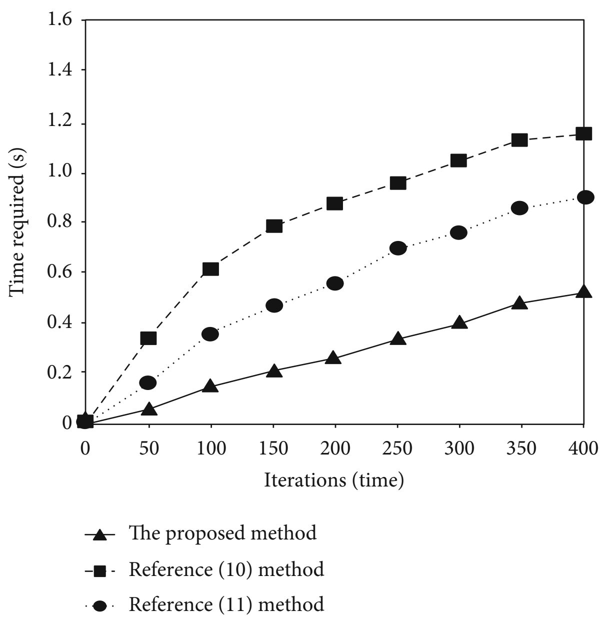

Figure 6: Comparison results of time required for evaluation of youth basketball training performance with different methods.

and defines the evaluation index according to the correct index. The size of the correct index is positively correlated with the validity of the evaluation algorithm in this study.

$$\tau = 1 - \left(\upsilon_x + \upsilon_y\right). \tag{21}$$

In formula (21), υ_x is the false negative rate and υ_y is the false positive rate. Through the comparative study of this research method and the methods in reference [10] and reference [11], the correct indicators of basketball training performance evaluation under different algorithms are analyzed.

According to Figure 5, when there were 8 subjects, the mean value of the correct index in the evaluation of adolescent basketball training results in the method of reference [10] was 0.82, and the mean value of the correct index in the evaluation of adolescent basketball training results in the method of reference [11] was 0.71. However, the average value of the correct index for the evaluation of youth basketball training results by the proposed method is as high as 0.96. It can be seen that the evaluation accuracy index of the proposed method is higher, indicating that the evaluation accuracy of the proposed method is higher.

The time needed to further verify the proposed method to evaluate the scores of youth basketball training. The method in reference [10], the method in reference [11], and the proposed method are, respectively, used for comparison, and the comparison results of the time required for evaluation of youth basketball training results by different methods are shown in Figure 6.

According to Figure 6, as the number of iterations increases, the time required for evaluation of youth basketball training results by different methods increases. When the number of iterations is 400, it takes 1.18 s for the evaluation of the youth basketball training result of the method in reference [10] and 0.9 s for the evaluation of the youth basketball training result of the method in reference [11], while it takes only 0.52 s for the evaluation of the youth basketball training result of the proposed method. Therefore, it can be seen that the time required for evaluation of youth basketball training results under the proposed method is relatively short.

To sum up, the PSO algorithm-based evaluation model of adolescent basketball training scores enables adolescents to have good training scores, and the mean value of the correct evaluation index of the training scores is as high as 0.96. The evaluation of adolescent basketball training scores by the proposed method has high authenticity. The evaluation time is only 0.52 s, and the model has good performance.

5. Conclusion

The evaluation model of youth basketball training performance designed in this study gives full play to the advantages of POS algorithm, builds up the evaluation index system based on the construction principle, and determines the weight of the evaluation index. The PSO algorithm is used to construct a youth basketball training performance evaluation model and solve it. The method can greatly enhance the authenticity of youth basketball training performance evaluation and shorten the evaluation time of youth basketball training performance, and the evaluation results have good youth basketball training performance. But this paper only considers 10 indicators in the indicator system for research. Therefore, in the following research, how to carry out detailed analysis and research according to the complex actual situation has great research value and prospect.

Data Availability

The authors can provide all the original data involved in the research.

Conflicts of Interest

The authors indicate that there was no conflict of interest in the study.

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