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Multimedia Teaching Quality Evaluation System in Colleges Based on Genetic Algorithm and Social Computing Approach

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ABSTRACT To improve the quality of classroom teaching and understand the effectiveness of teaching in a timely manner, the multimedia teaching quality evaluation system of colleges and universities was established. Combined with genetic algorithm, through the investigation, the evaluation process of multimedia teaching in colleges and the status quo of multimedia teaching were analyzed. Many teachers were interviewed. A set of evaluation indicators suitable for college multimedia teaching quality was discussed, and the indicators were visually displayed with data. From the aspects of multimedia courseware, multimedia classroom teaching process and multimedia teaching effect, teachers' basic information, students' basic information and evaluation relationship management are analyzed. The teaching quality evaluation system of college multimedia was designed and the results were tested. The research results showed that the evaluation of teaching quality was realized through the teaching evaluation system. Therefore, the system is of great significance to improve the effectiveness of classroom teaching.

INDEX TERMS Teaching quality, evaluation index, evaluation system, genetic algorithm, multimedia, social computing, quantum particle swarm optimization algorithm.

I. INTRODUCTION

The traditional teaching method is in the form of blackboard and textbook, which is limited by time and space in information expansion. With the continuous development of computers, multimedia has gradually entered the campus classrooms, which has enabled the continuous improvement of modern educational technologies. Such an advancement not only enables high computing and high storage of educational technologies but also integrate media in the form of text, pictures, and videos, providing students with multiple stimuli, thereby deepen the impressions of relevant information acquired by students. At present, many colleges and universities actively adopt multimedia teaching. The characteristics of multimedia teaching, such as diversity, intuition, and interactivity, have enriched the teaching forms, attracted the students to a certain extent, stimulated the interests of students in learning, improved the participation of students, and strengthened the memory of information of students. At the same time, the multimedia teaching of colleges and universities has also increased the classroom teaching capacity, enabling teachers to continuously expand the important and difficult problems, as well as the targeted teaching of individual students. Many cases have also shown that multimedia teaching can achieve better teaching results to a certain extent, which can provide students with more knowledge information than traditional teaching methods.

With the increasing emphasis on multimedia teaching methods in colleges and universities, colleges and universities have actively introduced multimedia teaching methods and changed the traditional teaching methods. The multimedia teaching method has also become a common teaching method in many universities. Therefore, the evaluation and estimation of the quality of multimedia teaching have become a part of the teaching work of colleges and universities. The evaluation of the teaching quality of multimedia teaching is also to find the problems in multimedia teaching from various aspects to better improve the quality of multimedia teaching [1].

Teaching evaluation system is the comprehensive management of teaching quality and an important means of teaching quality evaluation. Starting from the teaching goal, it conducts a correct evaluation of teaching activity methods, efficiency and results through comprehensive and feasible technical analysis methods in education and teaching

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activities [2], [3]. On the one hand, it generates trust and fairness to teachers, and through feedback of information after evaluation, teachers can obtain relevant information in time, pay attention to their success and deficiencies in the teaching process, and adjust teaching in a timely manner. On the other hand, through the evaluation and diagnosis of possible problems in the teaching process, teachers can timely correct and strengthen, constantly correct the errors and deficiencies in the teaching process, improve the results, and make the teaching quality to a higher level [4]–[6].

Considering the advantages of genetic algorithm and social computing technology in data analysis, this study uses the genetic algorithm and social computing technology to analyze the quality evaluation indicators of college multimedia teaching, hoping to establish a more perfect teaching quality evaluation system to provide more accurate evaluation results. Therefore, it will have a positive significance for improving multimedia teaching results in colleges and universities.

II. LITERATURE REVIEW

A. RESEARCH ON TEACHING QUALITY

As the most concerned content in teaching, teaching quality is also part of the active optimization and evaluation of many universities. Gao Xiang (2017) pointed out that the forms of the classroom in the new era had changed. Micro-courses, as a new carrier, could realize the fragmentation and situational learning of knowledge, enabling learners to acquire knowledge in a short period. Meanwhile, in the teaching reform, it could also help students to prepare in advance and review after class, which played an important role in optimizing the quality of teaching [7]. Hong Yimin (2017) pointed out that in order to promote the growth of college students, students should be regarded as the center of teaching, as well as their learning effect, therefore, the quality of teaching could be greatly improved, which was conducive to the cultivation of high-quality talents in colleges and universities [8].

B. RESEARCH ON THE EVALUATION INDICATORS AND EVALUATION SYSTEM

Yang Jing et al. (2017) used the analytic hierarchy process to determine the Saaty scale by the mean value difference method, construct the importance matrix, and then determine the weight value of the teaching quality evaluation indicators. The results showed that this method was scientifically feasible in determining the indicator and weight [9]. Lu Shouting (2018) pointed out that the indicators of teaching quality evaluation include target evaluation, program evaluation, process review, and effect evaluation. These indicators can help universities to continuously improve the practice teaching mode and process [10].

C. RESEARCH ON MULTIMEDIA TEACHING COURSEWARE

Computer-aided instruction (CAI) was originally developed by the United States in the 1960s and corresponding research was carried out. After entering the 1990s, multimedia computers were rapidly popularized. At the same time, with the continuous development of various multimedia teaching software, a large number of multimedia teaching software and applications are increasingly applied to the production of multimedia courseware, which provides a very solid foundation for the promotion of multimedia classroom teaching. On this basis, a variety of multimedia teaching courseware was produced [11]. In the new century, there are quite a lot of organizations on the evaluation of computer-aided teaching. These organizations have a set of evaluation methods and evaluation standards that are suitable for the internal system, and the evaluation personnel institutions are relatively stable. They play a very positive role in the promotion of computer-based police-assisted teaching [12].

D. RESEARCH ON OPTIMIZATION ALGORITHM

Zheng Li et al. (2018) used a fuzzy data mining algorithm to analyze the satisfaction of teaching quality. The research showed that this method could effectively make decisions. By using the satisfaction fuzzy rule base to summarize the key indicators that affect the satisfaction of teaching quality, providing decision support for university administrators and teachers [13]. Yue Qi et al. (2018) proposed a hybrid intelligent algorithm based on a genetic algorithm and back propagation neural network to evaluate the teaching quality. The results showed that the prediction accuracy of the hybrid algorithm was 15.45% higher than that of the two algorithms alone, which could effectively achieve the evaluation [14].

E. RESEARCH ON SOCIAL COMPUTING

From the macro perspective, social computing is more concerned with the application of traditional social science research theory, combined with computing technology, so as to promote human social activities and improve the efficiency and level of human social activities. From the micro and technical perspective, social computing mainly studies the application of computer and information technology in society from the research fields such as human-computer interaction [15]. In other words, an important function of social computing is to study relevant information technology tools, realize social interaction and communication, and build a virtual space for communication between people more conveniently. Such information technology tools are also called social software, and its core is to assist individuals in social communication and collaboration. The information technology of social computing has begun to open up new perspectives and heights for the computing, communication, cooperation and business of human society in the Internet era. Many scholars have studied social computing. For example, after analyzing the current educational application status of social software, Aswani et al. elaborated the advantages and points for attention of the application of social software in e-learning [16]. On the basis of a brief description of social computing, its development and characteristics, Azaouzi and Romdhane analyzed the impact of social computing on education and teaching as well as the problems caused by the use of social computing in education [17]. According to the current domestic research on the classification of social software, Ntalianis et al. proposed the classification of social software based on educational applications and compared the functional differences in typical e-learning of social software applications [18]. Starting from the elaboration on the specific connotation, extension and historical development of social computing, Yüksel analyzed the reform of education and teaching in the era of social computing. The result showed that although there are still obstacles in the application of social computing in education and teaching, the huge potential it exerts can make education reach a new height [19].

F. RESEARCH ON SIGNIFICANCE

Although the importance of multimedia teaching quality and teaching effect has been deepened, there is still a lack of a comprehensive, objective and scientific evaluation system for the quality of multimedia teaching in colleges and universities. Therefore, many universities have carried out multimedia teaching for many years, the quality of teaching is still not improved. Based on constructing evaluation index system of college multimedia teaching effectiveness as the goal, through the establishment of a set of in line with the modern school teaching present situation and characteristics of the multimedia classroom teaching evaluation, so as to evaluate the current level of multimedia classroom teaching in colleges and universities to provide a certain theoretical and practical reference, make contribution to promote the quality of multimedia teaching in colleges and universities.

III. METHODS

A. GENETIC ALGORITHM

Genetic algorithm is an evolutionary algorithm for solving optimal search. Genetic algorithm is a computational model that simulates the natural selection and genetic mechanism of Darwin's biological evolution theory, and it is a method to search the optimal solution by simulating the natural evolution process. The genetic algorithm is divided into five parts: coding, fitness calculation, selection, crossover and mutation [20]–[22]. Flow chart of genetic algorithm optimization is shown in Figure 1.

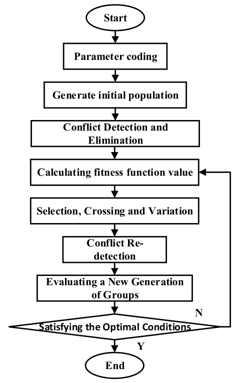

FIGURE 1. Flow chart of genetic algorithm optimization.

Firstly, as shown in Fig. 1, a group of candidate solutions is formed, and the fitness of these candidate solutions is estimated according to some fitness conditions. Some candidate solutions are retained according to fitness, and other candidate solutions are abandoned. Some operations are performed on the reserved candidate solutions to generate new candidate solutions. Genetic algorithms are good at solving global optimization problems. For example, timetable arrangement uses software scheduling with genetic algorithms, which are often used to solve practical engineering problems such as traditional mountaineering algorithms [23], [24]. The genetic algorithm can jump out of the local optimum and find the global optimal. If it is a traditional hill climbing algorithm, the variable range limits the complex process [25], [26]. To solve this problem, constrained optimization problems and non-binding optimization problems can be used [10], [27], [28]. Because the overall search strategy and optimization search method of genetic algorithm do not depend on gradient information or other auxiliary knowledge, but only the objective function and the corresponding fitness function that affect the search direction, genetic algorithm provides a general framework for solving complex system problems [29], [30]. It does not depend on the specific domain of the problem and has strong robustness to the types of problems. By consulting the data, it is seen that this algorithm can be used in the teaching evaluation system. However, in the process of calculation, the fitness function is difficult to determine. The convergence speed is slowed down due to the influence of multiple factors, so that only the local optimal solution can be obtained [31], [32].

There are three parameters of the genetic algorithm, namely the population size n, the crossover probability Pc and the mutation probability P_m. If the population size n is too small, it is difficult to find the optimal solution, if it is too large, the convergence time will increase. If the crossover probability Pc is too small, it is difficult to search forward, if it is too large, it is easy to destroy the structure with high adaptive value. And when the mutation probability P_m is too small, it is difficult to generate new gene structure, and the genetic algorithm will become a simple random search if it is too large.

B. DESIGN IDEA OF TEACHING EVALUATION SYSTEM BASED ON QPSO ALGORITHM

Quantum particle swarm optimization (QPSO) algorithm cancels the particle's moving direction attribute, and the updating of the particle's position has nothing to do with the particle's previous motion, thus increasing the randomness of the particle's position [33], [34].

First, according to the characteristics of the problem, the appropriate coding method is selected, which will have a direct impact on the performance and solution results of the QPSO algorithm. The so-called problem representation scheme is that when using the QPSO algorithm to solve a problem, the solution of the problem should first be mapped from the D-dimensional solution space to the representation space with a certain structure. This is the representation of the problem and the coding scheme. The solution to the problem is represented by a specific code string [12].

Second, an appropriate objective function or cost function is used to calculate the fitness value, which can be used to evaluate the quality of the solution. Fitness is the only parameter that reflects and guides the ongoing optimization process.

Third, different algorithm models can choose different control parameters. These parameters can directly affect the optimization performance of the algorithm. The control parameters of the QPSO algorithm mainly include the size of the particle swarm, the maximum algebra of the algorithm execution, the inertia coefficient, the cognitive parameters, the social parameters and other vehicle-assisted control parameters.

Fourth, in the QPSO algorithm, the most critical operation is how to determine the velocity of the particles. The dynamic adjustment of the flight speed and direction of each component of the particles is achieved by means of the memory information PbeSt of the particles themselves and the social sharing information Gbest.

Fifth, the most commonly used termination criterion in QPSO algorithm is to reach the maximum iteration number G, or meet a good enough adaptive value, or the optimal solution stops changing. If one of the above conditions is satisfied, the algorithm will be terminated [35], [36].

Sixth, according to the designed algorithm structure programming operation, the solution of the specific optimization problem is obtained. The quality of the solution and the validity, accuracy and reliability of the algorithm are verified [37], [38].

Seventh, the parameters of the QPSO algorithm are determined as follows. The number of particles is taken as M=30, $\alpha(t) = m - (m - n) \times \frac{\mathrm{t}}{\mathrm{MaxTimes}}$, among them, m is taken as 0.9, and n is taken as 0.1. That is, the effect is better when iteration α (t) decreases linearly from 0.9 to 0.1, the probability pr=0.75 of selecting a new person from the pool of candidates is determined, End condition is that the number of loop iterations reaches a certain number, that is, *MaxTimes*=1000. The quantum particle swarm optimization (QPSO) can optimize the weights in the evaluation system through the theory of optimization of particle flight through the transformation of quantum state in quantum mechanics, so as to achieve a more comprehensive evaluation.

IV. RESEARCH FRAMEWORK AND FACTOR ANALYSIS

A. CONSTRUCTION OF EVALUATION INDEX SYSTEM FOR MULTIMEDIA CLASSROOM TEACHING

The evaluation index system is the basis and scale for evaluating classroom teaching, and it is also the core of the whole classroom teaching quality evaluation system.

According to the collected survey data, the evaluation indicators of multimedia classroom teaching are shown in Table 1:

In order to facilitate quantitative evaluation, this study uses the 4-grade classification method for evaluation, i.e., the grades of excellent (≥90), good (80-89), medium (60-79), and poor (<60) to evaluate the indicators. The weight values are given by the experts through the expert survey method, thereby obtaining the average weight of each evaluation indicator. When students evaluate, the weights of multimedia courseware, multimedia teaching process, and multimedia teaching effect are 0.32, 0.36, and 0.32, respectively. In addition, the weights of teaching, technical, artistic, teaching attitude, teaching content, teaching ability, teaching organization, teaching media, and teaching effectiveness are 0.44, 0.36, 0.2, 0.26, 0.26, 0.21, 0.27, and 1, respectively. When teachers evaluate, the weights of multimedia courseware, multimedia teaching process, and multimedia teaching effect are 0.32, 0.37, and 0.31, respectively. In addition, the weights of teaching, technical, artistic, teaching attitude, teaching content, teaching ability, teaching organization, teaching media, and teaching effectiveness are 0.46, 0.35, 0.19, 0.25, 0.25, 0.23, 0.27, and 1, respectively.

In summary, the indicators of teaching attitude, teaching content, teaching ability, and teaching organization and media are selected for teaching evaluation, and the corresponding weight ratios are 0.26, 0.22, 0.22, and 0.15. Therefore, according to the different descriptions of the evaluation indicators, the evaluation can be divided into four levels, i.e., completed, basically completed, completed poorly, and poorly. The corresponding level weights are 0.9-1, 0.7-0.9, 0.5-0.7, and 0-0.5.

B. DATA PROCESSING OF EVALUATION INDICATORS FOR MULTIMEDIA CLASSROOM TEACHING

First, the collection is created:

The set of primary indicators is:

$$\mathrm{U} = (\mathrm{U}_1, \mathrm{U}_2, \ldots, \mathrm{U}_\mathrm{n}) \tag{1}$$

The weight set is:

$$A = (\mathrm{a}_1, \mathrm{a}_2, \ldots, \mathrm{a}_n), \quad \sum \mathrm{a}_n = 1 \tag{2}$$

The set of secondary indicators is:

$$\mathrm{U} = (\mathrm{U}_{\mathrm{i}1}, \mathrm{U}_{i2}, \ldots, \mathrm{U}_{\mathrm{ik}}) \tag{3}$$

The weight set is:

$$A = (\mathrm{a}_{i1}, \mathrm{a}_{i2}, \ldots, \mathrm{a}_{ik}), \quad \sum \mathrm{a}_{ik} = 1 \tag{4}$$

The set of comments is:

$$V = (\mathrm{V}_1, \mathrm{V}_2, \mathrm{V}_3, \mathrm{V}_4) \tag{5}$$

V_1, V_2, V_3, and V_4 represent four comment levels of excellent, good, medium, and poor, respectively.

In the second step, the matrix is built.

TABLE 1. Evaluation index system of multimedia classroom teaching in colleges and universities.

Evaluation factor	Primary indicator	Secondary indicators
Multimedia courseware	Instructional	Clear teaching objectives Specified content The important and difficult contents are high-lightened, which is easy for students to understand. The courseware is novel and attractive. To cultivate the innovative thinking
	Technical	Rational use of multimedia The software can run stably. Easy to operate and easy to manage Clearly interactive Excellent security and compatibility
	Artistry	The layout is reasonable and the overall style is coordinated. The layout is simple and beautiful. The multimedia effect is real. The sound quality of the dubbing and soundtrack is clear. The amount of text is easy to read and the font is easy to read. The look and feel of the color matching are comfortable and it is not easy to cause visual fatigue.
	Economy	The minimum cost is used to get the maximum value (the student evaluation indicator does not include this item).
Multimedia classroom teaching process	Teaching attitude	The teacher prepares the lesson carefully and explains it without notes. The Q&A is timely, and the questions are not overwhelming (teachers, peers, and expert evaluation indicators do not include this item). The teaching plan is clear and the level is clear (the student evaluation index does not include this item). The teaching plan is complete and the considerations are comprehensive and flexible (the student evaluation indicator does not include this item).
	Teaching content	Covering a wide range of content, rigorous teaching plans The content meets the requirements of the outline and has a certain expansion. The point of view is correct, the concept is clear, the focus is outstanding, and the difficulty is solved.
	Teaching skills	The teaching process is clear and logical. The academic level of the teacher is high, and the content of the lecture is vivid and affectionate. Teaching methods are diverse. According to different teaching objects and content, teachers teach students according to their aptitude.
	Teaching organization	To fully mobilize the enthusiasm and initiative of students. To control the teaching rhythm and mobilize the teaching atmosphere
	Teaching media	The media was chosen reasonably. The type of media is determined for the characteristics of different disciplines and courses. The effect that the media should have is played. The teacher operates the media proficiently.
	Classroom teaching effect	The attendance rate of students in class is high and their interest is strong. The interaction between teachers and students is active. The correct rate of questioning or written examination in the classroom is high.
Effect of multimedia classroom teaching	Classroom teaching effect	The course content and basic structure are correctly understood. Students not only learn the course, but also master the learning methods of the subject (teachers, peers, expert evaluation indicators do not include this item). The questions raised by the teachers can be effectively resolved. The solution (teachers, peers, expert evaluation indicators do not include this item) was designed.

The matrix from the comment indicator to the slogan V is:

$$R_i = \begin{pmatrix} a_{111} & \cdots & a_{114} \\ \vdots & \ddots & \vdots \\ a_{ik1} & \cdots & a_{ik4} \end{pmatrix} \tag{6}$$

If V_1 with index U_{i1} has V_{i12} comments, V_2 has V_{i12} comments, V_3 has V_{i13} comments, V_4 has V_{i14} comments, then:

$$\mathrm{r}_{i11} = \frac{V_{i11}}{V_{i11} + V_{i12} + V_{i13} + V_{i14}} \tag{7}$$

The evaluation results are calculated from the lowest level up to the highest level. The evaluation matrix R of the multimedia teaching quality and the membership vector B of the comment set V are obtained:

$$R = \begin{vmatrix} b_{11} & b_{12} & b_{13} & b_{14} \\ b_{21} & b_{22} & b_{23} & b_{24} \\ \cdots & \cdots & \cdots & \cdots \\ b_{ik1} & b_{ik2} & b_{ik3} & b_{ik4} \end{vmatrix} \tag{8}$$

$$B_i = A_i \times R_i = (b_{i1}, b_{i2}, b_{i3}, b_{i4}) \tag{9}$$

If the addition result of $B = A \times R = (b_1, b_2, b_3, b_4)$, b_1, b_2, b_3, b_4) is not equal to 1, it should be normalized.

The evaluation of classroom teaching quality is the evaluation process of the value of teaching activities by the evaluation subject, which is easily influenced by the evaluation subject itself and surrounding factors. Therefore, in order to have a reasonable evaluation of the quality of classroom teaching, the simplification of the evaluation subject must be overcome, and the diversification of the evaluation subject is realized. The quality of teachers' classroom teaching is evaluated from different perspectives, and then the evaluation results of different subjects are combined to give a scientific and comprehensive evaluation of classroom teaching quality. From the four evaluation subjects of students, teacher's self-evaluation, peers and experts, the comprehensive evaluation system of multimedia classroom teaching quality evaluation was constructed. In terms of the weight of the evaluation results of different evaluation subjects, it is considered that students are participants from beginning to end in the teaching process. Therefore, they are the most influential evaluators. Although peers and experts are experienced, their number of lectures is relatively small. After repeatedly seeking the opinions of leaders, supervisors, and teachers, the relationship between different evaluation subjects was designed as follows: the weight of the students' evaluation results is 0.5, while the teacher evaluation results account for 0.1. The results of peer review accounted for 0.1, and the weight of expert evaluation results was 0.3. The formula for calculating the comprehensive evaluation results of a course is as follows:

$$\mathrm{P} = S \times 0.5 + T \times 0.1 + Q \times 0.1 + R \times 0.3 \tag{10}$$

Among them, P is the comprehensive evaluation result, S is the student evaluation result, T is the teacher self-evaluation result, Q is the peer evaluation result, and R is the expert evaluation result. Above 90 points are excellent, 80-89 points are good, 60-79 points are average, and below 60 points are unqualified.

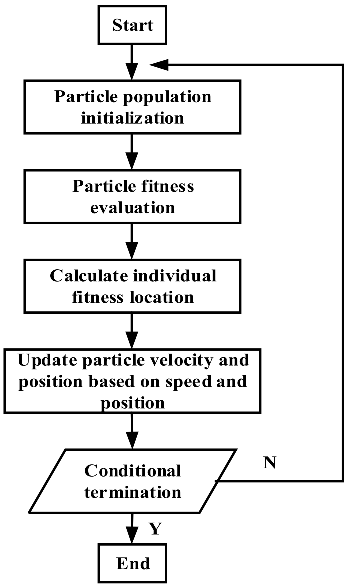

FIGURE 2. Flow chart of algorithm.

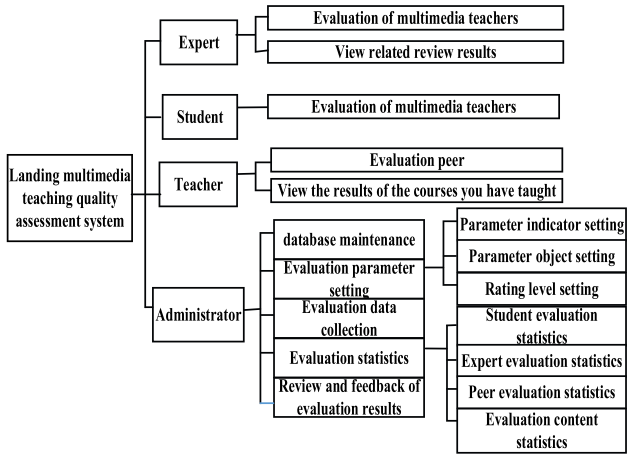

FIGURE 3. Structure diagram of university multimedia teaching quality evaluation system.

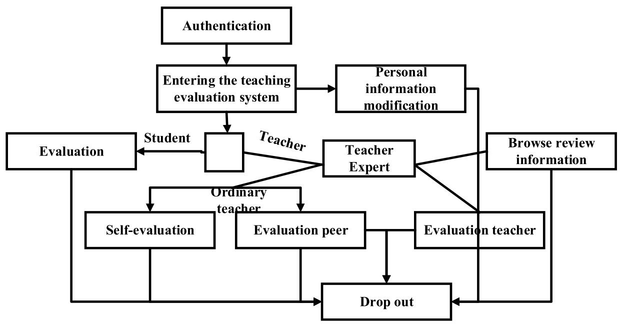

FIGURE 4. The flow chart for evaluating the main system.

V. EXPERIMENTAL DESIGN AND STATISTICAL ANALYSIS

A. DESIGN AND IMPLEMENTATION OF QUALITY ASSESSMENT SYSTEM FOR MULTIMEDIA CLASSROOM TEACHING IN COLLEGES AND UNIVERSITIES

The multimedia classroom teaching quality assessment system can be used as a subsystem of the educational administration system and can be closely integrated with the teaching platform. However, it requires a certain degree of independence to facilitate future expansion of the system. The management system consists of basic data management, evaluation index system management, data evaluation management and evaluation result management. According to the requirements of the system, the system is designed to be composed of functional modules such as database maintenance management module, evaluation parameter setting management module, evaluation statistical management module and evaluation result management module.

The flow chart for evaluating the main system is shown in Figure 4:

Based on the above system functions and flow charts, the relationship between the evaluation subjects and them is designed. Firstly, from the perspective of course selection, the entity relation diagram of teacher evaluation is established. Then, the main diagrams are integrated together.

When the teacher basic information management form is displayed, the administrator inputs the pre-added teacher basic information through the text box. In the category drop-down list box, all current categories are listed for selection. When the basic information is completely written, the add button is clicked and the teacher's basic information is stored in the database. If the identity of the added teacher is the supervisor or the leader, the information is only stored in the table TEACHER. If the identity of the added teacher is the teacher, the information is stored in the table TEACHER, and the teacher's number is also stored in the table ALLSCORE for use in recording the teacher evaluation score.

When the student basic information management form is displayed, the administrator inputs the pre-added basic information of the student through the text box. All currently existing lines are available for selection in the department drop-down list box. When the basic information is completely written, the add button is clicked and the student's basic information is stored in the database. The student information maintenance form displays all student information. The administrator can modify the selected record through the ''Edit'' button, or delete the selected information by clicking the ''Delete'' button. At the same time, the student's evaluable teacher is viewed through the ''evaluable teacher'' hyperlink.

Evaluation relationship management is in the ''evaluation corresponding relationship'' interface. The ''evaluable teacher'' hyperlink is clicked to enter the management interface of its corresponding evaluable teacher. Here, the administrator can determine the evaluable teachers based on the actual situation. When the delete button in the ''evaluable teacher'' is clicked, the corresponding record will be deleted from the table and added to the ''teacher of the department''. When the add button in the ''instructor of the department'' is clicked, the corresponding record will be deleted from the table and added to the ''evaluable teacher''.

After the students, supervisors, and school leaders entered the system, the quality of the teacher's teaching was evaluated. In the teacher drop-down list box, the teacher to be evaluated is selected. In the evaluation score column corresponding to each evaluation content, the evaluation level is selected. Finally, the submit button is clicked to submit the teacher's evaluation score to the database.

The inquiry operation of the evaluation result of the teacher's teaching quality is as follows. After the teacher enters the system, the detailed information of the teaching quality evaluation results is inquired, including the student evaluation results, the supervision evaluation results, the school leadership evaluation results and the comprehensive evaluation results. Among them, the results of student evaluation, the results of supervisory evaluation and the results of evaluation of college leaders are shown in specific scores, while the results of comprehensive evaluation are displayed in hierarchical form.

B. SOFTWARE APPLICATON TEST OF TEACHING QUALITY EVALUATION SYSTEM

The purpose of software testing is to find the biggest possible errors and defects in software products. The test has many one-sided or wrong opinions in the real world. These comments will seriously affect the smooth progress of the test. Therefore, the clarity of the purpose of the test is more important. In the use case test, in addition to the test data (input data), the output of the test data, or the expected result, should be provided. The actual output that needs to be tested is compared to the expected result, and if they do not match, there is an error. Therefore, test cases consist of data tests and expected results. In order to find errors in the program, the plan for the test report should be properly designed. A good test solution is very likely to find errors that have never been discovered.

Common software testing steps are unit testing, integration testing, and verification testing. Unit testing is also called module testing. Unit tests are typically written as a module and placed in the coding phase. Programmers always test the modules they have written to check whether the functions and algorithms of the modules meet the requirements of the design specification. The unit test is mainly to check the error generated by the code. Usually, the white box test is used. Integration testing is also known as assembly testing. The assembly of each module program is tested. It mainly checks the interface and communication between modules. Integration testing is mainly to check for errors in the design phase, which is commonly used in black box testing. Validation tests are used to check the functionality, performance, user requirements, and specification requirements. Usually, black box testing is used. Whether the generated test program meets the requirements of the specification is verified. The integrity of the software configuration is then checked to meet all aspects of the requirements. If the software is customized for the customer, the final acceptance test by the customer is finalized to confirm that the software meets the needs.

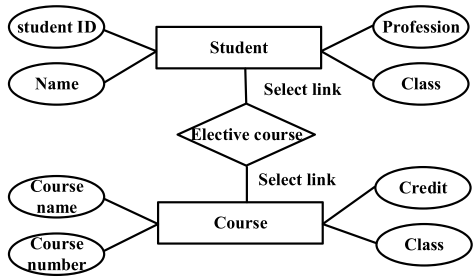

FIGURE 5. **The relation diagram between students and courses.**

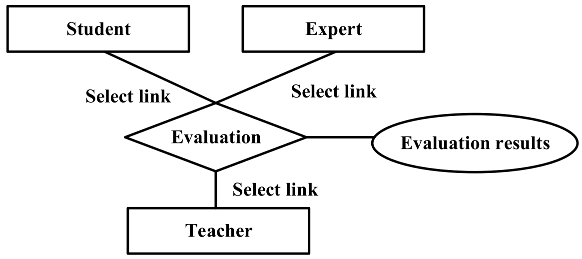

FIGURE 6. **Relation diagram of the part of the system.**

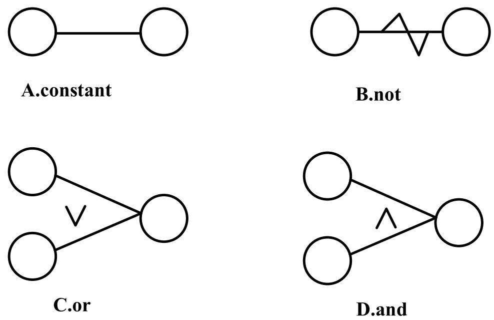

FIGURE 7. **Basic graph of cause and effect diagram.**

If a software is used as a product by many customers, it is impossible to get every customer to do acceptance testing.

Software test methods can be divided into manual test and automatic test from the perspective of testers. From the perspective of source code, it can be divided into unit test and functional test. From the theoretical definition, it can be divided into black box test and white box test. Black box test method: cause and effect diagram: if various combinations of input conditions must be considered during testing, the possible number of combinations will be astronomical. Therefore, the design of test cases must consider the combination of describing multiple conditions and the corresponding form of multiple actions, which requires the use of cause and effect diagram. The effect diagram method is used to find the cause (input condition) and result (change in output or program state) from the description of the program specification written in natural language, and convert it into a decision table through the cause and effect diagram. The basic graphical symbols for the cause and effect diagram are as follows:

Description of the test target: The user fills in the teacher's ID and login password to log in to the system to query the results of the teacher's evaluation. The premise is that the

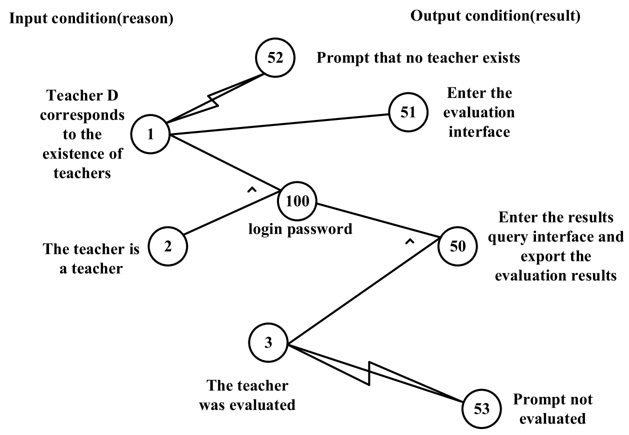

FIGURE 8. The cause and effect diagram.

TABLE 2. The scores of various indicators of the multimedia classroom teaching quality evaluation system.

Indicators	Rate of excellence	Rate of kelter	Rate of medium	Qualified rate	Failure rate
Teaching attitude	0.631	0.119	0.127	0.123	0
Teaching content	0.313	0.626	0.061	0	0
Teacher quality	0.376	0.497	0.127	0	0
Teaching method	0.391	0.245	0.364	0	0
Teaching effect	0.252	0.647	0.101	0	0
Synthesis score	0.377	0.466	0.138	0.019	0

teacher ID and login password are correct. If the ID of the teacher exists and the teacher is the instructor and has been evaluated, the teacher can enter the score query interface and output the evaluation result. On the contrary, the teacher cannot enter the score inquiry interface and the prompt that has not been evaluated appears. If the teacher is a non-lecturing teacher, the student enters the evaluation interface and can only evaluate the lecturing teacher. If the ID of the teacher does not exist, no operation can be performed, and the system will prompt that the login ID or password is wrong. It can be seen from the above description that the reason is: 1 indicates that the teacher corresponding to the teacher ID exists, 2 indicates that the teacher is the instructor, and 3 indicates that the teacher has been evaluated. Result: 50 means entering the performance query interface and outputting the evaluation results, 51 means entering the evaluation interface, 52 means prompting that no teacher exists, 53 means prompting has not been evaluated. The cause and effect diagram are shown in Figure 8.

Firstly, the purpose and principle of system testing are introduced. Then, test cases are compiled according to the compiling criteria of test cases, and the problems in the system are detected through system testing. Only in this way can the system be more perfect. Through testing, some problems in the system are also checked out and repaired. The teaching quality evaluation system was tested, and the basic concepts

TABLE 3. Comprehensive evaluation results of multimedia teaching quality.

-	≥90	80 ~ 89	70 ~ 80	60 ~ 70	<60
First semester of 2018-2019	1 (33.33%)	25 (52.08%)	6 (12.5%)	1 (0.02%)	0 (0.00%)

and test procedures were introduced. The system was tested by black box test method, which proved the correctness of the system program.

C. ANALYSIS OF THE APPLICATION ON THE EVALUATION SYSTEM

The school of economics and management of XX university were chosen as the research object of multimedia classroom teaching quality evaluation system. At present, courses taught through multimedia account for 48% of the total, among which compulsory courses account for 82%. Moreover, the proportion of courses taught by multimedia and the utilization rate of multimedia classrooms are on the rise year by year. Therefore, there are higher requirements on the teaching quality evaluation system of multimedia courses. The constructed evaluation system was applied to the quality evaluation of 39 multimedia courses opened in the first semester of the academic year 2018-2019. 48 teachers were evaluated, 615 students participated in the evaluation, and 17 experts were selected to evaluate each teacher after attending lectures in the whole semester. The comprehensive evaluation result ≥90 is excellent, 80-89 is good, 70-80 is medium, 60-70 is passing, and below 60 is failing. The score of teachers is shown in table 3.

Through this system, students and experts can judge the difference of teaching quality evaluation results of the same teacher. The student evaluation results of 5 teachers were randomly selected and compared with the expert evaluation results. Statistical analysis was conducted according to the method of mean test of randomized paired design data, and correlation analysis was conducted. The calculation formula was as follows:

$$r = \frac{n\sum xy - \sum x \sum y}{\sqrt{n\sum x^2 - (\sum x)^2}\sqrt{n\sum y^2 - (\sum y)^2}} \quad (11)$$

It was calculated that r=0.576, indicating that the results of student evaluation and expert evaluation were moderately correlated, and the difference between the two groups was not statistically significant. The specific evaluation results of the five teachers are shown in table 4.

Where TN represents the teacher number, R1 represents the evaluation result given by the student, and R2 represents the evaluation result given by the expert.

After the implementation of the teaching quality evaluation system, 86% of the teachers hold the belief that this teaching quality evaluation method is objective and accurate, and the evaluation results are scientific. Compared with the traditional questionnaire, the teaching information obtained

TABLE 4. Five evaluation results of students and experts of the teachers.

TN	R1	R2	Difference value x-y
1	87.3	86.2	1.1
2	84.9	85.2	-0.3
3	91.4	92.0	-0.6
4	85.9	85.5	0.4
5	82.1	81.8	0.3

through the application of multimedia teaching evaluation system is more comprehensive, and when the evaluation results are analyzed, teachers can be considered more scientifically in various aspects.

VI. CONCLUSION

A. IMPLICATION FOR ACADEMIC CONTRIBUTIONS

There are mature evaluation criteria for multimedia teaching courseware at home and abroad, but there is no scientific and reasonable evaluation index system for the effectiveness of multimedia teaching courseware in classroom teaching. The innovation is to construct an evaluation index system for the effectiveness of multimedia teaching courseware in classroom teaching, which is applicable to both classroom teaching and classroom teaching record. Compared with traditional evaluation, the evaluation index system has a wider scope and more specific problems. However, due to the lack of thorough research, the subsystem of the teaching evaluation system needs to be further improved. Therefore, in the future research, the design practice teaching subsystem should be further developed to further improve the implementation of the college teaching quality evaluation system. For the realization of the classroom teaching quality evaluation system, the constant changing factors of the input indexes can be further considered, and the interface can be designed to be more flexible and convenient to adapt to the situation of the continuous development of higher education.

B. IMPLICATION FOR INDUSTRY PRACTICES

The design concept of the multimedia classroom teaching evaluation system is introduced, which provides a new solution for teaching quality management and evaluation. The multimedia teaching quality assessment system was designed. The system is designed according to the mode of multi-media multimedia teaching quality evaluation system and based on the characteristics of multimedia teaching in the university. In the process of system design, the defects of the general teaching evaluation mode are overcome, and the real-time and objectivity of the system are reflected. The system framework is designed and completed. According to the results obtained from the system requirements analysis, and using the related system design methods and technologies, combined with genetic algorithm and QPSO algorithm, the system is designed, including the overall system architecture, functional architecture, etc., so as to complete the system framework. In addition, social computing method is adopted in this study. Social computing, as an interdisciplinary field of dynamic integration of the three, has opened up a new exciting network situation. It has completely changed the way people share and communicate information and brought great influence to the global economy, social interaction and people's life. Education is also inevitably affected by the new concept of social computing. The development of social computing software provides good support for education and teaching. It changes the traditional way of communication, expands the learning space and enriches the learning resources. What's more, it realizes the sharing of knowledge and information between teachers and students, stimulates students' desire for knowledge innovation, cultivates students' ability of information collection and processing, and promotes the socialization of teaching. Multimedia classroom teaching evaluation index system should adapt to the development of the times and reflect the current teaching quality standards. In the process of application, it should be revised and improved in time to better play its role in guiding, monitoring and promoting the teaching quality of teachers' courses.

C. SUGGESTIONS AND COUNTERMEASURES

In order to effectively improve the quality of multimedia teaching in colleges and universities, this study puts forward suggestions and countermeasures on the basis of establishing an evaluation system.

1)To select the right and appropriate amount of multimedia at the right time. In the teaching process, some of the abstract concepts can be used to attract the attention of students by means of pictures and videos, thereby deepening the impression and virtually expanding the knowledge of students. For some complex equations or examples to be deduced, the teachers need to use the blackboard so that students can keep up with the ideas and grasp the content in time.

2) To control the rhythm of multimedia teaching. Since multimedia teaching can highly integrate a large amount of information, teachers should reasonably control the teaching rhythm so that students can deepen their understanding of the content while communicating. If the explanation is too fast, many students will not be able to catch up. Therefore, the students will have more questions and eventually lose their interest in learning. Therefore, teachers need to control the use of multimedia rhythm based on the feedback of students so that students can accept the content more efficiently.

3) To avoid excessive multimedia courseware content. Multimedia courseware is only for attracting the attention of students and allowing them to receive information more quickly, thus, there is no need to add too many pictures or videos to multimedia, which may distract the students and reduce the teaching effect.

4) To strengthen teacher-student interaction and rely less on multimedia. Multimedia is only used as a teaching tool. Therefore, teachers should not rely too much on multimedia. They should explain relevant content from time to time,

interact with students, and still focus on students rather than multimedia.

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