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Research Article

Research on the Construction of the Quality Evaluation Model System for the Teaching Reform of Physical Education Students in Colleges and Universities under the Background of Artificial Intelligence

Hao Guo

Chongqing College of Humanities, Science & Technology, Chongqing 401524, China

Correspondence should be addressed to Hao Guo; ym520@swu.edu.cn

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With the continuous progress of the times, the reform of physical education teaching in colleges and universities has to be promoted day by day. The most important task in the process of reform is how to improve the quality of physical education teaching. Only by reforming colleges and universities can we transport outstanding talents into the society. It is very important to improve the teaching quality by improving the physical education quality evaluation system. As artificial intelligence technology has been more and more widely used in different fields, various educational administration systems based on information management have been established in various colleges and universities. On the one hand, it has brought great convenience to the management of physical education in colleges and universities and improvement of the efficiency of sports education management, but on the other hand, there are many shortcomings in the process of practical application. For example, the application of the database does not fully reflect its function and convenience, and it is only used at the level of query and statistics. Therefore, a better evaluation system of physical education teaching quality has become the common expectation of all colleges and universities. This paper makes a powerful analysis of the current quality evaluation of physical education in colleges and universities and proposes a method of establishing a basic framework through expert systems, filling in details with the idea of knowledge base and fuzzy sets, and further using a three-layer B/S framework model to design universal teaching quality assessment system. When discussing the requirements, functional framework, and actual development of the teaching evaluation system, the characteristics of the traditional physical education evaluation model are deeply analyzed, and the system's interactivity, flexibility, accuracy, and fairness are emphasized in the implementation process. Object-oriented design and analysis are carried out on the requirements of the system, and finally, black-box testing is carried out to ensure the reliability and correctness of the system logic.

1. Introduction

With the promotion of artificial intelligence to the national strategy, it will have a profound impact on various industries. Colleges and universities should keep up with the trend of the times, seize the pace of the "artificial intelligence" era, and apply "artificial intelligence" to the education of college sports students The reform is in progress, but how should the "artificial intelligence +" road go? This article will discuss the application of artificial intelligence to physical education teaching reform in colleges and universities and build a teaching reform quality evaluation model through artificial intelligence technology. If colleges and universities want to better combine artificial intelligence technology with physical education, they need to have an in-depth understanding of artificial intelligence technology and a clear direction and overall design for how to use it; discuss which technologies of artificial intelligence can be applied to the reform of physical education, what kind of changes will be produced, and how to change; and discuss the application of intelligence in the construction of the quality evaluation model system in the reform of physical education and how to

use intelligence for teachers in the future. Applying to optimize teaching, students using intelligent applications to achieve personalized learning, and teaching administrators using intelligent applications to improve work efficiency, etc., have guiding significance to reduce the burden [1–5]. In this paper, the design and implementation of the physical education quality evaluation system are designed by constructing the artificial intelligence course teaching mode for college sports students. After testing, the system has good applicability.

2. Related Work

Countries around the world pay close attention to teaching reform because education is closely related to the development of economy, society, and culture, and people hope to promote teaching reform through technology. With the help of 47 papers published in the journal Artificial Intelligence in Education, Roll I and Wylie R analyzed the research focus and application scenarios in the field of artificial intelligence in education and predicted two parallel studies in education in the next 25 years according to the research results: first, it is the evolutionary process of physical education, focusing on the existing sports practice, cooperation with teachers, and the diversification of technology; the second is the transformation process of physical education, which should embed sports technology into students' daily life and support students' culture and practice and target. Ozbey N et al. put forward an optimization method for factors affecting students' learning process by analyzing the factors affecting students' learning by artificial intelligence technology. In addition, some scholars have conducted research on the changes caused by the application of artificial intelligence to specific disciplines. For example, Tiffany Barnes and others have conducted research on the application of artificial intelligence to computer teaching, pointing out that artificial intelligence is a more efficient means of promoting computer science learning and teaching. Kanda conducted a practical evaluation of teaching robots in assisting primary school students in English learning, and the results show that teaching robots can promote learners' English learning [6–10]. From the current point of view, teaching reform is a major development and change in education in various countries, especially with the development of artificial intelligence technology, the development path of teaching reform will become wider.

3. Related Theoretical Methods

3.1. Artificial Intelligence. When understanding artificial intelligence, usually we are mainly divided into two parts: "artificial" and "intelligent." "Artificial" refers to man-made and produced by human beings. "Intelligence" focuses on human intelligence. Artificial intelligence is relative to human's natural intelligence. It refers to the use of artificial methods and technologies to develop intelligent machines or intelligent systems to imitate, extend, and expand human intelligence; realize intelligent behavior and "machine thinking"; and solve problems that require human experts, issues that can be dealt with. As a branch of computer science, artificial intelligence is a comprehensive subject covering mathematics, philosophy, computer science, psychology, and other disciplines. The main research fields involve expert systems, virtual reality, image recognition, games, natural language processing, problem-solving, machine learning, intelligent database, language recognition, intelligent robot, pattern recognition, etc. To sum up, artificial intelligence is not only a rising emerging technology but also a multidisciplinary comprehensive discipline. The main research is to use new technical means to simulate the process of the human brain engaged in related thinking activities, that is, to use machines to simulate human intelligence [11]. The application of artificial intelligence technology to the quality assessment of physical education teaching in colleges and universities will accelerate the progress of physical education teaching reform.

3.2. The Theory of Educational Change. Educational change theory points out that education is in constant change, and change is the driving force for the dynamic development of education. Educational change experts RG Havelock and CV Goode divide educational reforms into two categories: planned educational reforms and natural educational reforms: "Planned educational reforms" refer to deliberate educational reforms implemented through certain programs, generally referred to as educational innovations., educational reform, and educational revolution are all planned educational reforms; "natural educational reforms" are the opposite of planned educational reforms and refer to changes that are not planned and artificially implemented. Educational change theory believes that educational change has the characteristics of nonlinearity and complexity. Nonlinearity means that the educational reform is not a linear process from initiation to implementation, and the top-down educational reform from the organizational structure may not achieve ideal results; complexity refers to the object of educational reform—the educational system is nonlinear and dynamic. It is a complex system with both natural and social nature, and it is difficult to predict the development of the system. The nonlinear and complex characteristics of educational reform determine the uncertainty of educational reform. Not all educational reforms are positive and beneficial. The results of educational reform may be "positive" or "reverse." The theory of educational change has important guiding significance for this research: artificial intelligence to promote teaching reform belongs to the category of planned educational reform. Changes in the nature of things are called reforms, but teaching reforms are not a complete denial of traditional teaching but on the basis of inheriting the advantages and wisdom of traditional teaching, optimizing the process of teaching and learning, and innovating teaching and learning methods and means. The process of teaching reform should also follow the "law of quantitative change and qualitative change." Only on the basis of the full integration of artificial intelligence and physical education teaching will physical education be fundamentally changed, and then, the entire physical education structure will be changed. Therefore, the

physical education reform discussed in this study is a process of changing the status and role of various elements of physical education based on the specific teaching environment and the effective support of artificial intelligence, including changing the form of teaching resources, teaching organization, and learning activities, and learning evaluation methods, among which the status and role of each element are important indicators to evaluate the effect of teaching reform [12–15].

4. Construction of Teaching Mode of Artificial Intelligence Course for College Sports Students

4.1. Establish an Evaluation Index System. An excellent physical education quality evaluation index system needs to meet the characteristics of authenticity, specificity, and convenience. Table 1 is based on the summary and arrangement of all the elements of the physical education quality evaluation system, showing a comprehensive set of multidimensional and multilevel three-dimensional evaluation index system [16–18]. The establishment of the entire physical education quality evaluation index hierarchy is mainly established from two aspects: firstly, the current status of the teaching quality evaluation system at home and abroad and, secondly, combined with the country's policy development orientation.

The entire physical education reform evaluation index structure can be divided into three layers: the first layer is the target layer; the second layer is the criterion layer, and there are two factors here: $P = (P1 + P2)$; and the third layer is the indicator layer. This part is divided into two parts according to the two factors of the previous layer, where $T_1 = (t_{11}, t_{12}, t_{13} \ldots t_{19})$, $T_2 = (t_{20}, t_{22})$ [19].

4.2. Design Quality Comprehensive Evaluation Model. If there is a set of factors to evaluate things $U = \{u_1, u_2, u_3 \ldots u_m\}$, V = {v1,v2,v3. . .vm} is a set of decision comments, R is the fuzzy mapping between U and V, and rij($i = 1,2, \ldots,$ m ; $j = 1,2, \ldots, n$) describes the beginning of the ith factor, produces the result of the jth factor of the evaluated physical education teacher and establishes the following fuzzy evaluation matrix:

$$R = \begin{bmatrix} r_{11} & r_{12} & \cdots & r_{1n} \\ r_{21} & r_{22} & \cdots & r_{2n} \\ \vdots & \vdots & \cdots & \vdots \\ r_{m1} & t_{m2} & \cdots & r_{mn} \end{bmatrix}. \quad (1)$$

$A = (a_1, a_2, a_3 \ldots a_m)$ is a very important set of U. When both R and A are known, the fuzzy transformation method can be used to obtain the model $B = A \times R = (b_1, b_2, b_3 \ldots b_m)$.

4.3. Methods of Comprehensive Evaluation

4.3.1. Constructing a Comprehensive Evaluation Factor Set X. A set of excellent physical education quality evaluation system often contains a variety of factors. However, if the factors to be considered are too complicated, it will be difficult to evaluate. For comprehensive consideration, a set of evaluation factors is set up: $X = \{$The content of the lesson preparation is detailed and the teaching attitude is correct; the classroom knowledge is rich, and the priority is clear; help understanding; interact, mobilize the learning atmosphere; teach students in accordance with their aptitude, pay attention to the exercise of ability; be strict with oneself, set an example for students; care for students, deeply loved by students$\}$ [20]. The construction of the evaluation system in this study draws lessons from the hierarchical method of index system construction in intelligent manufacturing project evaluation [21].

4.3.2. Establish Evaluation Set Y. Whether the teaching quality of physical education teachers is good or bad can be reflected through the evaluation set, in which different grades represent the degree of teachers' physical education teaching quality. $Y = \{$excellent, good, fair, poor$\}$, and the evaluation result is reflected by membership degree. The four grade values in the evaluation set Y are determined by a range of values, which are very vague and difficult to calculate accurately. So, in the actual evaluation process, a specific range of values can be used to limit the levels included in Y. Based on the above analysis, the domain of discourse can be set to [50, 100] and then divided into four decreasing intervals. If the obtained scores are placed in the interval [80, 100], the median value of 90 can be taken, that is, the teaching situation of this physical education teacher can be evaluated as " "excellent"; if the obtained grade is placed in the [70, 90] interval, the median value of 80 can be taken, that is, the teacher's teaching situation can be evaluated as "good"; if the obtained grade is placed in the [60, 80] interval, then the median value of 70 can be taken. That is to say, the teacher's teaching situation can only be evaluated as "average"; if the obtained grade is placed in the [50, 70] interval, the median value of 60 can be taken, that is, the teacher's teaching situation is not ideal and expressed as "poor." However, it is actually stipulated that the median value of each achievement interval represents the basis of grade division, and the parameter column vector can be set as $Y = [90, 80, 70, 60]$T. The result is shown in Figure 1 [21].

4.3.3. Establish the Weight Set of Evaluation Factors. Each factor occupies a different key position in the evaluation factor set, that is, the weight is different, so it is very important to formulate the weight of different factors. How to reasonably distribute the weights of each factor determines the accuracy of the evaluation results. The Delphi method is an authoritative method of assigning weights. The core idea of the Delphi method is to anonymously ask experts for their opinions. After sorting and summarizing, they are anonymously passed on to the experts. The experts give their opinions again. An ideal set of weights can be obtained. The evaluation scores given by experts listening to teachers' lectures are used to verify the scientificity of the fuzzy evaluation method. Take two classes in a certain semester as an example. Both classes A and B have 200 students. According to the evaluation of experts, the scores are ranked

Table 1: Hierarchical structure of physical education quality evaluation indicators.

Target layer	Criterion layer	Indicator layer
Physical education quality	Teacher teaching situation	Tl *l* fully prepared before class and serious teaching attitude
		T12 The key points are highlighted and the teaching content is substantial
		T13 reflect the latest achievements, link theory with practice
		T14 teacher-student interaction is appropriate, and teaching methods are flexible
		T15 diverse teaching methods, using modern technology
		T16 strengthen ability training and focus on teaching students in accordance with their aptitude
		T17 care for students and strictly require management
		T18 pay attention to teaching and educating people and be a teacher everywhere
	Course information	T19 comprehensive teaching effect
		T20 course content
		T21 course load

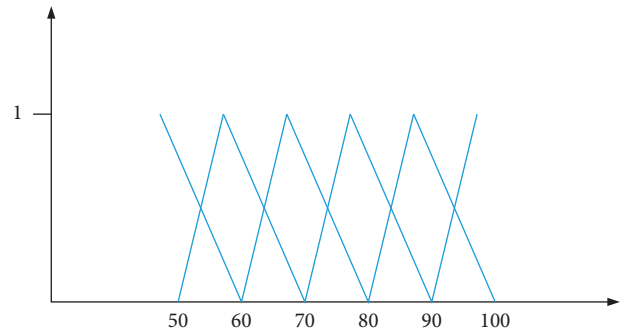

Figure 1: Four standard fuzzy partitions of the universe of discourse $Y = [50, 100]$.

6th and 8th. Randomly check the data in the database of their class, from the beginning of the evaluation to the end of the evaluation, a total of 11 sampling points are selected, and the evaluation results are obtained.

4.3.4. Establishment of Fuzzy Relationship Matrix. All evaluation personnel give objective evaluations based on the daily behavior of physical education teachers in various factors, establish a fuzzy relationship matrix R through induction and sorting, and further obtain the possibility measure. Suppose there are 200 people who participate in the evaluation to give an evaluation to a certain aspect of physical education teachers, of which 140 people's evaluation results are "excellent," 40 people determine "good," and 20 people determine "average," so the result is "excellent." The probabilities are as follows: 140/200 = 0.7; the probability of "good" is 40/200 = 0.2"; the probability of fair" is 20/200 = 0.1"; the probability of poor" is 0/200 = 0.

4.3.5. Obtaining Fuzzy Comprehensive Evaluation Results. The following fuzzy evaluation model based on weight set A and fuzzy relation matrix R can be obtained:

$B = A \times R = (b_1, b_2, b_3 \ldots, b_4)$.

Use.

$S = B \times V = 90 * b_1 + 80b_2 + 70b_3 + 60b_4$.

The obtained value can be used as the final evaluation score of the evaluated physical education teacher. If the fuzzy evaluation matrix of a physical education teacher is

$$R = \begin{bmatrix} 0.418 & 0.348 & 0.201 & 0.033 \\ 0.625 & 0.218 & 0.115 & 0.042 \\ 0.740 & 0.165 & 0.080 & 0.015 \\ 0.365 & 0.424 & 0.169 & 0.042 \\ 0.732 & 0.168 & 0.170 & 0.019 \\ 0.620 & 0.219 & 0.118 & 0.043 \\ 0.431 & 0.358 & 0.202 & 0.034 \\ 0.755 & 0.155 & 0.075 & 0.015 \\ 0.632 & 0.214 & 0.114 & 0.039 \end{bmatrix} \quad (2)$$

$B = A \times R = (0.534, 0.286, 0.146, \ldots, 0.034)$.

Use.

$S = B \times V = 90 * b1 + 80b2 + 70b3 + 60 * b4$.

The comprehensive evaluation value $S = 83.2$ is obtained by calculation. According to the range in the evaluation set Y, it can be known that the teaching quality of the physical education teacher is evaluated as "good."

5. Design and Implementation of Physical Education Teaching Quality Evaluation System

5.1. Overall Design. The most commonly used and widely implemented architectural design pattern includes three parts: presentation layer, business logic layer, and data access layer. The main idea of this architecture pattern is to simplify a complex problem by decomposing it. More importantly, it can efficiently reuse business logic and maintain the connection with resources to further control the development cycle of the system. Then, the physical education quality evaluation system is mainly based on the model of the three-tier B/S architecture.

5.1.1. Model of Three-Tier B/S Architecture. Hierarchical structure is a representative and most classic structure in the software system design process. The three-tier architecture has matured over the years and has been welcomed by developers. This commonly used application architecture is usually divided into three layers: data access layer, business logic layer, and presentation layer.

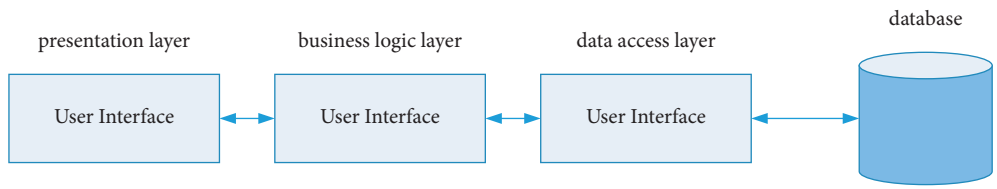

Figure 2: Schematic diagram of three-layer B/S structure.

The presentation layer includes all forms of controls and components involved in the interactive interface, the business logic layer includes how to complete all business rules and logic, and the data access layer includes all database components as shown in Figure 2. Architecture design is the primary task of a system design. A simple and functional system architecture can facilitate developers and users to maintain and expand the system, and the reusability can also be greatly improved. The operability, practicality, extensibility, and development cycle of this system have been improved. The architecture-building process clarifies the concept of packages and describes how packages interact and communicate.

The three-layer B/S mode is extended to the two-layer mode. The graphical operation interface implemented in the presentation layer is helpful for users to digest and master the efficient operation and positioning application services as soon as possible; the business logic layer is in the middle layer, and the purpose is to realize the application method, encapsulate the application mode, and associate the client application with the data service involved. Together, the data access layer is at the bottom, and its main task is to define, query, and modify data and respond to requests sent by application services to data.

5.1.2. System Planning and Analysis. For users, it is very convenient to use the web method. They can log in to the system in the browser to query the results without downloading the client. Taking into account user demands and excellent system processes, an evaluation system should follow the following principles:

(i) Allow users to generate questionnaires to evaluate the survey through a variety of evaluation index systems;

(ii) Allows users to define the importance of any indicator system by selecting models with differences;

(iii) Allow users to select a certain index system to generate any batch of questionnaires;

(iv) Managers can inquire about the progress of the investigation and manage it at any time;

(v) Users can evaluate the questionnaire by using different evaluation models and conduct a comprehensive analysis of the results obtained. In order to meet the above requirements, this system applies a three-tier B/S model and uses the structure in Figure 2 to plan and deploy, using SQL Server as the background database.

The staff controls the whole evaluation process. The evaluation form, the relevant data of the participants, and the relevant data of the people being evaluated are all stored in the SQL Server database. As for how to determine the weight and how to determine the results of the comprehensive evaluation, all these data need to be processed by the staff. It is presented to the server through the web side, and then, the server calls the corresponding program for management and finally delivers the result to the presentation layer. Participating evaluators can fill in the price list on the web page, and the final evaluation results of the evaluators can be viewed via the web page.

5.1.3. Functional Design. The purpose of this system is to provide online teaching evaluation services: evaluators can use this system to evaluate all teachers online and adjust teachers' work through comprehensive evaluation results. This system covers system entry, relevant quantity input, determination of evaluation system indicators and weights, real-time scoring, evaluation result confirmation, evaluation result sorting, evaluation data maintenance, and other functions. The functional frame structure is shown in Figure 3. The relevant function windows can meet the needs of current teachers during the trial operation.

5.2. Evaluation Process. The evaluation process consists of index design, real-time evaluation, data query statistics, and result analysis as shown in Figure 4.

5.3. Front-End System Implementation. The system can be run on the campus network and uses a three-layer structure model. The front desk is mainly developed with Active Server Page program, and Excel is used to query and export the results and print the report.

"Evaluation" includes "student evaluation," "peer evaluation," and "expert evaluation", and "inquiry" includes "personal inquiry" and "department inquiry."

Student evaluation: the purpose is to evaluate all teachers in the current semester and can only evaluate once, and students can also maintain information and passwords.

Peer evaluation: the purpose is to evaluate the teaching situation of other teachers in the same semester. The method is that any course can only be evaluated once, and teachers can also check their own evaluation scores and maintain their personal passwords.

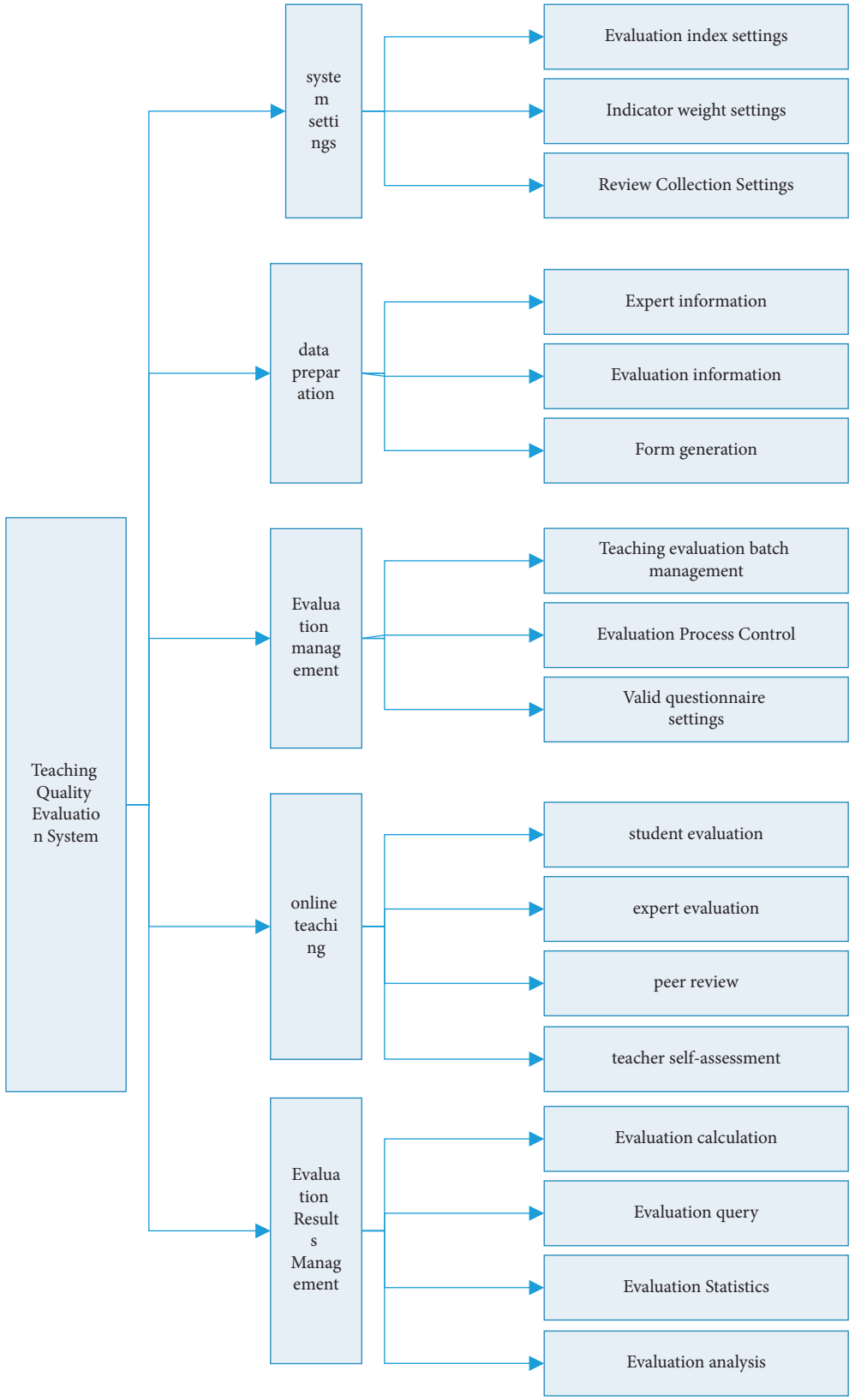

Figure 3: System function block diagram.

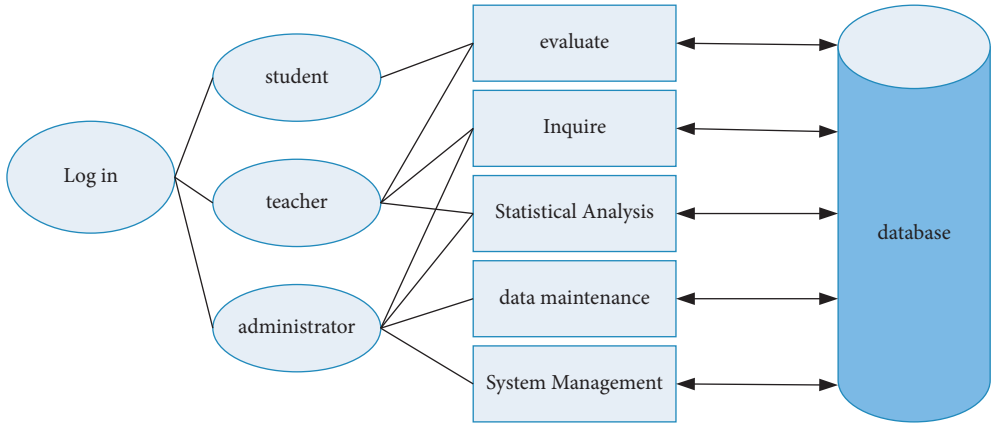

Figure 4: Evaluation process.

Expert evaluation of teaching: the purpose is for experts to evaluate all teachers in the current semester, can only evaluate once at the same time, and can also maintain the personal information and passwords of experts.

5.4. System Test. The system test is carried out in order to achieve two conditions: first to check whether the system can meet the expected expectations and second to check the possible errors during the operation of the system and modify them in real time. The purpose of error checking is to comprehensively retrieve possible errors so that it can be modified before the system works normally to avoid the avoidable difference that may occur after the system works. Generally speaking, software testing generally includes white-box testing and black-box testing. The white-box test is also called structure or logic-driven test. The principle of this test method is to test the program according to the internal structure of the program so as to check whether there is any behavior that violates the design regulations in the product and whether any path in the program can be tested. This testing method regards the test object as an open box. The tester refers to the internal logic structure of the program, designs or selects the example, and tests all the logic paths of the program. After checking the state of the program at each point, to confirm the state that appeared to meet the expected goals. Black-box testing is also known as functional testing or data-driven testing. This testing method is to know all the functions that the product should have in advance and test these functions to verify whether any function can operate normally. During the test, the program is assumed to be a black box that cannot be opened. At the same time, under the condition of ignoring the internal structure and coding nature of the program, the tester can test whether the function of the program can realize the normal operation of the function described by the software function by testing at the program interface and whether the program can reasonably receive input data and output information that meets expectations while ensuring the integrity of external information. The black-box method focuses on the structure outside the program, does not take the internal logic structure of the program into consideration, and tests the interface and function of the software at the same time. The black-box method is a typical exhaustive input testing method. Only by testing all possible situations can all errors in the program be detected by this method. In fact, there should be an infinite number of such tests, and workers need to test not only all legal possibilities but also illegal but possible inputs. In general, white-box testing and black-box testing have different applications. White-box testing is suitable for code rereview and individual testing phases, but in the case of combined testing and system testing, black-box testing is best used. In this case, the method of dividing equivalence classes in black-box testing is used, and the dividing equivalence classes are shown in Table 2.

Table 2: Dividing equivalence classes.

Enter equivalence class	Effective equivalence class	Invalid equivalence class
Date type and length	(1) 8 digit characters	(2) nonnumeric characters (3) less than 8 characters (4) more than 8 characters
Year range	(5) between 1990 and 2050	(6) less than 1990 (7) greater than 2050
Month range	(8) between 01 and 12	(9) is equal to 0 (10) greater than 12
Date range	(11) between 01 and 31	(12) is equal to 0 (13) greater than 31

Examples of selected test cases in black-box testing are shown in Table 3.

Table 3: Select test cases.

Test data	Expected results	Coverage
20020512	Input is valid	(1) (5) (8) (11)
02may512	Input is valid	(2)
20025	Input is valid	(3)
200205012	Input is valid	(4)
20550500	Input is valid	(7) (12)
19890512	Input is valid	(6)

The test reports and results of the teaching evaluation control module are shown in Tables 4 and 5.

Table 4: Test report.

Test plan source	Instructional evaluation control test plan
Testing object	Teaching evaluation control module
Test environment	Windows 10 operating system, SQL Server 2017 database
Testers	JAME
Testing time	2022.3

Table 5: Test results.

Test case name	Test results	Defect severity
Evaluation end-time input test case	Boundary overflow	Middle
Program syntax test cases	Correct syntax, redundancy, few comments	Light

6. Conclusion

As we all know, the content involved in pedagogy at this stage can be mainly divided into three fields, which are the research of basic theory, education development theory, and education evaluation system, and there is a certain internal connection between these three modules. Among them, the education evaluation system has a very prominent position and role in the evaluation of educational research and the actual education system. The primary reason is that it can not only evaluate the level of students but it can also evaluate the level of teachers, truly feedback the state of the education system, and evaluate the education of colleges and universities. It also has the function of detecting the educational reform achievements of colleges and universities, which provides a good basis for improving the educational system. This paper uses the structure of teaching quality evaluation based on the fuzzy overall evaluation method. At the same time, the uncertainty in the system is solved by the method of fuzzy mathematics, and the evaluation index system is constructed by the standard fuzzy division method and the Delphi method. The ambiguity of the data has been improved, and the combination of quantitative and qualitative analysis makes the teaching evaluation system more comprehensive, which greatly improves the authenticity and credibility of the evaluation results. Based on the three-tier B/S system framework, combined with ASP and SQL Server technologies, a web-based teaching quality evaluation system is researched and developed. However, there are still some areas that need to be improved and optimized. For example, in the actual process of software design, developers need to maintain communication with users in order to achieve a better dynamic user interface that meets user needs. It is necessary to further improve teaching methods and provide ideas to improve teaching quality and efficiency.

Data Availability

The data set can be accessed upon request.

Conflicts of Interest

The authors declare that there are no conflicts of interest.

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