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Retraction

Retracted: Evaluation Method of Advanced Mathematics Teaching Reform Effect Based on Big Data Analysis Technology

Advances in Multimedia

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] Y. Chen, "Evaluation Method of Advanced Mathematics Teaching Reform Effect Based on Big Data Analysis Technology," *Advances in Multimedia*, vol. 2022, Article ID 6051413, 12 pages, 2022.

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Research Article

Evaluation Method of Advanced Mathematics Teaching Reform Effect Based on Big Data Analysis Technology

Yeqin Chen

Department of Quality Education, Jiangsu Vocational College of Electronics and Information, Huai'an 223003, China

Correspondence should be addressed to Yeqin Chen; wcartersl51362@student.napavalley.edu

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In order to promote the teaching reform, deepen the professional construction, innovate the talent training mode and course teaching mode, improve teachers' advanced vocational education teaching design ability and teaching level, and promote the connotation construction of higher vocational colleges, an evaluation method of higher mathematics teaching reform effect based on big data analysis technology is proposed. In the research, the teaching status of advanced mathematics courses and the problems existing in teaching are firstly analyzed and studied. Then, on the basis of comprehensive analysis of various influencing factors of course teaching effect evaluation, a set of two-level index system with a total of 25 indicators is established. The results verify the rationality of these indicator settings. Finally, combined with the real historical data of the teaching evaluation effect of a private college, the validity of the proposed model is verified. The experimental results show that the 530 sample data of the course are submitted to the RBF network for the training, and the network converges after 3385 iterations. Among all 100 test samples, the maximum test error is 0.0513, of which 92 samples are judged correct, 7 samples are judged as excellent, and 3 samples are judged as medium. Therefore, the evaluation accuracy rate of the RBF network is as high as 92%. It is concluded that this method provides a new way to evaluate the teaching effect of the course objectively and impartially.

1. Introduction

With the rapid development of vocational education in our country, higher vocational colleges have trained millions of full-time graduates, provided tens of thousands of specialized technical personnel for the development of socialist society, promoted social progress, and accelerated the development of the economy has also solved the current situation of the shortage of technical talents in our country, so as to make the growth of talents meet the actual needs of the rapid social development and play an important role in improving social productivity and labor level [1].

Under the principle of "necessary and sufficient" in higher vocational education teaching, advanced mathematics in vocational colleges should enable students to learn richer and more useful modern mathematics knowledge, provide knowledge guarantee for the learning of professional knowledge, and provide the quality assurance for the sustainable development of students [2]. In the actual teaching, through a lot of data review and field investigation, it is found that many vocational colleges do not have obvious effect of higher mathematics teaching reform under the background of teaching reform, and even some unreasonable status quo appears. Taking Xianyang Vocational and Technical College as an example, the advanced mathematics course has been compressed from the original two semesters to one semester, resulting in a serious shortage of advanced mathematics hours. Teachers have excessive class hours in the first semester and insufficient in the second semester, and teachers are not very motivated in teaching. On the one hand, when students use mathematical knowledge to solve professional problems, the knowledge is not enough or they have not learned, which affects students' learning of professional courses [3]. On the other hand, students think that learning advanced mathematics is useless, they do not like learning advanced mathematics, their interest in learning mathematics has dropped significantly, and the phenomenon of being late, absent, and leaving early in

mathematics class is serious. The phenomenon of mobile phones and chatting is more serious, students' mathematics scores have dropped significantly, and the number of unqualified students has increased significantly, as shown in Figure 1.

2. Literature Review

Pan et al. considered the curriculum reform from a macro perspective. First, he reformed from the teaching concept and the positioning of the curriculum. The curriculum was set based on the curriculum content, goals, and plans. Finally, he proposed the reform of teaching material construction, teaching mode, and evaluation method. A relatively complete mathematics curriculum reform system was established, but her reform ideas did not mention the integration with majors [4]. Starting from practical exploration, Jolivet et al. proposed a teaching strategy that combined with majors, mainly from stimulating students' interest, students' learning methods, modular teaching, etc., and also mentioned the compilation of advanced mathematics lecture notes in combination with majors, which was a bold and most practical reform strategy [5]. Zdunek put forward the teaching concept that higher mathematics served the profession. Mathematics teaching should reflect the characteristics of basic and tool and focus on cultivating students' comprehensive quality. In the construction of professional advanced mathematics textbooks, it mainly focused on the basic mathematics of students, the application of advanced mathematics, highlighting the connection between mathematical concepts and practical problems and adding application examples related to majors. The class of mechanical and electrical majors used the example of the "Engineering Mechanics" course to explain the application of advanced mathematics [6]. According to the characteristics of the computer major, Wamsler proposed a teaching mode for the establishment of mathematical experimental courses, which changed the original teaching mode of mathematics from "closed" to "open" and changed mathematics teaching into a teaching based on students' hands-on, operation, and experience. The teaching mode was mainly based on the teacher's teaching and supplemented by the teacher's teaching to increase the students' practical ability. This teaching mode was the so-called "student-centered" modern teaching concept [7]. Jian and Yth reexamined the current situation of the reform of higher vocational mathematics curriculum and proposed more specific reform methods from the selection and processing of teaching content, students' learning factors, and teachers' teaching methods. The construction of the teaching staff was linked to increase the connotation of curriculum reform [8]. Si advocated the modular teaching. According to different majors, different contents were selected. In teaching, emphasis was placed on diluting theory, strengthening application, emphasizing intuitive teaching, attaching importance to teaching methods and learning methods, and putting forward ideas and methods for layered teaching, especially proposed that the reform of higher mathematics teaching was inseparable from the construction of teachers. Teachers were the disseminators of advanced educational ideas and the direct implementers of the teaching process, which affected the quality of teaching [9].

In the research, the research on students and teachers of a college was conducted. Through the data of the questionnaire survey, the current situation of higher mathematics teaching in higher vocational colleges was analyzed, and an evaluation model according to the status quo was established.

3. Research Methods

3.1. Investigation and Research on Current Situation of Higher Mathematics Teaching in Higher Vocational Colleges

3.1.1. Subjects of the Survey. The subjects of this survey are students of different majors in a certain college, teachers of science teaching and research offices, and teachers of other professional courses. 20 classes were selected, and 20 students were randomly selected from each class. 16 mathematics teachers and 20 professional teachers were surveyed, and different professional titles, different genders, and different age levels were considered in the selection process.

3.1.2. Method and Content of the Survey. In the process of the investigation, the questionnaire and the interview outline are firstly designed according to the situation. The questionnaire is mainly conducted from five aspects, such as the foundation of mathematics, learning interest, learning attitude, the use of teaching materials, and classroom participation, so as to understand the students' learning status, and then interviews are conducted for mathematics teachers. The content of the interviews mainly focuses on teaching materials, teaching methods, classroom conditions, etc. Through the survey of mathematics teachers, the current situation of teaching is grasped. The last is a survey of professional teachers. The purpose of the interview is to understand the mathematics requirements, what mathematical knowledge is needed in professional courses, and how to make mathematics courses better serve professional courses. In order to respect the privacy of the subjects, the questionnaires and interviews are conducted anonymously [10].

3.1.3. Distribution and Collection of Questionnaires. For different classes and different majors, 400 students were randomly selected from a total of 1,062 students in 20 classes to distribute the questionnaires. There were 20 students in each class, 400 copies were actually distributed, and 387 copies were recovered, with a recovery rate of 96.75%. A total of 36 teachers were interviewed, and all of them were valid.

3.1.4. Investigation and Research on Current Situation of Higher Mathematics Teaching in Higher Vocational Colleges. At present, students in higher vocational colleges have many problems in their learning, and they have no motivation and enthusiasm for learning, so the effect and performance of learning are not ideal. Students are the main body of teaching, so the students' foundation and learning status are first investigated to find out the reasons that affect

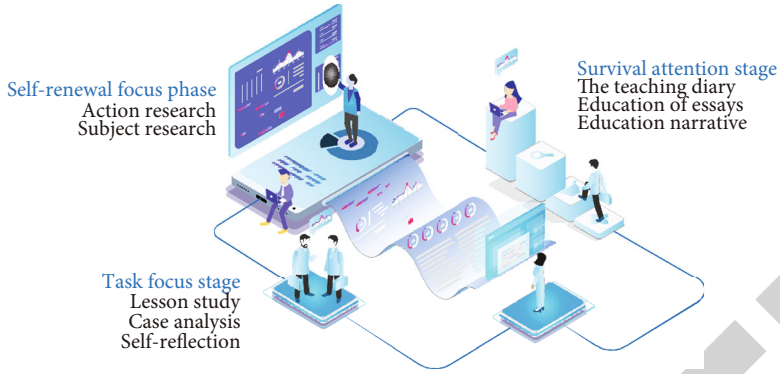

Figure 1: The technology based on big data analysis.

the students' learning effect and find reliable data for the research [11].

(1) The Study Status of Students in Higher Vocational Colleges. On the basis of the questionnaire survey, data analysis is carried out. And it is found that the reason why students' learning difficulties are mainly related to the following factors:

(1) Poor learning foundation and lack of basic knowledge

The statistics of the mathematics scores of the college entrance examination are as follows in Table 1 and Figure 2. The data shows that there are very few students with a score of more than 90 points. And according to the total score of 120 points, 90 points are only the pass line, and most of the students' mathematics scores are below 60 points.

From the data in Table 1 and Figure 2, it can be seen that the students' learning foundation is not ideal. The qualified students only account for 5.9% of the overall research, while those with scores below 60 account for 84.4%. Most of them are in this range. It shows that the mathematics knowledge of higher vocational students is very lacking, there are problems even with the most basic mathematical concepts and operation skills, and the transfer and application of knowledge cannot be talked about. In the middle and secondary vocational stage, they basically did not learn much mathematics courses. Most of the students have unclear mathematical concepts, basic symbols, and names; and basic elementary function images cannot be drawn. The ability to combine numbers and shapes is not enough, and the ability to imagination space is not enough. For example, students majoring in mechatronics are very difficult to study in professional courses such as drawing, and they cannot apply the mathematical knowledge they have learned to the study of professional courses. The ability to apply mathematics is relatively low. The poor mathematical foundation in a large area brings great challenges to the teaching of mathematics in higher vocational colleges. In teaching, it is necessary to spend great efforts to supplement the basic knowledge for students and consolidate the foundation in order to successfully transition to advanced mathematics. Otherwise, teaching mathematics will be difficult.

Table 1: Statistics of students' college entrance examination mathematics scores.

Math scores	Number	Frequency
Above 90 points	23	5.9%
60-90 points	76	19.6%
40-60 points	173	44.7%
Below 40 points	115	29.7%

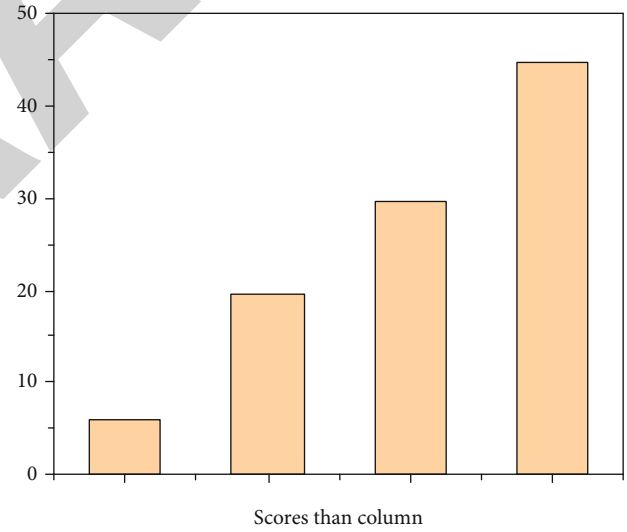

Figure 2: Pie chart of college entrance examination results.

(2) Students are not self-conscious enough and are not interested in learning

Interest in mathematics is the key to opening the door to mathematics learning, and interest is the best tutor. A survey of students' interest in learning shows the following data in Table 2.

From the data in Table 2, it can be seen that 14.5% of the students are interested in mathematics learning, 31.8% are interested in the history of mathematics, and 44.2% are not

Table 2: Statistics of interest in mathematics learning.

Interest in mathematics	Number	Frequency
The students are very interested in mathematics	56	14.5%
Interested in the history of mathematics	123	31.8%
Not interested in mathematics	171	44.2%
Afraid of mathematics	37	9.6%

Table 3: Statistics of students' performance in class.

Students' performance in class	Number	Frequency
Listen carefully and be active	81	20.9%
Try to listen and understand	204	52.7%
Not interested, nodding off in class	67	17.3%
Play mobile phones and games in class	35	9.0%

interested in learning mathematics. The data shows that most students lack interest in mathematics. The main reason is that students have unclear learning goals, no learning goals, and no learning motivation. Most of the students' goals are only to pass exams, so they are not interested in learning.

(3) The lack of management in the class link and the effect is not ideal

From the data in the statistics table of students' classroom performance (Table 3), it can be seen that 20.9% of the students listen to the class seriously and actively, and 52.7% of the students have a positive learning attitude and try hard to listen to the class, but they cannot fully understand it. There are 26.3% of students who are completely outside the classroom and are unwilling to listen to the class. These data show that the students' study habits are not good. Mobile phones, talking, and sleeping lead to the poor classroom teaching [12]. On the other hand, the reason is that teachers lack management in the classroom. Students in higher vocational colleges do not have the pressure to go to school, and there is no ranking of grades. Therefore, the quality of teachers' teaching lacks an evaluation mechanism. It can be believed that the teaching of teachers in higher vocational colleges is one of the "conscience" depends entirely on the teacher's sense of responsibility. If the teacher lacks management in the classroom and is separated from the main body of the students, it is difficult to attract students' attention into the classroom.

(4) The individual differences of students are great and the learning effect varies greatly

In addition to the influence of students' foundation, students' interests, and classroom management, the individual differences of students also have a great relationship with the effect of teaching. The same group, the same teaching method, and the development of different students are different, see Table 4 below.

The individual differences of students are also a major factor affecting the learning effect. Most of the girls in the classroom are more positive, while the boys are relatively negative. The final exam results show that the results of girls are generally higher than that of boys. Another difference is the liberal arts. The difference between students and science students is that due to the different training methods of high school Chinese science students, the students' learning foundation and learning thinking are also different. The mathematics foundation of science students is generally much better than that of liberal arts students, and the content of mathematics learning in high school is not the same. There are many liberal arts students, and their interest in mathematics is also higher than that of liberal arts students, because most students choose liberal arts because they are not interested in mathematics, physics, and chemistry; and science students have already been exposed to the preliminary knowledge of univariate function calculus in middle school. The study of mathematics provides a good knowledge preparation, so the overall learning effect will be much better [13].

(2) Investigation on the Current Situation of Higher Mathematics Teaching. Advanced mathematics is an important basic course in higher vocational colleges, and the other main body of teaching is teachers. In the wave of education reform, the old teaching mode is no longer suitable for the existing teaching needs. Mathematics teachers are given a higher historical mission, education is a major event related to the survival of a nation, and teachers have a major historical mission on their shoulders.

From the data in Table 5, it can be seen that the composition of mathematics teachers in terms of professional title, age, and educational background, 93.8% of the teachers have a bachelor's degree, 100% of the teachers have intermediate professional titles or above, mainly experienced old teachers. It can meet the teaching requirements as a whole. Teachers are the leaders of teaching. How to design teaching with effective numbers so that students at different levels can develop is the key to the effective implementation of teaching. In terms of teaching methods, a single method is not satisfied, and we should make use of modern teaching methods and various media materials to let students learn in a novel and interesting classroom atmosphere. In the preclass preparation, in addition to preparing textbooks, we should pay more attention to students and a variety of teaching methods. Using a combination of means to change the traditional "filling the classroom" and "cramming" teaching, at the same time, it should strengthen the classroom communication with students, use the interaction between teachers and students to mobilize the enthusiasm of students, and fully understand the individual situation of students. Different students should be inspired and taught differently. We should try to teach students in accordance with their aptitude and oppose one model across the board, because different students have different psychological conditions and receptive abilities. And it is necessary to improve

Table 4: Statistics of individual differences among students.

Content	Gender (frequency)		Arts and sciences (frequency)	
	Male	Female	Arts	Sciences
Think positively and answer questions	35.7%	64.3%	28.4%	71.6%
Take the initiative to communicate with teachers	53.6%	46.4%	38.2%	61.8%
Finish the homework independently	33.7%	66.3%	31.6%	68.4%
Do well in exams	43.8%	56.2%	36.4%	63.6%

Table 5: Statistics of teachers.

Title			Record of formal schooling		Age	
Professor	Associate professor	Lecturer	Postgraduate	Undergraduate	Above 40	Under 40
1	300.00%	1200.00%	100.00%	1500.00%	15	1
6.25%	18.70%	75.00%	6.25%	93.75%	93.75%	6.25%

the effectiveness of the classroom and must pay attention to different individuals.

(3) Teaching Hours of Mathematics in Vocational Colleges. At present, the class hours of practical training courses in the curriculum of higher vocational colleges are gradually increasing, while mathematics courses, as a public basic course, have been continuously compressed and less and less. The reason is to serve the cultivation of high-skilled talents. If the content is weakened, there is no need to talk about the cultivation of high skills. The class hours of advanced mathematics in Yunnan Energy Vocational and Technical School was 96 class hours in a semester three years ago, and now it has been reduced to the minimum class hours of 32 hours. The arrangement of mathematics class hours for some majors in three years is shown in Table 6.

3.2. Evaluation Model Construction

3.2.1. Overview of Curriculum Reform. The specific outline of the curriculum reform is as follows.

Learning method: using a blended teaching method of online learning and traditional classrooms, students can listen to lectures, ask questions, participate in interactive exchanges, complete homework, and take exams online and in the classroom, respectively.

Learning time and place: during the specified teaching week, online learning time can be arranged relatively freely, and classroom learning can be attended according to the specified time and place of the timetable.

Learning content: click on the selected corresponding course to study, watch the course video according to the study plan, read the relevant bibliography, watch the relevant lecture video, ask questions and discuss according to the learning content, and communicate and discuss with the students and teachers in the face-to-face class [14]. During the learning process, students study videos according to the plan, do after-class exercises, participate in after-class discussions, and master the course content.

Homework exam: complete homework and exams on time according to personal homepage reminders to get corresponding grades.

Assessment standard: after completing all task points, the test is taken uniformly to test the learning results. The weight ratio of the learning process such as video, homework, and test has been set, and the video is 40%, the test is 20%, and the test is 40%.

3.2.2. Evaluation Index System. According to the specific characteristics of teaching activities and the specific problems encountered in teaching practice, in line with the principle of reflecting the measurability and operability of evaluation indicators, a teaching evaluation index system is set up. The specific set of two-level index system is shown in Figure 3.

3.2.3. Classification of Evaluation Grade. According to the experience of experts and the actual situation of the teaching effect of the course, the evaluation results are divided into 5 grades, namely, "excellent, good, medium, qualified and unqualified." The numerical range of each grade is shown in Table 7.

According to the above table, if the evaluation output value is 0.97, the evaluation result of the course is excellent. If the evaluation output value is 0.65, the corresponding evaluation result of the course is qualified.

3.2.4. Evaluation Model Construction. The selection of neural network structure model is very important. The proper selection of model can greatly reduce the number of network training and ensure a higher accuracy of network learning.

According to the neural network theory, BP network is suitable for solving the approximation problem, and RBF network is suitable for solving the classification and evaluation problem. Since the problem to be solved in the research is to establish the evaluation method of course teaching effect, RBF neural network is selected as the evaluation model, and RBF network is trained based on the improved L-M algorithm [15, 16].

Network structure mainly includes connection mode, network level, and the number of nodes at each level, that is, the number of neurons in explicit input layer, hidden layer, and output layer. Teaching quality evaluation can be regarded as a nonlinear mapping from input value (teaching

Table 6: Statistical table of class hours for some majors of the college.

Semester	2019		2020		2021	
Major	First	Second	First	Second	First	Second
Electrical automation	96	48	64	48	48	32
Machinery manufacturing	96	48	64	48	48	32
Mine geology	96	48	64	32	48	32
Industry analysis,	96	48	64	32	48	32
Mining	96	48	64	32	48	32
Accounting	64	32	64	32	64	0

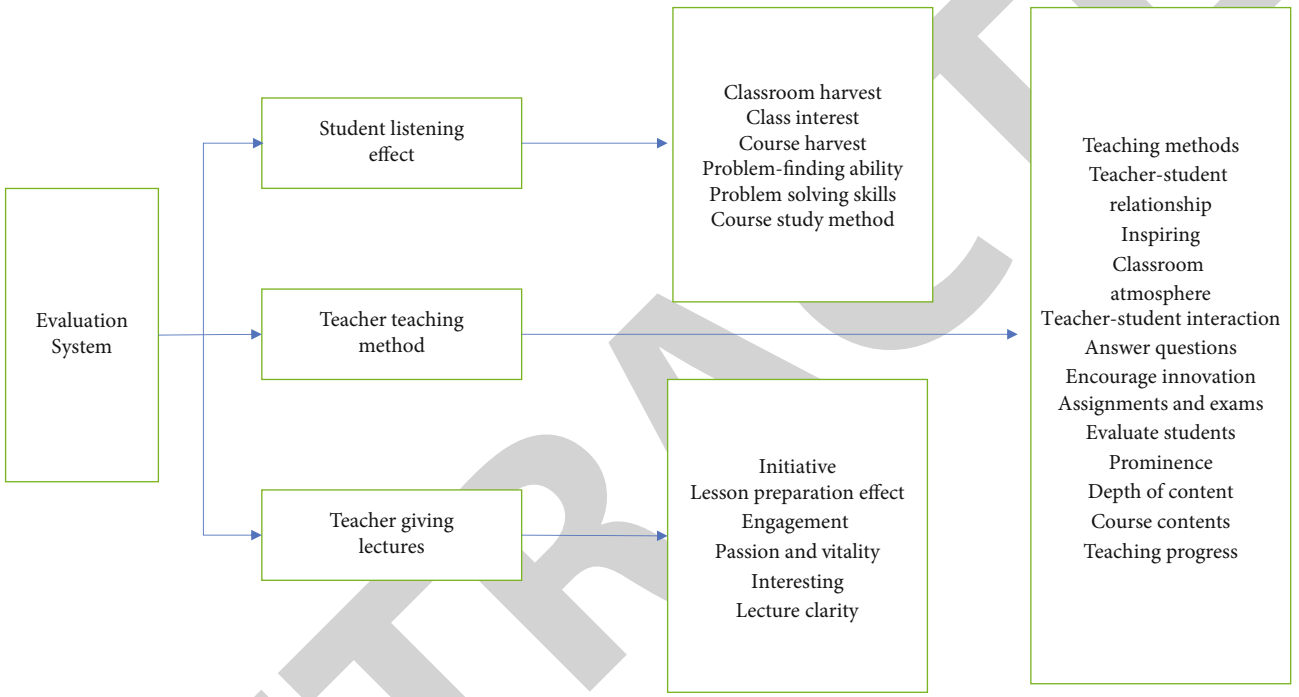

Figure 3: Evaluation index system.

Table 7: Teaching evaluation grade standard.

Grade criterion	Excellent	Good	Medium	Qualified	Unqualified
The output value	0.90~1.00	0.80~0.89	0.70~0.79	0.60~0.69	59.00%

quality evaluation index) to output value (final evaluation result of teacher teaching quality).

3.3. Sample Data Collection. The final result of artificial neural network training reflects the performance of the network and is closely related to the selected training samples. A good training sample should pay attention to both sample quantity and sample quality. Samples can be selected according to the following rules:

(1) *The Sample Size Is Sufficient*. It is ensured that the number of samples selected is enough to ensure the effect of network training

(2) *Representativeness*. Be sure to include all patterns in your sample

(3) *Balance*. Try to keep the number of samples in each category roughly equal

(4) *Scientific Distribution*. Distribution can be carried out in accordance with the principle of "egalitarianism," or samples can be randomly selected [17]

(5) Remove special samples that do not meet the standard

The research obtains the input data of information collection by using the method of students' online evaluation of teaching, that is, to input the indicators in the student evaluation table into the classroom teaching quality evaluation system and then organize students to score and evaluate

the course. Students can complete the evaluation independently in the process of online evaluation. In addition to evaluating the score, students can also express their own opinions or views on the course [18]. Online evaluation way has the formidable time and space, interactivity, openness, spread of sex convenience of data collection management, covering both personalized communication, and convenient data statistics and analysis function. It has become the mainstream of current universities information acquisition. It introduces the advantage of the network classroom teaching quality evaluation system. The quality evaluation has realized systematization, quantification, and objectification.

For the desired output index, based on the experts of higher mathematics course of the comprehensive score after listening to lectures, students in the class rating is chosen in the training data, meaning that although the indicators of course is through the students to play out, but the final evaluation result is obtained by network training study simulates the experts evaluation thought.

As for the sample data required by RBF network training, questionnaires are issued to students to obtain the data. The evaluation object is the teaching effect of advanced mathematics course. The questionnaire is distributed to the students. The specific design method of the questionnaire is that each evaluation index (question) included 5 options "strongly agree, agree, general, disagree and strongly disagree," with the score of "4, 3, 2, 1 and 0," respectively. Each student is allowed to choose only one item for each index. The specific form of the questionnaire is shown in Table 8.

The number of questionnaires is N, each questionnaire is one training sample, and the total number of samples is N. The purpose of collecting these data is to use these data to train the RBF network, so that it can "learn" the complex nonlinear mapping relationship between the evaluation index of the course and its corresponding evaluation level. The training is aimed at future application.

According to the mentioned above, the teaching effect of the higher mathematics courses participating in the teaching reform of the above colleges was investigated by questionnaire, and sample data were obtained. Then, sample data were used to train RBF network, and the teaching reform effect of higher mathematics was tested and evaluated by the trained network, so as to investigate the effectiveness of the method in this paper [19].

According to the above methods, all the questionnaires of the course in detail were recorded, and then all 630 sample statistics were obtained, among which the first 530 were used for RBF network training, and the last 100 were used for network generalization ability test.

In order to facilitate RBF network training, qualitative evaluation results given by experts should be quantified into numerical results that CAN be processed by RBF network. The median value of each evaluation grade interval is taken as the quantization result of this grade. In fact, this quantization result is the expected output of this kind of samples. Some sample data are shown in Table 9.

3.4. Processing of Sample Data. First, a suitable sample of data is selected. Before data samples are input into RBF network, data should be normalized. Because in the obtained data, the input value range of each indicator of the sample is different, and there will be a large difference in the value obtained by different indicators. Therefore, it is necessary to normalize the data obtained from each indicator first, so as to prevent the large value information from drowning the small value information [20]. Normalization is to normalize the range of index input value to [0,1] through operation. The commonly used methods include exponential function method and maximum and minimum value method. In this study, the maximum and minimum value method was selected to normalize the data samples. Because the data processing of this method is a linear transformation, it can better retain the primacy of data and will not cause the distortion of data information.

The input and output data are normalized to the value between [0,1], and the transformation formula is as follows:

$$\chi_i^* = \frac{\chi_i - \chi_{\min}}{\chi_{\max} - \chi_{\min}}. \quad (1)$$

In formula (1), χ_i is the input data, $\chi_{\min}$ is the minimum value in the input data, and $\chi_{\max}$ is the maximum value in the input data.

The maintenance of sample library is a very important link. The maintenance of sample library can reduce the complexity of neural network model and enhance the robustness of network, so as to ensure the calculation accuracy and accuracy of training network.

3.5. Construction of RBF Network. First, the topology of the network is determined. According to the evaluation index, the input layer of RBF has 25 nodes. According to the classification of evaluation grade, there are five evaluation categories, and each level corresponds to a class of samples. Therefore, RBF has five hidden layer radial basis function nodes, each corresponding to a class. The output layer is a node, and the evaluation results are given.

Next, the network parameter are initialized. The network parameters of RBF are divided into two categories. The first is the center and variance of the radial basis function node of the hidden layer, and the second is the weight of the output layer. Both types of parameters need their initial values are set before using L-M iteration. In the research, K-means clustering algorithm is adopted to determine the center and variance of hidden layer nodes [21, 22].

The basic idea of K-means clustering algorithm is to minimize the total in-class distance (the sum of the distance between samples and the center in all types), as shown in the following formula.

$$E = \sum_{j=1}^{k} \sum_{x_i \in w_j} x_i - m_j^2. \quad (2)$$

The basic steps of k-means clustering algorithm are as follows.

Initialization: the cluster number is k. The number of iterations is N. The minimum deviation of continuous

Table 8: Questionnaire of students' evaluation of teaching.

No.	First-level index	Second-level index	Points				
			Strongly agree	Agree	General	Disagree	Strongly disagree
1	Students' listening effect	Classroom harvest	4	3	2	1	0
2		Interest in the classroom	4	3	2	1	0
3		Course harvest	4	3	2	1	0
4		Ability to detect problems	4	3	2	1	0
5		Problem solving skills	4	3	2	1	0
6		Course learning methods	4	3	2	1	0
7		Motility	4	3	2	1	0
8	Teacher's teaching effect	Effect of preparation	4	3	2	1	0
9		Professional degree	4	3	2	1	0
10		Passion and energy	4	3	2	1	0
11		Interesting	4	3	2	1	0
12		Teaching clarity	4	3	2	1	0
13		The teaching way	4	3	2	1	0
14		The relationship between teachers and students	4	3	2	1	0
15	Teacher's teaching method	Illuminating	4	3	2	1	0
16		The classroom atmosphere	4	3	2	1	0
17		Interaction between teachers and students	4	3	2	1	0
18		To solve the problem	4	3	2	1	0
19		Encourage innovation	4	3	2	1	0
20		Assignments and exams	4	3	2	1	0
21		Evaluation of student	4	3	2	1	0
22		Emphasis degree	4	3	2	1	0
23		Content depth	4	3	2	1	0
24		Teaching content	4	3	2	1	0
25		Teaching schedule	4	3	2	1	0
	Total						

iteration is δ. The current algebra is $t = 0$. k centers (usually the first k) are randomly selected m_j^t.

$t = t + 1$, x_i will be assigned to the class represented by its nearest center m_j^t.

(1) Calculate the new center m_j^{t+1}, and performance index after allocation $E(t+1)$ is shown in the following formula

$$m_j^{t+1} = \frac{1}{N_j} \sum_{x_i \in m_j'} x_i. \tag{3}$$

(2) If $t > N$ or $\|E(k+1) - E(k)\| < \delta$, stop, otherwise, go to (2), continue

In relation to the problem in the research, it is obvious that the number of classes $K = 5$. The first sample of each type is selected as the initial class center, and the minimum deviation $\delta = 10^{-5}$ and iteration times $N = 100$ are taken. The sample centers after clustering are shown in the following formula.

$$\begin{cases} C_1 = [3.8,4.1,4.2, \cdots, 3.9], \\ C_2 = [2.7,3.0,2.9, \cdots, 3.0], \\ C_3 = [2.2,2.1,1.8, \cdots, 2.0], \\ C_4 = [1.2,0.9,1.1, \cdots, 1.0], \\ C_5 = [0.1,0.1,0.0, \cdots, 0.0]. \end{cases} \tag{4}$$

Variance is determined by empirical formula (5) as follows.

$$\sigma^2 = \frac{d \max}{\sqrt{h}} = \frac{\|[4,4,4,\cdots,4] - [0,0,0,\cdots,0]\|}{\sqrt{5}} = 8.9443. \tag{5}$$

In formula (5), d max is the maximum Euclidean distance between centers, and h is the number of centers.

Table 9: Partial evaluation sample data obtained from the questionnaire survey of the six courses.

No.	The evaluation index					Rating	Quantitative results
	$X1$	$X2$	$X3$		$X25$		
1	4	4	4	……	3	Excellent	0.95
2	3	4	4	……	4	Excellent	0.95
3	4	4	3	……	4	Excellent	0.95
……	……	……	……	……	……	……	……
630	4	3	4	……	4	Excellent	0.95

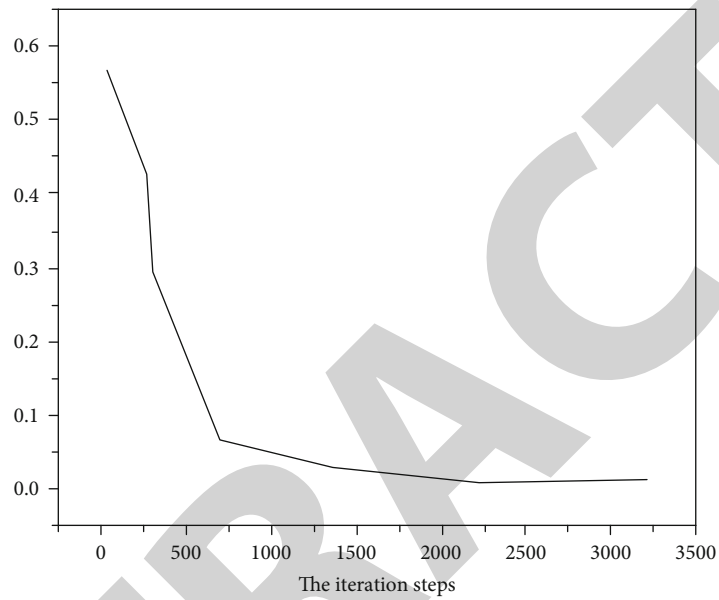

Figure 4: Decrease curve of RBF approximation error during the training.

The weights of the output layer are determined to be random numbers evenly distributed between the interval (-1,1). For parameters of L-M algorithm, $\mu_1 = 0.1$, and $\mu_2 = 1.0$. The number of iterative steps is 5000, and the error accuracy is 10^{-2}.

4. Result Analysis

530 sample data of the course are submitted to RBF network for training, so as to approximate the complex mapping relationship between evaluation indicators and various evaluation results. The network converges after 3385 iterations. The dynamic curve of approximation error decreasing with the number of iterative steps is shown in Figure 4.

Since the output of the network is real, it is necessary to transform the quantitative numerical results into qualitative evaluation grades. Let the numerical result of the output of the first sample be y_i. If $y_i < 0.59$, it is unqualified; if $0.60 \le y_i < 0.69$, it is qualified; if $0.70 \le y_i < 0.79$, it is medium; if $0.80 \le y_i < 0.89$, it is good; if $0.90 \le y_i < 1.00$, it is excellent [23]. According to the scheme designed above, the training results of some samples are shown in Tables 10–13.

Table 10 is the comprehensive evaluation index system of teaching reform projects (first-level index: students' listening effect).

As for the network after training, if it is wanted to evaluate the teaching effect of a new course in the future, it is only necessary to issue the same type of questionnaire to students and submit the sample data directly to the RBF network, so that the evaluation result of the course can be directly obtained.

The purpose of the training is application. The original intention and end-result of designing neural network training is application. Whether the trained network can be applied depends on whether the network has lighter generalization ability. This is the key criterion to evaluate the advantages and disadvantages of neural network evaluation method. No matter how good the network performance is in the training stage, if the network has no generalization ability or the network has generalization ability but is not ideal, then, the model is failed and unusable. Next, the generalization ability of trained RBF network is examined and verified. 100 samples of advanced mathematics courses not used in the training stage are used to test the RBF network after training. The evaluation results of some samples are shown in Table 14.

In all 100 test samples, the maximum test error is 0.0513, among which 92 samples are judged correctly, 7 samples are judged as excellent, and 3 samples are judged as medium. Therefore, the evaluation accuracy rate of RBF network is

Table 10: Comprehensive evaluation index system of teaching reform projects (first-level index: students' listening effect).

Second-level index	The interpretation of second-level index
Classroom harvest	Through the teacher's instruction, the students learn something valuable
Interest in the classroom	The students' interest in the subject increased through the teacher's teaching
Course harvest	Through the teacher's teaching, students understand and learn the content of the course
Ability to detect problems	Through the teacher's teaching, the students' ability to understand the relevant issues has been improved
Problem solving skills	Through the teacher's teaching, the students' ability to solve relevant problems has been improved
Course learning methods	Through the teacher's instruction, the students learned the method of learning the subject

Table 11: Comprehensive evaluation index system of teaching reform projects (first-level index: teaching effect of teachers).

Second-level index	The interpretation of second-level index
Motility	Teachers can arrive early and get to and from classes on time
Effect of preparation	Students feel that the instructor has prepared well for the content and methods of the course
Professional degree	The students felt the teacher's enthusiasm for teaching
Passion and energy	Students feel that the teacher is full of vigor and energy in teaching
Interesting	Students feel that the lecturing style keeps students interested in the class
Teaching clarity	The students found the teacher's explanation of the course very clear

Table 12: Comprehensive evaluation index system of teaching reform projects (first-level index: teachers' teaching methods).

Second-level index	The interpretation of second-level index
The teaching way	The way the teacher lectures helps the students to develop their abilities
The relationship between teachers and students	The teacher is very kind to the students, both in and out of the class can feel the teacher welcome students to come to him for help
Illuminating	The teacher's lectures can stimulate students' positive thinking and be inspiring
The classroom atmosphere	The teacher encouraged the students to participate in class discussions
Interaction between teachers and students	Students are encouraged to express their personal opinions and communicate with their classmates
To solve the problem	Students are encouraged to ask questions and provide meaningful answers
Encouraging innovation	The teacher encourages students to express opinions that differ from his or her own or to challenge
Assignments and exams	The teacher corrects the homework and examination papers carefully and makes targeted comments
Evaluation of student	The teacher evaluated his students' learning in a fair and proper way
Emphasis degree	Tests and assignments reflect the teacher's emphasis
Content depth	The depth of the teacher's lecture suits the students' understanding level
The teaching content	The volume of the teacher's lecture is suitable for the students to grasp
The teaching schedule	The teacher's teaching progress is moderate

Table 13: Training results of some samples.

No.	Actual output	Expected output	Training result	Expert result
1	0.9581	0.95	Excellent	Excellent
2	0.9569	0.95	Excellent	Excellent
3	0.9467	0.95	Excellent	Excellent
……	……	……	……	……
530	0.9488	0.95	Excellent	Excellent

as high as 92%. The verification results show that the improved RBF neural network and the teaching effect evaluation model proposed in the research have strong generalization ability, and it is a feasible and reasonable evaluation model, thus providing a new way to solve the comprehensive evaluation problem of the teaching effect in colleges and universities.

The enthusiasm of the students in the reform class is obviously higher than that of the students in the general class. This is mainly due to the reform in the teaching

Table 14: Training results of some samples.

No.	Actual output	Expected output	Training result	Expert result
1	0.8581	0.85	Good	Good
2	0.8569	0.85	Good	Good
3	0.8467	0.85	Good	Good
……	……	……	……	……
100	0.8488	0.85	Good	Good

process pay attention to the combination of theoretical knowledge and practical knowledge, pay attention to the student hands-on ability and problem solving skills, and pay attention to basic knowledge and professional knowledge, such as breaking the advanced mathematics course is boring, the shortcomings of theory cannot contact the actual, etc. [24]. In order to transform from traditional teaching class, teachers must prepare a lot of theoretical lessons, read literature, study suitable projects, and learn mathematical software before class. In this process, teachers need to learn a lot of content by themselves or further study, so as to transform teachers from traditional teaching class to modern teaching class. However, due to the theoretical, abstract, and complex nature of mathematics, the project search is the focus and difficulty of this reform [25].

5. Conclusions

In this chapter, the improved RBF neural network and neural network model are trained and verified, including sample selection, processing, maintenance, and the training of the created RBF neural network model. And it is calculated by using the trained neural network, and the calculation results are compared with the expert evaluation results. And through the comparison of experimental data, it can be seen that the RBF neural network based on LM algorithm established training speed advantage is obvious and can meet the error accuracy requirements, and the error is very small. And the use of trained network model for data calculation has achieved very close to the expert evaluation effect. Therefore, it is believed that the teaching quality evaluation model based on RBF neural network is operable and provides another convenient tool for scientific evaluation of teaching quality.

Data Availability

The experimental data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The author declared no conflicts of interest regarding this work.

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