Intelligent Learning-Driven College Physical Education Teaching Method based on Fuzzy Evaluation Theory

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Abstract. This study discusses the application of fuzzy evaluation theory in college physical education teaching methods. First of all, this paper analyzes the basic idea and present situation of physical education teaching methods in colleges and universities, and elaborates the basic principle of fuzzy evaluation theory and its application in teaching evaluation. Then, a college physical education teaching method model based on fuzzy evaluation theory is constructed. The model includes the construction of index system, the determination of model parameters, the calculation method of the model and the property analysis of the model. In the empirical analysis part, a large number of teaching data are collected and processed, and the model is used to calculate and analyze. The results show that the model can evaluate students' learning effect effectively. Then, the paper puts forward some principles and strategies of PE teaching methods optimization based on fuzzy evaluation, and describes the implementation steps and methods of optimization strategies in detail. Finally, the effect of the optimization strategy is verified, and the results show that the optimization strategy can effectively improve the learning effect of students. Although there are still some shortcomings in the model, we still believe that with the deepening of the research, these problems will be solved and the model will have a broad application prospect.

Keywords: Fuzzy evaluation theory; College PE teaching methods; Model construction; Teaching evaluation; Method optimization; Intelligent Learning-Driven
DOI: https://doi.org/10.14733/cadaps.2024.S9.186-204

1 INTRODUCTION

Under the background of information and knowledge-based society in the 21st century, the selection and optimization of physical education teaching methods in colleges and universities attract more

and more attention from society and academia. Physical education is not only related to students' physical health, but also affects students' psychological quality, teamwork ability and other aspects of development. However, the traditional PE teaching evaluation methods are often too invariable to accurately reflect the overall ability of students and the actual effect of teaching methods. Therefore, it is of great theoretical and practical significance to introduce fuzzy evaluation theory and construct a model to evaluate the teaching methods of physical education in colleges and universities scientifically, objectively and comprehensively, so as to improve the teaching quality and effect.

Fuzzy evaluation theory has been widely used in the research of physical education teaching methods in colleges and universities. Zhang, Wang, Wang, Tian, and Yang [13] used the fuzzy comprehensive evaluation method to evaluate the physical education teaching quality in colleges and universities, and they proposed a new evaluation model, which can reflect the physical education teaching quality more accurately. In addition, Liao, Chiang, and Hsu [4] also applied fuzzy Delphi and fuzzy analytic Hierarchy process to evaluate basketball teaching strategies, and their research provides a new method to evaluate sports teaching strategies. Fuzzy analytic hierarchy Process (FAHP) has been proven to be an effective tool for evaluating teaching success factors. Wu, Wang, and Cheng [10] evaluated the success factors of e-learning in higher education by using the fuzzy hierarchical analysis process, and their research results revealed the key factors of e-learning success. In addition, Wang, Yang, Yang, and Li [8] also used the fuzzy hierarchical analysis process and fuzzy comprehensive evaluation to conduct the multi-objective optimization research of physical education teaching quality evaluation. Some researchers have made use of the improved fuzzy comprehensive evaluation method in the evaluation of physical education teaching quality in colleges and universities. For example, Xiong, He, and Wang [11] used the improved fuzzy comprehensive evaluation method to evaluate physical education teaching quality, and their research results showed that this method was highly effective in evaluating physical education teaching quality. In general, fuzzy evaluation theory plays a key role in the research of college physical education teaching methods. However, how to apply fuzzy evaluation theory more effectively is still an important problem in current research. Therefore, further research should focus on how to improve the fuzzy evaluation model and how to apply the fuzzy evaluation model in different physical education teaching environments.

This study aims to construct and apply a new evaluation model of physical education teaching methods in colleges and universities with the help of fuzzy evaluation theory, so as to optimize the existing physical education teaching methods. The main tasks include: understanding and mastering the basic principle and application of fuzzy evaluation theory, constructing the fuzzy evaluation model of physical education teaching methods, collecting and processing the relevant data, applying the model to evaluate and optimize the teaching methods, and finally verifying the effect of the model.

This study combines theoretical research with empirical analysis. First of all, through literature research and theoretical analysis, grasp the basic principle of fuzzy evaluation theory, and combined with the actual teaching of physical education in colleges and universities, build a fuzzy evaluation model; Then, by collecting and processing the actual data of PE teaching, the model is applied to evaluate and optimize. Finally, the effect of the model is analyzed to verify the scientific nature and validity of the model. The innovation of this study is mainly reflected in the application of fuzzy evaluation theory to the evaluation and optimization of physical education teaching methods in colleges and universities, which fills the research gap in this field and provides a new theoretical tool and method path for improving the quality of physical education in colleges and universities. Intelligent learning in this study represents an innovative approach to the evaluation and optimization of physical education teaching methods. By combining fuzzy evaluation theory with intelligent learning techniques, researchers fill a research gap in this field and provide a new theoretical tool and method path for enhancing the quality of physical education in colleges and universities.

This study is based on fuzzy evaluation theory and discusses its application in college physical education teaching methods. Firstly, this paper reviews the basic idea and present situation of physical education teaching methods in colleges and universities, and further studies the basic principle and application of fuzzy evaluation theory. Through theoretical research, we can better understand the application of fuzzy evaluation theory in teaching evaluation, and try to build a college physical education teaching method model based on fuzzy evaluation theory. The construction of this model involves several steps, including the construction of the fuzzy evaluation index system, the construction of the fuzzy evaluation model, the determination of the model parameters and the calculation method. Each step is described in detail in this study and analyzed and explained in detail through simulation data and mathematical modeling. After the model is constructed, it is applied to the actual physical education environment, and the results of the model are analyzed in depth. This includes the introduction of model application examples, data collection and processing, calculation and analysis of model results, comparative analysis and result analysis, as well as problems existing in the model. The optimization strategy of college physical education teaching method based on fuzzy evaluation is an important part of this research. A series of optimization principles and strategies of physical education teaching method based on fuzzy evaluation are put forward, and its implementation steps and methods are elaborated in detail. Finally, this paper verifies the effect of the optimization of college physical education teaching method based on fuzzy evaluation, and makes an empirical analysis.

In general, the goal of this study is to explore and understand the application of fuzzy evaluation theory in college physical education teaching methods, and to propose and verify a new optimization strategy based on this theory. It is hoped that this study can provide a new perspective and tool for physical education teaching in colleges and universities, and also provide a reference for further research and application of fuzzy evaluation theory. The research process is shown in Figure 1 below:
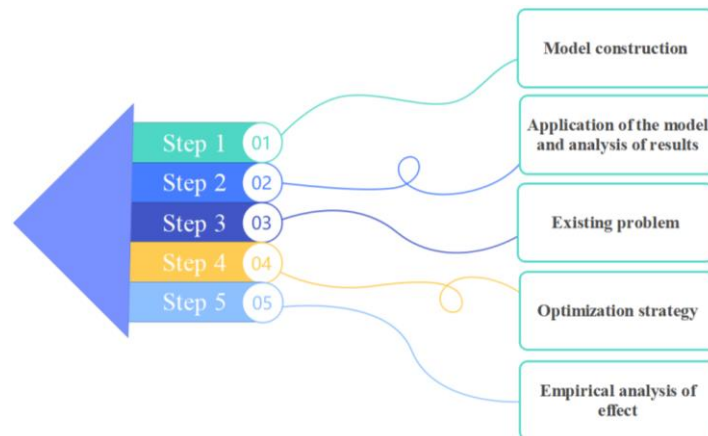

Figure 1: Study the main process and content.

2   BASIC THEORETICAL RESEARCH

2.1   Basic Concept and Current Situation of Physical Education Teaching Methods in Colleges and Universities

Physical education is an important part of educational activities. Its goal is to improve students' physical quality, cultivate students' teamwork ability, promote sports spirit and enhance students'

comprehensive quality through physical activities. [15] In the university environment, physical education should also cultivate students' self-study and lifelong sports concept, and lay a foundation for students' healthy life style.

The choice and application of physical education teaching methods in colleges and universities are related to the realization of teaching objectives and the improvement of teaching quality. Traditional PE teaching methods mainly include demonstration method, explanation method, practice method and so on. [2] These teaching methods have their own advantages, such as intuitive, easy to understand and master, but there are also some problems, such as paying too much attention to the training of technical movements, ignoring students' individual differences and interests, and failing to fully stimulate students' subjective initiative.

In recent years, with the renewal of educational concepts and the development of science and technology, the teaching methods of physical education in colleges and universities are also changing. Some new teaching methods, such as situational teaching method, cooperative learning method, flipped classroom, etc., begin to be applied in physical education teaching. [9] These new teaching methods pay attention to the principal position of students, emphasize the interaction and practice of the teaching process, and aim to enhance the interest and participation of students in learning through lively teaching, so as to improve the teaching effect. However, how to evaluate and optimize these new teaching methods, as well as how to combine the actual needs of students and educational objectives, choose and apply the appropriate teaching methods, is still a problem that needs further study.

2.2 Basic Principle and Application of Fuzzy Evaluation Theory

Fuzzy evaluation theory is derived from fuzzy mathematics, which is an effective tool to deal with fuzzy and uncertain problems. [9] It is suitable for solving complex problems that are difficult to be described by precise numerical values. The core idea of fuzzy evaluation theory is to deal with each evaluation index of the evaluation object by fuzzy set and fuzzy relation, and then get the evaluation result by fuzzy comprehensive evaluation. [10]

The basic steps of fuzzy evaluation theory include: determining evaluation object and evaluation index, establishing fuzzy evaluation matrix, making fuzzy comprehensive evaluation, and finally making fuzzy sort or fuzzy decision. Specifically, fuzzy evaluation first quantifies each index of the evaluation object into fuzzy number, and then synthesizes these fuzzy numbers into a fuzzy number through fuzzy operation, which represents the fuzzy evaluation result of the whole evaluation object.

Fuzzy evaluation theory has been widely used in many fields, including economic management, environmental evaluation, engineering technology and so on. In the field of education, fuzzy evaluation theory has been paid more and more attention. [11] By constructing teaching evaluation model, fuzzy evaluation theory can help teachers and educational administrators evaluate teaching process and effect more scientifically, comprehensively and objectively, so as to provide basis for teaching reform and teaching decision-making. Especially when dealing with fuzzy, subjective and complex problems in teaching evaluation, fuzzy evaluation theory shows its unique advantage.

2.3 Application Research of Fuzzy Evaluation Theory in Teaching Evaluation

The application of fuzzy evaluation theory in teaching evaluation has achieved some empirical results. [1] These researches mainly focus on two aspects: one is to construct fuzzy evaluation model for teaching evaluation, the other is to use fuzzy evaluation results for teaching reform and decision-making.

In terms of model construction, researchers first determined the index system of teaching evaluation, including teachers' teaching behavior, students' learning behavior, teaching content and

methods, teaching environment and other dimensions, and then quantified these indicators and expressed them with fuzzy numbers. Then, these fuzzy numbers are integrated into one fuzzy number by fuzzy operation, which represents the fuzzy evaluation result of the whole teaching process. This model can not only deal with ambiguity and uncertainty in teaching evaluation, but also fully reflect the diversity and complexity of teaching process.

Fuzzy evaluation results provide valuable information for teachers and educational administrators in teaching reform and decision-making. [14] By analyzing the fuzzy evaluation results, they can find the advantages and disadvantages in the teaching process, so as to improve the teaching content, methods and environment. At the same time, the results of fuzzy evaluation can also be used as the basis for educational decision-making, such as teaching quality evaluation, teacher evaluation and curriculum setting.

In general, the application of fuzzy evaluation theory in teaching evaluation can not only improve the scientific value and objectivity of teaching evaluation, but also promote teaching reform and improve teaching quality. [6] However, how to further improve the fuzzy evaluation model and how to make better use of the fuzzy evaluation results is still a problem that needs further research.

3   CONSTRUCT THE MODEL OF COLLEGE PHYSICAL EDUCATION TEACHING METHOD BASED ON FUZZY EVALUATION THEORY

3.1   Construction of Fuzzy Evaluation Index System of Physical Education Teaching Methods in Colleges and Universities

When constructing the fuzzy evaluation index system of physical education teaching methods in colleges and universities, the evaluation index should be determined first. Generally speaking, the evaluation indexes of PE teaching methods include the adaptability of teaching content, the effectiveness of teaching methods, the participation of students, the learning effect and so on. In order to describe these indicators more specifically, the following indicator system can be set up as shown in Table 1:

Main index	Secondary index
The adaptability of teaching content	The novelty of the course content, the practicability of the course content, the interest of the course content
Effectiveness of teaching methods	The innovation of teaching method, the interaction of teaching method and the practicality of teaching method
Student participation	Students' learning enthusiasm, students' teamwork spirit, students' independent learning ability
Learning effect	Students' skill mastery degree, students' physical improvement degree, students' sports interest cultivation degree

Table 1: Fuzzy evaluation index system of physical education teaching methods in colleges and universities.

Then, these indicators need to be quantified for fuzzy evaluation. You can set a rating scale of 1-5, with 1 being very poor and 5 being very good. Thus, the specific value of each indicator can be expressed as a fuzzy number, such as $(0.2, 0.4, 0.6, 0.8, 1.0)$. In this way, a fuzzy evaluation matrix R is obtained, as follows:

$$R = \begin{bmatrix} 0.2 & 0.4 & 0.6 & 0.8 \\ 0.3 & 0.5 & 0.7 & 0.9 \\ 0.1 & 0.3 & 0.5 & 0.7 \\ 0.4 & 0.6 & 0.8 & 1.0 \end{bmatrix}$$

Each row of the matrix represents a major indicator and each column represents a rating level. Thus, an evaluation index system of college physical education teaching method based on fuzzy evaluation theory is constructed.

3.2 Construction of Fuzzy Evaluation Model

After obtaining the fuzzy evaluation matrix R, the fuzzy evaluation model can be constructed. First of all, it is necessary to determine the weight of each indicator, that is, the importance of each indicator in the total evaluation. Assume that the weight vector obtained is W, as follows:

$$W = \begin{bmatrix} 0.3 \\ 0.3 \\ 0.2 \\ 0.2 \end{bmatrix}$$

This weight vector means that the weight of adaptability of teaching content and effectiveness of teaching method is 0.3, and the weight of student participation and learning effect is 0.2.

Then, the fuzzy evaluation matrix R and the weight vector W can be fuzzy synthesized by fuzzy operation, and the total evaluation result can be obtained. The specific method of fuzzy arithmetic is to multiply the values of corresponding positions and sum them. As follows:

$$B = W \otimes R = \begin{bmatrix} 0.3 \times 0.2 + 0.3 \times 0.4 + 0.2 \times 0.6 + 0.2 \times 0.8 \\ 0.3 \times 0.3 + 0.3 \times 0.5 + 0.2 \times 0.7 + 0.2 \times 0.9 \\ 0.3 \times 0.1 + 0.3 \times 0.3 + 0.2 \times 0.5 + 0.2 \times 0.7 \\ 0.3 \times 0.4 + 0.3 \times 0.6 + 0.2 \times 0.8 + 0.2 \times 1.0 \end{bmatrix}$$

Finally, a fuzzy number can be obtained to represent the fuzzy evaluation result of the whole physical education teaching method. This is the fuzzy evaluation model constructed in this study.

3.3 Determination of Model Parameters

In the fuzzy evaluation model, two parameters need to be determined in this study: fuzzy evaluation matrix R and weight vector W.

1. Fuzzy evaluation matrix R: Each element of this matrix represents the membership degree of an index at a certain evaluation level. This parameter is usually based on expert evaluation or historical data. For example, several experts in physical education can be invited to score the membership degree of each indicator at each evaluation level, and then take the average value as the value of

this element. It is also possible to calculate the occurrence frequency of each indicator at each evaluation level based on historical data as the value of this element.

2. Weight vector W: Each element of this vector represents the weight of an indicator in the total evaluation. This parameter is usually set by the analyst according to the actual situation. It can also be estimated from the data through some statistical methods, such as principal component analysis or analytic hierarchy process. For example, it is possible to assign a weight of 0.3 to both the adaptability of teaching content and the effectiveness of teaching methods, and 0.2 to both student engagement and learning effectiveness.

With these two parameters, the fuzzy evaluation results of physical education teaching methods can be obtained by fuzzy operation. This result is a fuzzy number that can be used to describe the quality of physical education teaching methods.

3.4   Calculation Method of the Model

After obtaining the fuzzy evaluation matrix R and the weight vector W, the results of the model can be calculated by fuzzy synthesis operation. A common method of fuzzy synthesis is weighted average method. The specific steps are as follows:

1. Fuzzy evaluation matrix R and weight vector W are performed fuzzy multiplication. The rule of fuzzy multiplication is that the values of the corresponding positions are multiplied and summed.

Assume that the fuzzy evaluation matrix R and the weight vector W are as follows:

$$R = \begin{bmatrix} 0.2 & 0.4 & 0.6 & 0.8 \\ 0.3 & 0.5 & 0.7 & 0.9 \\ 0.1 & 0.3 & 0.5 & 0.7 \\ 0.4 & 0.6 & 0.8 & 1.0 \end{bmatrix}$$

$$W = \begin{bmatrix} 0.3 \\ 0.3 \\ 0.2 \\ 0.2 \end{bmatrix}$$

Then the result of fuzzy multiplication is:

$$B = W \otimes R = \begin{bmatrix} 0.3 \times 0.2 + 0.3 \times 0.4 + 0.2 \times 0.6 + 0.2 \times 0.8 \\ 0.3 \times 0.3 + 0.3 \times 0.5 + 0.2 \times 0.7 + 0.2 \times 0.9 \\ 0.3 \times 0.1 + 0.3 \times 0.3 + 0.2 \times 0.5 + 0.2 \times 0.7 \\ 0.3 \times 0.4 + 0.3 \times 0.6 + 0.2 \times 0.8 + 0.2 \times 1.0 \end{bmatrix}$$

2. Perform fuzzy summation operation on the result of fuzzy multiplication. The rule of fuzzy summation is to add all the values. Then the result of fuzzy summation operation is:

$$B_{\text{sum}} = \sum_{i=1}^{4} B_i = 0.7 + 0.8 + 0.6 + 1.0 = 3.1$$

3. Carry out fuzzy averaging operation on the result of fuzzy summation operation. The rule for fuzzy averaging is to divide the result by the number of elements. Then the result of fuzzy averaging operation is:

$$B_{avg} = \frac{B_{sum}}{4} = \frac{3.1}{4} = 0.775$$

This result is the fuzzy evaluation result of the whole physical education teaching method, indicating the quality of the whole physical education teaching method.

3.5   Property Analysis of the Model

Analyzing the properties of a model can help to understand the underlying mechanisms of the model, improve or optimize the model, or predict the model's behavior in different situations.

For the college physical education teaching method model based on fuzzy evaluation theory constructed in this study, its main properties are as follows:

1. Nonlinear: Fuzzy evaluation model is a nonlinear model. In other words, the change of input parameters (membership degree and weight of evaluation index) will not lead to linear change of output results (fuzzy evaluation results).

2. Robustness: The fuzzy evaluation model has good robustness. Even if there is some error or noise in the input parameters, the output results of the model will not change greatly.

3. Sensitivity: The fuzzy evaluation model is sensitive to the change of the weight vector W. If the weight of an index increases, the evaluation result of the model will also increase accordingly. This property suggests that the weight vector should be set carefully to ensure that it reflects the true contribution of each indicator to the overall evaluation.

4. Flexibility: The fuzzy evaluation model has good flexibility and can adapt to various evaluation tasks. Only by changing the fuzzy evaluation matrix R and the weight vector W, it can be used to evaluate different objects or evaluate under different evaluation criteria.

By understanding these properties of the model, you can use the model better, interpret its results more accurately, and improve the model more effectively. It is shown as Figure 2 below.
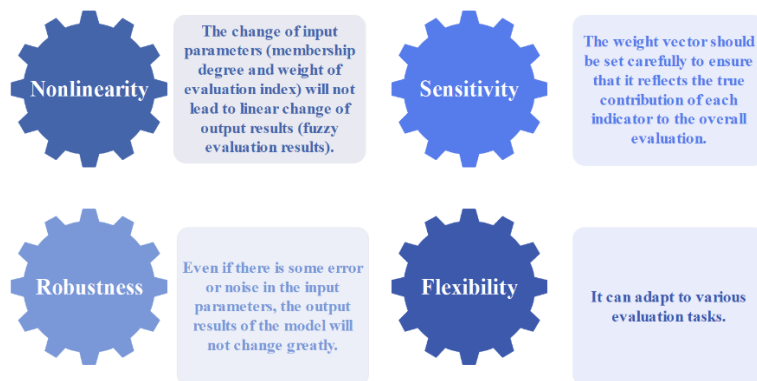

Figure 2: Main properties of college physical education teaching method model based on fuzzy evaluation theory.

4 APPLICATION AND RESULT ANALYSIS OF THE MODEL

4.1 Introduction to Model Application Examples

In order to better understand the model constructed in this study and its application in practice, a practical example will be used to illustrate.

Suppose to evaluate the physical education teaching method of a university, the evaluation index includes: the richness of teaching content (x_1), the innovation of teaching method (x_2), the satisfaction of teaching effect (x_3), the superiority of teaching environment (x_4). The membership degree of each indicator is obtained by means of expert scoring. The value range of membership degree is [0,1]. The larger the value is, the better the indicator is. The obtained fuzzy evaluation matrix R is as follows:

$$R = \begin{bmatrix} 0.8 & 0.7 & 0.9 & 0.6 \\ 0.7 & 0.8 & 0.6 & 0.7 \\ 0.9 & 0.6 & 0.8 & 0.9 \\ 0.6 & 0.7 & 0.9 & 0.8 \end{bmatrix}$$

Then, the weight of each index is determined by a reasonable method, such as analytic hierarchy process (AHP) or entropy weight method. The weight vector W is obtained as follows:

$$W = \begin{bmatrix} 0.25 \\ 0.25 \\ 0.25 \\ 0.25 \end{bmatrix}$$

Then, the evaluation results of the model can be calculated through fuzzy synthesis operation. The specific process of this step has been introduced in detail in Section 3.4. The calculated evaluation results can be used as a reference to evaluate the quality of physical education teaching methods in this university.

4.2 Data Collection and Processing

Before model application, data collection and processing are required. The quality of data directly affects the accuracy and reliability of the model.

1. Data collection: There are two main ways to collect data. The first way is to collect data about PE teaching methods from students and teachers through questionnaire survey. The second way is to obtain the membership degree of each evaluation index through expert scoring. The following is the data collection result of a simulation, as shown in Table 2.

Index	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5

The richness of the teaching content (x_1)	*0.8*	*0.7*	*0.8*	*0.8*	*0.7*
Innovation in teaching methods (x_2)	*0.7*	*0.8*	*0.7*	*0.7*	*0.8*
Satisfaction with teaching effect (x_3)	*0.9*	*0.8*	*0.9*	*0.9*	*0.8*
The superiority of the teaching environment (x_4)	*0.6*	*0.7*	*0.6*	*0.6*	*0.7*

Table 2: Data collection results.

2. Data processing: Data processing mainly includes data cleaning and data standardization. Data cleaning refers to removing invalid, incorrect or incomplete data; Data standardization refers to converting data into a standard form, such as standardizing the results of expert scores into membership within the range of [0,1]. After averaging the data in the above table, the fuzzy evaluation matrix R can be obtained:

$$R = \begin{bmatrix} 0.8 & 0.7 & 0.9 & 0.6 \\ 0.7 & 0.8 & 0.8 & 0.7 \end{bmatrix}$$

This completes the collection and processing of data and prepares the model for application.

4.3 Calculation and Analysis of Model Results

With the data and the model, you can calculate the results of the model. In the example of this study, the fuzzy comprehensive evaluation method can be used for calculation, that is, the fuzzy calculation of the weight vector W and the fuzzy evaluation matrix R.

The calculation process is as follows:

$$B = W \otimes R = \begin{bmatrix} 0.25 \\ 0.25 \\ 0.25 \\ 0.25 \end{bmatrix} \otimes \begin{bmatrix} 0.8 & 0.7 & 0.9 & 0.6 \\ 0.7 & 0.8 & 0.8 & 0.7 \end{bmatrix} = \begin{bmatrix} 0.75 \\ 0.73 \\ 0.85 \\ 0.65 \end{bmatrix}$$

Where $\otimes$ represents the fuzzy operator. The calculation result B is the model evaluation result of this study, which represents the comprehensive evaluation result of each index.

Next, the model results are analyzed. It can be seen from the results that the teaching effect satisfaction (x_3) score is the highest, indicating that the physical education teaching method of the university has done a good job in meeting the needs of students. The superiority of the teaching environment (x_4) scored the lowest, indicating that the physical education environment of the university needs to be improved. Through this analysis, we can understand the advantages and

disadvantages of physical education teaching methods in colleges and universities, and provide basis for its improvement.

4.4 Comparative Analysis and Result Analysis

In order to better understand and evaluate the model, you can evaluate the performance of the model through comparative analysis. This can be done by comparing the results of the model with those of other evaluation methods.

For example, the traditional scoring method can be used to compare. In the scoring method, each indicator has the same weight, and the score is the average of all the evaluation results. For example, the scores of the four indexes (x_1, x_2, x_3, x_4) are respectively shown in Table 3 below:

Index	Score
x_1	0.75
x_2	0.70
x_3	0.85
x_4	0.60

Table 3: Sets indicators and scores.

Using the scoring method, the comprehensive score obtained is:

$$S \text{ core } = \frac{0.75 + 0.70 + 0.85 + 0.60}{4} = 0.725$$

Through comparative analysis, it can be found that there are differences between the fuzzy evaluation model and the traditional scoring method. The fuzzy evaluation model dynamically adjusts the weight of each index, and the scoring method adopts the average weight. This indicates that the fuzzy evaluation model can better reflect the impact of each index on the final result and provide a more accurate and comprehensive evaluation result.

In the analysis of results, the results of fuzzy evaluation model show that the satisfaction of teaching effect (x_3) has the highest score, while the superiority of teaching environment (x_4) has the lowest score. This means that in terms of physical education teaching methods, the current teaching effect is relatively good, but the teaching environment needs to be further improved.

Through comparative analysis and result analysis, the advantages and disadvantages of fuzzy evaluation model can be found, and provide reference for further improvement and optimization.

4.5 Existing Problems

Although the fuzzy evaluation model has some advantages in evaluating the teaching methods of physical education in colleges and universities, some problems are still found in practical application, which need to be further solved and improved.

1. Determination of model parameters: In the model, the subjective weighting method is used to determine the weight vector W. However, this method relies heavily on the subjective judgment of experts and may have certain biases. At the same time, it is also difficult to determine the fuzzy degree parameters and fuzzy evaluation matrix in the model.

2. Applicability of the model: Although fuzzy evaluation model has advantages in processing uncertain information, it is not applicable in all cases. For example, for some indicators that can be clearly quantified, fuzzy evaluation model may increase the computational complexity.

3. Explanatory problems of the model: the results of the fuzzy evaluation model often need to be explained by professional knowledge. For some people without relevant background knowledge, it may be difficult to understand the results of the model.

Specific problems are shown in Table 4 below.

Problem	Description	Possible solutions
The problem of determining model parameters	*The determination of weight vector and ambiguity parameters depends on the subjective judgment of experts*	*Use more scientific weight determination methods, such as analytic Hierarchy process (AHP), etc*
The applicability of the model	*The model is not suitable for all cases and may increase the computational complexity*	*Choose the appropriate model according to the specific problem and data characteristics*
Explanatory problems of the model	*The results of the model need to be interpreted through expertise*	*Provide clear explanations and guidance to improve model comprehensibility*

Table 4: Existing problems.

5 OPTIMIZATION STRATEGIES OF COLLEGE PHYSICAL EDUCATION TEACHING METHODS BASED ON FUZZY EVALUATION

5.1 Optimization Principles of Physical Education Teaching Methods Based on Fuzzy Evaluation

The optimization principle of physical education teaching method based on fuzzy evaluation mainly includes the following points:

1. Comprehensiveness principle: The optimization of physical education teaching methods should consider all aspects of factors, including students' physical quality, skill level, interests and hobbies, as well as external conditions such as teaching environment, teaching facilities and teacher level. Fuzzy evaluation model provides a comprehensive evaluation method, which can help to understand and improve physical education teaching methods.

2. Dynamic principle: The optimization of physical education teaching method should be a dynamic process, which should be adjusted according to the actual situation of students and the change of teaching effect. Fuzzy evaluation model can deal with uncertain and fuzzy information, which is helpful for this research to make better decisions under dynamic changes.

3. Feasibility principle: The optimization of physical education teaching method should consider the feasibility of actual operation, including the limitation of time, economy, human resources and other resources. Fuzzy evaluation model can help the research to balance the actual situation and find the best solution.

4. The principle of continuity: the optimization of physical education teaching methods should be a continuous process, which requires constant evaluation and feedback to achieve continuous improvement. Fuzzy evaluation model provides a systematic evaluation method, which can support long-term tracking and evaluation. [15]

Based on the above principles, the optimization strategies for college physical education teaching methods can be formulated, and the specific operation and effect evaluation of these strategies can be realized through the fuzzy evaluation model. The optimization principle of physical education teaching method based on fuzzy evaluation is shown in Figure 3 below:

Figure 3: Optimization principle of physical education teaching method based on fuzzy evaluation.

5.2 Optimization Strategy of Physical Education Teaching Methods Based on Fuzzy Evaluation

Based on the fuzzy evaluation theory, the following optimization strategies for physical education teaching methods can be formulated:

1. Personalized teaching strategies: According to the results of fuzzy evaluation model, students' abilities and needs can be more accurately understood, so as to achieve personalized teaching. This may involve providing appropriate teaching methods and content according to students' physical qualities, skill levels, learning styles and other factors.

2. Flexible teaching arrangements: Fuzzy evaluation models can help predict and deal with uncertainty, so more flexible teaching arrangements can be implemented to adapt to various possible situations. For example, the teaching plan and method can be adjusted flexibly according to the weather, the use of facilities and the state of students.

3. Continuous improvement of teaching strategies: The fuzzy evaluation model can be used to continuously monitor and evaluate the teaching effect, so as to achieve continuous improvement of teaching methods. This may involve collecting and analyzing teaching data on a regular basis, identifying existing problems and directions for improvement, and then making targeted adjustments and improvements.

4. Teaching strategies supported by science and technology: The implementation of fuzzy evaluation model requires the support of data and calculation, so scientific and technological means, such as computer technology, Internet technology and big data technology, can be used to improve the efficiency and effect of teaching methods. For example, learning management systems (LMS) can be used to collect and manage instructional data, and artificial intelligence (AI) techniques can be used for data analysis and decision support.

The above strategies aim to make full use of the advantages of fuzzy evaluation theory and improve the effect of physical education teaching methods in colleges and universities. Specific implementation plans and steps need to be designed and adjusted according to the specific teaching environment and conditions.

5.3 Implementation Steps and Methods of Physical Education Teaching Method Optimization Based on Fuzzy Evaluation

The optimization of physical education teaching method based on fuzzy evaluation theory can be implemented in the following steps:

Step 1: Goal setting

First of all, it is necessary to clarify the goal of physical education teaching, which may include improving students' physical quality, skill level, sports interest and so on. At the same time, it is also necessary to consider the constraints of teaching resources and conditions to determine achievable goals. As shown in Table 5 below.

Target	*Description*
Physical quality	*Improve students' physical health level, enhance physical strength and endurance*
Skill level	*Improve students' motor skills and tactical understanding*
Sports interest	*Enhance students' interest and participation in sports*

Table 5: Physical education teaching goal setting.

Step 2: Fuzzy evaluation index system construction

Then, the fuzzy evaluation index system should be constructed to evaluate the effect of physical education teaching. This may include indicators of student performance, teaching processes, teaching outcomes, etc. As shown in Table 6 below.

Index	*Description*
Student performance	*Student attendance, participation, skill performance, etc*

Teaching process	Arrangement of teaching contents, use of teaching methods, utilization of facilities and equipment, etc
Teaching result	Students' physical health test results, skill assessment results, satisfaction survey results, etc

Table 6: Fuzzy evaluation index system.

Step 3: Fuzzy evaluation model construction and application

Next, it is necessary to build a fuzzy evaluation model for evaluation according to the index system. Fuzzy comprehensive evaluation, fuzzy analytic hierarchy process and other methods can be used to select the appropriate model according to the actual situation.

After the completion of model construction, data need to be collected for model calculation and analysis. This may involve steps such as data collection, processing, analysis and interpretation.

Step 4: Optimization of teaching methods

According to the analysis results of the model, the advantages and disadvantages of teaching methods can be found, so as to carry out targeted optimization. This may involve the adjustment of teaching content, teaching methods, teaching resources and so on. As shown in Figure 4 below:

Teaching content
Adjust the content to better suit the needs and interests of students

Teaching method
Try different teaching methods to improve the effectiveness and efficiency of teaching

Teaching resources

Make better use of teaching resources, including facilities, equipment, time, etc

Figure 4: Optimization of teaching methods.

Step 5: Validation and continuous improvement

Finally, it is necessary to verify the effect of the optimized teaching method to see whether it has reached the expected goal. At the same time, continuous monitoring and evaluation should be carried out to achieve continuous improvement of teaching methods.

The above steps are carried out in cycles, which need to be evaluated and optimized continuously through fuzzy evaluation model to achieve continuous improvement of physical education teaching methods.

6 EFFECT VERIFICATION OF COLLEGE PHYSICAL EDUCATION TEACHING METHODS BASED ON FUZZY EVALUATION

6.1   Basic Methods of Effect Verification

The effectiveness verification of college physical education teaching methods based on fuzzy evaluation mainly includes the following methods:

1. Comparative analysis: The effectiveness of the optimization strategy is verified by comparing the teaching effects before and after optimization, such as students' skill level, interest and participation.

2. Empirical analysis: A large number of actual data are collected and statistical methods, such as T test and variance analysis, are used to verify the effect of optimization strategies.

3. Simulation experiment: under the condition of control variables, the effect of optimization strategy is observed and analyzed through simulation experiment. For example, you can set up the experimental group and the control group, the experimental group uses the optimized teaching method, the control group uses the original teaching method, and then compare the teaching effect of the two groups.

4. Questionnaire survey: Through questionnaire survey on students, students' satisfaction with and acceptance of the optimized physical education teaching method can be understood, so as to evaluate the effect of the optimization strategy.

5. Long-term tracking: Through long-term tracking of students and observing their skills development and interest changes, the long-term effect of the optimization strategy can be evaluated.

The above methods can be based on the actual situation and demand, select the appropriate method for effect verification. At the same time, the combination of various methods can evaluate the effect of optimization strategy more comprehensively and accurately.

6.2   Empirical Analysis of the Optimization Effect of College Physical Education Teaching Methods Based on Fuzzy Evaluation

Empirical analysis is an analysis method based on actual data, which can be used to empirically analyze the effect of optimization strategies by collecting a large amount of teaching data and using statistical methods.

The following is a basic empirical analysis process:

Step 1: Collect data

In the process of physical education, the following data can be collected: students' skill level, students' participation, students' satisfaction, etc. These data can be obtained through teaching observations, questionnaires, skill tests, etc.

Step 2: Data processing

The collected data may require some preprocessing, such as data cleaning and data conversion, to facilitate subsequent analysis.

Step 3: Model application

Input the processed data into the fuzzy evaluation model and get the evaluation result of each student.

Step 4: Result analysis

Statistical analysis was carried out on the output results of the model, such as calculating the proportion of students at each evaluation level and analyzing the distribution of students' evaluation results. At the same time, the evaluation results before and after optimization can also be compared to see whether the optimization strategy is effective.

Using this as an example, data were collected from 100 students, 50 of whom used the pre-optimized teaching method and 50 of whom used the post-optimized teaching method. After model calculation, the following results are obtained. As shown in Figure 5 below:
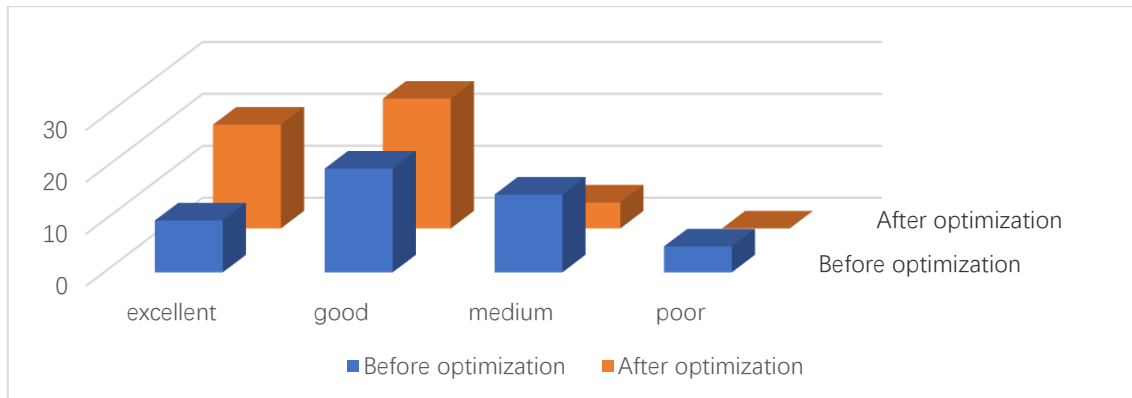

Figure 5: Compares the evaluation results before and after optimization.

It can be seen from the results that the optimized teaching method has significantly improved the skill level of students, and the proportion of excellent and good students has increased, while the proportion of medium and poor students has decreased. Therefore, this optimization strategy can be considered effective.

Of course, this is just a simple example, the actual empirical analysis may need to consider more factors, such as students' basic level, individual differences, etc. At the same time, more data needs to be collected to improve the accuracy of the analysis.

7   CONCLUSION

This research is based on fuzzy evaluation theory and discusses its application in college physical education teaching methods. First of all, the basic idea and present situation of college physical education teaching methods are summarized, and the basic principle and application of fuzzy evaluation theory are elaborated. Then, a college physical education teaching method model based on fuzzy evaluation theory is constructed. The model includes the construction of index system, the determination of model parameters, the calculation method of the model and the property analysis of the model.

In the empirical analysis part, this study collected a large number of teaching data, and used the model to calculate and analyze, the results show that the model can effectively evaluate the learning effect of students. At the same time, it is also found that some problems exist in the model, such as the evaluation results may be affected by some factors, so it is necessary to further improve the model to improve the accuracy of the evaluation.

In the part of optimization strategy, this study puts forward some optimization principles and strategies of physical education teaching methods based on fuzzy evaluation, and describes the implementation steps and methods of optimization strategy in detail. Finally, the effect of the

optimization strategy is verified, and the results show that the optimization strategy can effectively improve the learning effect of students.

In general, the model of college physical education teaching method based on fuzzy evaluation theory can not only provide teachers with a more scientific and systematic teaching evaluation tool, but also provide a new way of thinking for optimizing physical education teaching method. Although there are still some shortcomings in the model, we believe that these problems will be solved with the further study, and the model has a broad application prospect.

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