Eng Int Syst (2025) 1: 31–38

Engineering
Intelligent Systems

Online Teaching Quality Evaluation Algorithm of Preschool Education Major Courses under the Background of Internet plus

Hua Li[1]*

[1] *College of Preschool Teacher Education, Shaanxi Business College, Xi'an 710068, China*

Currently, in response to the evaluation of teaching quality issue, because the indicators involved in the evaluation are mostly qualitative, it is difficult to quantify accurately, and the traditional qualitative evaluation and single-factor evaluation methods lead to greater subjectivity and bias which, in turn, negatively affect the accuracy of the evaluation. In this regard, the online teaching quality evaluation algorithm of preschool education major courses under the background of internet plus is proposed. The teaching-quality data knowledge base and database structure are designed, the teaching evaluation index system is constructed, the weights of the evaluation indexes are established by using hierarchical analysis, and the teaching-quality evaluation model is constructed. The experiment results suggested that this method improves the accuracy of the evaluation. Experimental analysis shows that when this method is used to evaluate the quality of teaching, the evaluation score of the model is very close to the actual score, with small error and high evaluation accuracy.

Keywords: Preschool education major; teaching quality evaluation; hierarchical analysis; neural network.

1. INTRODUCTION

Teaching quality evaluation is an objective method that is applied to determine whether teaching practices and results meet specific indicators [1]. This quality evaluation is an important component of teaching activities, aimed at improving the quality of teaching and learning and, ultimately, the education system in general. The contemporary guidelines for the evaluation of teaching quality point out that this is commonly understood to be the measurement of teaching results, and the objective of evaluation is to consider all aspects of teaching practice to enable a systematic and dynamic analysis. The evaluation of teaching quality includes qualitative and quantitative assessment, of which quantitative assessment is the most basic way to qualitative evaluation. Quantitative assessment is based on the established index items used to assess the actual accomplishment, while qualitative evaluation is based mainly on the teaching goals. Teaching objectives and evaluation indexes are intrinsically related but cannot be generalized. Evaluation indicators are clear, controllable, assessable and quantifiable. Different indicators can target different aspects of a teaching goal from different perspectives, while the same indicator can reflect an aspect of different teaching goals [2]. Quantitative and controllable indicators of quality assessment of teaching generally measure the achievement of teaching objectives from both qualitative and quantitative perspectives. Traditional statistical methods include linear regression and grey theory, which examine simple factors and describe only the simple and linear relationship between the influencer and the quality of teaching in universities. In this

*Email of Corresponding Author: Li.hua25290@163.com

case, the accuracy of quality assessment of teaching does not meet the practical requirements. Machine learning algorithms are mainly BP neural networks, extreme learning machines, etc., which are used for data mining. According to modern statistical theory, they have certain learning and expression abilities and can show the relationship between influencing factors and the quality of university education. They make full use of the expertise and experience of experts and achieve good results in assessing the quality of university education. There is a wide variety of methodological models for teaching evaluation, using the overall learning of students as the results of their educators' teaching practices.

The measure of a teacher's performance is used as a basis for judging the quality of teaching and the overall quality of the teaching process [3]. In this regard, when measuring a teacher's performance, the quality and effectiveness of teaching becomes a formative assessment. In addition to the completion of classroom targets and school-mandated assignments, this greatly dampens the enthusiasm of teachers. Meanwhile, students' learning outcomes are mainly a result of their classroom learning experience; therefore, classroom teaching plays a crucial role in improving the overall teaching quality. The establishment of an effective system for the evaluation of teaching quality system is intended to accurately distinguish between the teaching quality of educators. It enables excellent teachers to exploit their strengths and acknowledge any shortcomings that need to be addressed. Usually, preparatory evaluation is predictive, formative evaluation is historical, and summative evaluation is systematic and general. Although formative evaluation and summative evaluation are two quite different evaluation approaches, they cannot be viewed in isolation [4]. For example: The summative evaluation obtained for the previous semester will be a beginning of the summative evaluation of the following semester. Therefore, the summative evaluation is both a preparatory and a formative evaluation. In order to solve the problem whereby the current model cannot accurately evaluate the teaching quality of colleges and universities, this paper puts forward the online teaching quality evaluation algorithm of preschool education major courses under the background of internet plus. The aim is to improve the accuracy of teaching quality evaluation in colleges and universities, and determine the advantages of the teaching quality model by means of specific examples [5].

2. DESIGN OF ONLINE TEACHING QUALITY KNOWLEDGE BASE FOR PRE-TEACHING EDUCATION COURSES

A knowledge base system is a type of knowledge-based intelligent data system, which comprises a combination of artificial intelligence technology and database technology to achieve the maximum integration of knowledge and information [6]. The system includes hardware, software and related data information. According to the functions, it can be divided into knowledge base, memory, knowledge base management system and corresponding mechanism, knowledge learning mechanism and relevant staff information. The role of the knowledge base system is to meet the actual needs of users based on the contents stored in the system. Firstly, it is important to understand the needs of users through the user interface, analyse and establish the task list, then call the relevant knowledge from the knowledge base to solve the problem and verify it, and finally give feedback to the users [7]. The knowledge base system has certain intelligence compared with the ordinary database system, and uses its own stored knowledge to determine and analyse a problem and obtain the final result when dealing with the actual problems proposed by the users, instead of relying entirely on the information provided by the users [8].

Because the content of the knowledge base is used multiple times to solve practical problems, the structure of the knowledge base has a significant effect on the operational efficiency of the system, and the implementation of appropriate organizational strategies can substantially improve the processing efficiency of the system.

In the traditional approach, there are various types of database structures, although each of these has its own advantages and disadvantages. In order to balance the efficiency of querying and compiling, and make both operations more efficient, the strategy of "sequential storage and dynamic organization" is proposed, i.e., each rule corresponds to a record and is stored in the rule base sequentially, and the rule base can be dynamically classified according to the target result before use, thus improving the reasoning efficiency [9].

There are three types of basic knowledge in the evaluation of teaching quality system: basic information knowledge, assessment index knowledge and assessment process knowledge. The basic information includes the teaching plan, course schedule, and the personal information of students and teachers for each semester and each class. Using this basic information, the education quality evaluation system has developed corresponding evaluation indicators [10]. The system for teaching quality evaluation is based on evaluation rules to obtain the final evaluation results, which specify the relevant contents of the index system, including the selection, classification and index options of the indexes. The knowledge of the evaluation process mainly refers to the data submitted by students participating in teaching evaluation surveys. Teaching evaluation survey data includes both objective evaluation options selection results and subjective suggestions from students. To meet the practical needs of applications and achieve a larger knowledge base system, it is necessary to combine the advantages of databases and knowledge bases into one system; i.e., to combine data for factual descriptions and abstract knowledge, and to integrate rule-based logical algorithms and simple data organization functions to form a knowledge base system in a broad sense. The knowledge base organizes the data information knowledge information systematically and efficiently, so that the system has dynamic knowledge management, data organization, and fast data update and system maintenance functions [11]. Therefore, this paper proposes a knowledge base structure based on relational database for storing data related to the teaching quality of preschool education major online courses, which is convenient for subsequent

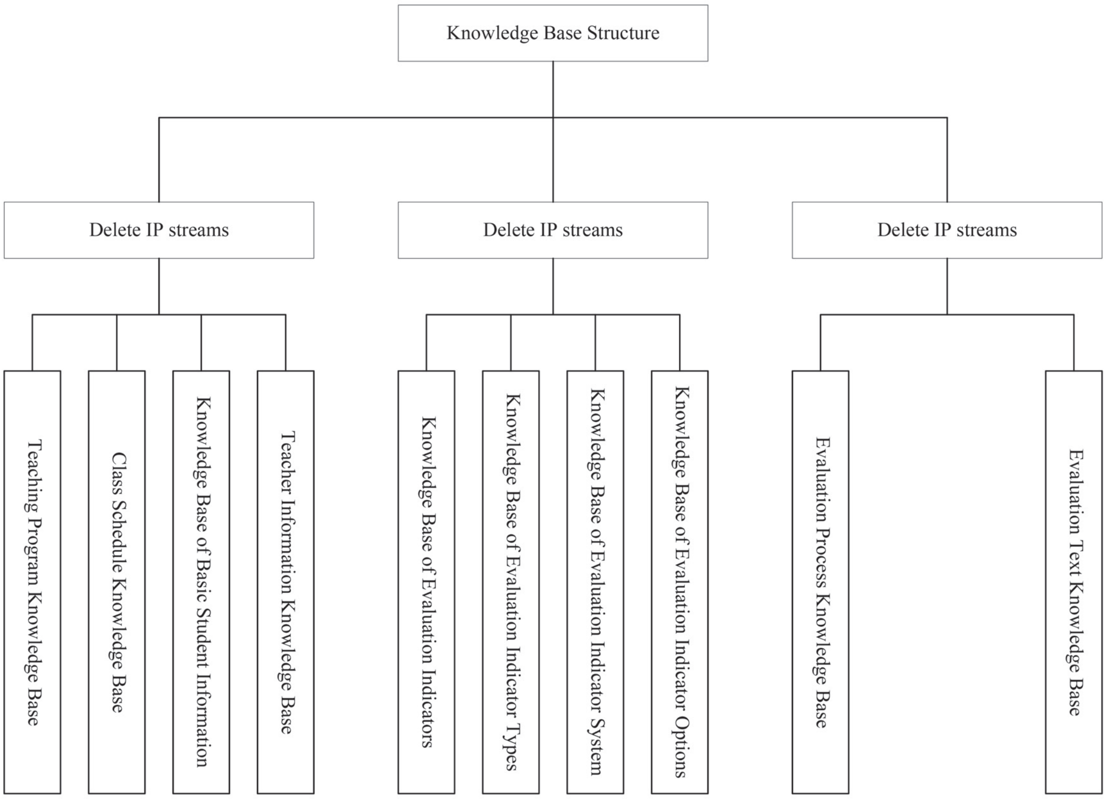

Figure 1 The proposed database structure.

Table 1 Basic structure of teaching plan library.

Field Name	Field Meaning	Data Type
xqdm	Semester Code	Vchar (8)
ccdm	Level Code	Vchar (8)
jbdm	Level Code	Vchar (8)
yxdm	Faculty Code	Vchar (8)
zydm	Major Code	Vchar (8)
kcdm	Course Code	Vchar (9)
kcjhlxdm	Course Plan Type Code	Vchar (9)

Table 2 Basic structure of teaching quality evaluation index system library.

Field Name	Field Meaning	Data Type
xqdm	Semester Code	Vchar (9)
pjtxdm	Evaluation system code	Vchar (9)
pjtxmc	Evaluation system name	Vchar (50)

evaluation of teaching quality model to call and process the data. The database structure proposed in this study is shown in Figure 1.

As shown in Figure 1, the database designed in this study consists of three parts: the basic database, valuation rules and valuation process database, each of which consists of the databases below. The database data are presented in Tables 1-3 [12].

Through the above steps, the knowledge base and database related to teaching quality evaluation data are constructed to improve the operability and maintainability of the data and provide the basis for subsequent dynamic knowledge management and teaching quality evaluation [13].

3. CONSTRUCTION OF AN ONLINE EVALUATION OF TEACHING QUALITY SYSTEM FOR PRESCHOOL EDUCATION MAJOR COURSES

The index system plays a key role in reflecting the scientific, fair and rational assessment of the quality of education. Different indices should be used for evaluation in different schools with different division of labor, location and their own characteristics. Therefore, a scientific and reasonable evaluation index system should be established for various pre-vocational programs.

Table 3 Basic structure of the evaluation process library.

Field Name	Field Meaning	Data Type
xqdm	Semester Code	Vchar (8)
kcdm	Course Code	Vchar (8)
jxbh	Teaching class number	Vchar (8)
pjdm	Evaluation Code	Vchar (8)
pjlxdm	Evaluation type code	Vchar (8)
pjxxdm	Evaluation option code	Vchar (8)
pjrs	Evaluation number	Smallintt

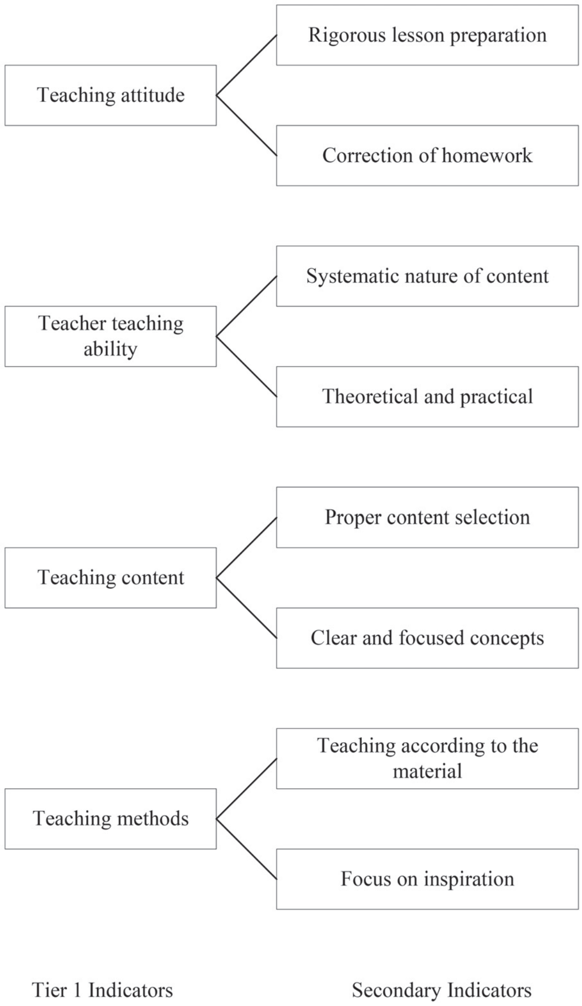

Figure 2 Evaluation of teaching quality index table.

According to a scientific principle, the established indicators and standards must reflect the goals of educational development and the objective laws of teaching. Specifically, the evaluation indicators must be consistent with the overall goals of education and learning, which means that the correctness of the goals must be measured in the correct direction. If the indicators do not match the educational goals, it may lead to goal transfer and decision-making errors, ultimately leading to misleading teaching. Evaluation indicators themselves can guide teaching and learning, as teachers pay attention to whatever indicators are evaluated and assessed [14]. Therefore, the design and selection of indicators are crucial, not only to indicate the effectiveness of teaching, but also to select typical and objective indicators, and also to ensure that they play a guiding role in the future. Otherwise, indicators are too simple and overused, making the evaluation of teaching useless.

In regard to the actual teaching activities of preschool education major courses, reference is made to the evaluation index system for the level of education of general schools, intended to reflect the principles of science, completeness, accuracy and measurability and functional ability. The index system is designed to comprise four basic indices and eight secondary indices in such a way that they fully reflect the educational situation [15]. The index system is shown in Figure 2 below; the index system determines the network structure of the evaluation of teaching quality model.

Table 4 Importance judgment .

Level of importance	*f(x, y)*	*f(y, x)*
x and y are equally important	1	1
x is a little more important than y	3	1/3
x is significantly more important than y	5	1/5
x is more strongly important than y	7	1/7
x is more important than y absolutely	9	1/9
The level of importance is between the levels	2, 4, 6, 8	1/2, 1/4, 1/6, 1/8

Because the input for the secondary index is obtained by grading students using a percentage system, there are significant differences in the order of magnitude of different component values. If the raw data is applied directly without first being converted, the absolute value of the raw data may be too high, beyond the effective processing range of neurons, leading to the so-called "saturation phenomenon". Even if the absolute value of each raw data is not too high, it is possible that one component is too large and has a much greater impact on the network than other components, thus depriving them of the ability to regulate the network [16]. Therefore, the input mode of the neural network must be normalized. When using S-shaped functions in neural networks, the input values must be normalized between [0.1]. There are many normalization methods, usually using exponential function methods, maximum minimum methods, etc. This study uses the maximum minimum method for normalization, as it is a linear data transformation that better preserves its original values without causing information loss.

The standardized formulas used in this document are as follows [17].

$$X = \frac{I - I_{\min}}{I_{\max} - I_{\min}} \tag{1}$$

Where X represents the normalized neural network input, I represents the unprocessed neural network input, $I_{\max}$ and $I_{\min}$ represent the maximum and minimum neural network input. Through the above steps, the evaluation of teaching quality index can be constructed to provide the judgment basis for the subsequent assessment sessions [18].

4. ESTABLISHMENT OF A LEARNING QUALITY EVALUATION MODEL

After developing a database and evaluation metrics, we can combine neural network algorithms to create a model for evaluating the quality of preschool education major courses online learning [19]. In this case, we need to construct an evaluation matrix, calculate the weights of different indicators, and verify the consistency of the evaluation matrix, as shown in the following steps [20].

This study uses the Analytic Hierarchy Process to construct a judgment matrix and calculate the weights of elements in the matrix. Sub-analysis is a multifunctional decision analysis method that combines qualitative and quantitative aspects, fully utilizes professional knowledge and subjective experience, applies mathematics for strict logical reasoning, and eliminates the subjective components of the weighting process as much as possible. Determining weights in a satisfactory matrix order helps to make participating weights more objective, thereby effectively improving the accuracy and objectivity of fuzzy comprehensive evaluation [21].

Suppose the judgment function is $f(x, y)$, which is used to represent the importance scale between each factor x and y [22]. In order to determine the specific data of importance, the following constraints are applied to the judgment function. The scale of the judgment function is constructed using the form of Table 4.

$$f(x, y) = \frac{1}{f(y, x)} \tag{2}$$

Assuming that $X = \{x_1, x_2, \ldots, x_n\}$ represents the ensemble of all factors, a judgment matrix can be constructed by comparing two factors, and the specific matrix expression is shown below.

$$C = (c_{ij})_{m \times n} \tag{3}$$

$$C = \begin{bmatrix} c_{11} & c_{12} & \ldots & c_{1n} \\ c_{21} & c_{22} & \ldots & c_{2n} \\ \ldots & \ldots & \ldots & \ldots \\ c_{m1} & c_{m2} & \ldots & c_{mn} \end{bmatrix} \tag{4}$$

Determine its maximum feature root based on the discriminant matrix C, and determine the eigenvector of the discriminant matrix on the maximum feature root, as shown in the following formula [23].

$$\xi = (x_1, x_2, \ldots, x_n) \tag{5}$$

To verify whether various estimation matrices have satisfactory coherence, equation (6) can be used. During testing, the ratio between the coherence index (CI) of the judgment matrix and the average value of the random coherence index (RI) of the same order is used. The formula for calculating the matrix coherence index is:

$$CR = CI/RI \tag{6}$$

Where CR is the random consistency coefficient of the evaluated matrix when $CR < 0$. The estimation matrix must be proven to have a satisfactory consistency, meaning that the weight allocation matrix is reasonable and the results are acceptable. Otherwise, the estimation matrix must be adjusted to achieve satisfactory consistency [24].

After completion of the above consistency test, a neural model with neural network algorithms was constructed. The advantage of neural networks is that they can simulate multiple variables without making complex assumptions about the correlation of input variables. It uses only observational data to extract and approximate implicit nonlinear I/O relationships

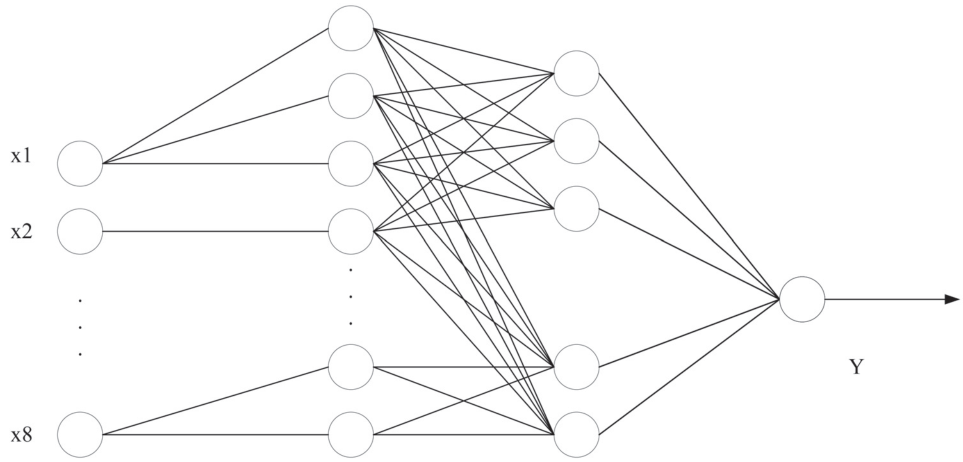

Figure 3 Structure of the neural network-based evaluation of teaching quality model.

and examines them during the learning process. In a three-layer BP neural network that contains hidden layers, if the number of hidden nodes is large enough, it can execute any continuous function in a finite range with arbitrary accuracy. After training, the neural network does not respond to small changes in input data, which reflects its inaccurate work. This inaccuracy is a drawback, but can sometimes be used to achieve good system performance. For example, this inaccuracy can be expressed as a "noise removal and defect tolerance" capability. For this reason, this study introduces BP's neuro network for evaluation of teaching quality method and builds a model for evaluation of teaching quality.

Choosing the structure of the network model is a very important task, and a good choice can reduce the number of e-learning and improve the accuracy of e-learning. The structure of the network consists of connection methods, network layers and the number of nodes per layer (i.e. determining the number of neurons in the input layer, implicit layer, and output layer). Assessment of quality issues in learning can be seen as a non-linear mapping of input (quality assessment indicator of learning) to output (outcome of quality assessment of learning). Due to the ability of BP's three-layer network to reflect any mapping relationship of data, this paper adopts a three-layer structure of BP neural network, including input layer, hidden layer, and output layer, as the evaluation model.

Firstly, the nodes within different structural layers are determined. Due to the eight secondary indicators mentioned above, this paper uses eight secondary indicators as inputs to the neural network layer, so the number of nodes in this layer is defined as 8. Since there is only one result for learning quality evaluatitheon, the output node of the network output level is set to 1. Choosing the optimal number of nodes in the hidden layer remains an unresolved issue. If the number of nodes in the hidden layer is too small, the convergence speed of the entire neural network is slow and not easy [25]. Conversely, if there are too many nodes in the hidden layer, the topology of the neural network will become complex, and iterative learning will result in a large number of errors.

Since the expected baseline values of the evaluation results fall within the [0,1] interval after normalization, the activation functions of the implicit and output units of the neuroblood pressure network can be used as sigmoid functions as shown below.

$$f(x) = \frac{1}{1 + e^{-x}} \tag{7}$$

where, e represents the activation parameter of the Sigmoid function. Through the above derivation, the structure of the neural network model graph for evaluation of teaching quality can be derived as shown in Figure 3.

Neural network learning is the process used for weight adjustment, the aim of which is to reduce errors. This model uses a combination of BP algorithm and simulated annealing method to adjust weights, while taking into account the advantages of BP algorithm, which determines the adjustment of the combined weights, and the advantages of simulated annealing algorithm, in which the correction (quantity) of combined weights can escape from very small local points due to the randomness and testing type of the algorithm.

Based on the neural network structure model constructed above, the formula for weight adjustment is derived as shown below.

$$\Delta v_{ij} = (1 - \alpha)x_i - (1 - \beta)y_i \tag{8}$$

Where Δv_{ij} represents the adjusted indicator weights, α and β represent the adjusted modification parameters, and x_i and y_i represent the output values of the implied and output layers, respectively.

The model for the evaluation of the teaching quality can be constructed through the above steps, and according to the actual situation of preschool education major courses, the eight secondary rating indicators proposed in this paper are input to the model, and the output values are calculated and the weights are adjusted. Combined with the knowledge base and evaluation system constructed above, the design of online evaluation of teaching quality algorithm for preschool education major courses utilizing Internet+ is now completed.

5. TESTING AND ANALYSIS

5.1 Test Preparation

In order to determine whether the online (Internet +) evaluation of the teaching quality algorithm for preschool education major courses is better than the online evaluation of the traditional teaching quality algorithm, the evaluation effect

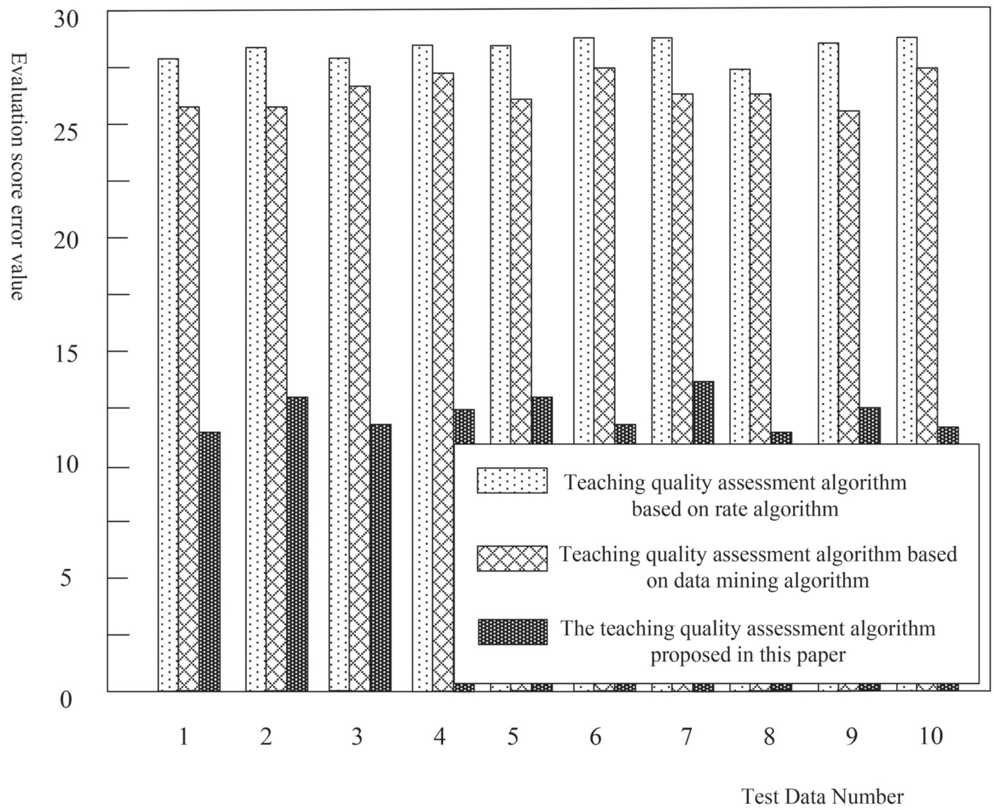

Figure 4 Comparison of evaluation score error values.

of the online evaluation algorithm is verified, supplementing the theoretical aspect of teaching quality. In order to ensure the reliability of the data results, a comparative experiment was conducted, and two traditional online teaching quality evaluation algorithms were selected as experimental controls, namely the online teaching quality evaluation algorithm based on rate algorithm and the online teaching quality evaluation algorithm based on the data mining algorithm.

This experiment was conducted on an analysis platform. Win10 is the operating system of the platform; , Python 7.5.2 is the programming tool, the CPU configuration is Intel Corei5 DDR4 2666 8 GB, the hard disk model is Intel SSD 660P 512 GB, and the display card model is RX560D 4.5 GB. In order to: i) explore the effectiveness of fuzzy hierarchical analysis method in the evaluation of teachers' teaching quality, ii) find out the knowledge of rules between evaluation levels and evaluation indexes, and iii) determine the influence of these rules on teaching practice, the classroom teaching quality evaluation data of one teacher in a school during the second semester of a school year were randomly selected for validation in order to determine the correlation between students' evaluation and educators' quality of teaching. Three methods were used to evaluate the collected historical data and compare them with the actual evaluation data in order to determine the accuracy of the evaluation methods.

5.2 Analysis of Test Results

Define evaluation accuracy as the error between the evaluation values obtained by different methods and the actual evaluation values. The smaller the error, the more accurate the estimated value of the method. The experimental results are shown in Figure 4.

The results shown in Figure 4 indicate that the online evaluation algorithm for teaching quality of preschool education major courses proposed in this paper has significant advantages in terms of evaluation accuracy. The numerical comparison shows that when the two conventional evaluations of teaching quality methods simulate the above historical data, the errors between the assessment scores and the actual scores are significantly larger, and the average error score is more than 25 points. The evaluation scores of the algorithm proposed for the evaluation of teaching quality are more aligned with the actual evaluation scores and have a smaller evaluation error value.

6. CONCLUSION

In order to improve the accuracy of teaching quality evaluation of preschool education major courses, this paper studies the online teaching quality evaluation algorithm of preschool education major courses based on Internet plus. Constructed a knowledge base for teaching quality data and a system for evaluating teaching quality indicators. The Analytic Hierarchy Process was used to determine the weights of different evaluation indicators in the evaluation system. A teaching quality evaluation model was constructed based on BP neural network, and the model was used to complete teaching quality evaluation. The test results show that the algorithm designed in this article is an accurate and effective method for evaluating teaching quality, which can provide reference for improving teaching quality and has a very wide range of educational application value.

REFERENCES

1. Yuan, T. 2021. Algorithm of classroom teaching quality evaluation based on Markov chain. Complexity, 21:1–12.
2. Fatima, S., Sohail, F., Fatima, S., Rafique, S., Sultan, M., Aziz, A. 2021. Online physiology teaching and assessment in undergraduate medical students during COVID-19 pandemic. Medical Forum Monthly, 32(5):49–52.
3. Liu, P., Wang, X., Teng, F. 2021. Online teaching quality evaluation based on multi-granularity probabilistic linguistic term sets. Journal of Intelligent and Fuzzy Systems, 40(2):1–20.
4. Hou, J. 2021. Online teaching quality evaluation model based on support vector machine and decision tree. Journal of Intelligent and Fuzzy Systems, 40(2):2193–2203.
5. Bhuyan, M. H. 2021. Practices of online teaching, learning and assessment of the students of the BSc in EEE programme during the COVID-2019 pandemic. Contemporary Educational Researches Journal, 11(2):14–28.
6. Sun, Q. 2021. Evaluation model of classroom teaching quality based on improved RVM algorithm and knowledge recommendation. Journal of Intelligent and Fuzzy Systems, 40(2):2457–2467.
7. Al, J. 2021. Online teaching and practical implications of teacher professional development. Turkish Journal of Computer and Mathematics Education (TURCOMAT), 12(3):3909–3912.
8. Beretska, S. 2021. Model of management of continuity of preschool and primary school education. The Sources of Pedagogical Skills, (26):12–17.
9. Burchinal, M., Garber, K., Foster, T., Bratsch-Hines, M., Franco, X., Peisner-Feinberg, E. 2021. Relating early care and education quality to preschool outcomes: the same or different models for different outcomes? Early Childhood Research Quarterly, 255:35–51.
10. Jidovtseff, B., Kohnen, C., Belboom, C., Dispa, C., Vidal, A. 2021. Outdoor education practices in Belgian preschools and relationships with both environmental and personal factors. Journal of Physical Education and Sport, 21:530–536.
11. Potapchuk, T., Kravets, N. 2021. Formation of self-educational competence future educators preschool education institutions. Educological Discourse, 32(1):180–193.
12. Ngren, S. 2021. The role of school counsellors in children's adjustment to preschool education. Journal of Psychologists and Counsellors in Schools, 1–15.
13. Semchuk, B. 2021. Application of digital technologies in the educational process of future preschool education specialists. Psychological and Pedagogical Problems of Modern Schools, (5):111–117.
14. Shaybakova, E. 2021. Trends and prospects of financing preschool education in Russia. Russian Journal of Management, 8(4):6–10.
15. Li, J. 2021. Shaping education policy of home-school cooperation in China's preschool education: trends and strategies. Education, 3(1):113–119.
16. Irisova, S. R. 2021. The importance of interactive methods in the development of preschool education. Theoretical & Applied Science, 95(3):288–291.
17. Smyrnova-Trybulska, E. 2021. Development of prospective preschool and primary school teachers in the area of ICT use in education. e-Mentor, 90(3):32–42.
18. Karademir, A., Saatiolu, Z. 2021. Preschool teachers' preparation programs in Turkey: a multi-level analysis of variables on classroom management models. Erken Çocukluk Çalış maları Dergisi, 5(2):152–179.
19. Björkman, K., Vissing, J., Østergaard, E., Bindoff, L. A., de Coo, I. F., Engvall, M., et al. 2023. Phenotypic spectrum and clinical course of single large-scale mitochondrial DNA deletion disease in the paediatric population: a multicentre study. Journal of Medical Genetics, 60(1), 65–73.
20. Bierman, K. L., Heinrichs, B. S., Welsh, J. A. Nix, R. L. 2021. Sustained benefits of a preschool home visiting program: child outcomes in fifth grade. Early Childhood Research Quarterly, 56:260–271.
21. Zhao, H. 2022. Research on the teaching of "mandarin" course in preschool education major under the occupational activity orientation. Psychology Research, 12(6):334–339.
22. Wu, J., Tian, J. 2021. Research on the influence of E-commerce on the adjustment of rural industrial structure under the background of "internet plus" using Journal of Intelligent and Fuzzy Systems, (1):1–9.
23. Goswami, A., Sadhu, P. K. 2021. Nature inspired evolutionary algorithm integrated performance assessment of floating solar photovoltaic module for low-carbon clean energy generation. Sustainable Operations and Computers, 3:67–82.
24. Cheng, P., Yang L., Niu, T. 2022. On the ideological and political education of material specialty courses under the background of the internet. Journal of Higher Education Research, 3(1): 79–82.
25. Guo, H., Li, H., Feng, J. 2022. Ship AIS data quality evaluation algorithm based on big data processing, Computer Simulation, (6) 298–303.