Research on the Evaluation of Teaching Quality in MOOC Based on the AHP Fuzzy Integrated Evaluation Method

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Abstract: Due to the lack of scientific evaluation index system of MOOC evaluation of teaching effectiveness, the reliability of the corresponding evaluation results is low. Therefore, a study on MOOC evaluation of teaching effectiveness based on AHP fuzzy comprehensive evaluation method is proposed. Based on the comprehensiveness and systematicness of MOOC teaching, a preliminary evaluation index system covering the background, input, process and result of MOOC teaching is constructed. After revising it according to the teaching situation of MOOC, an evaluation index of MOOC evaluation of teaching effectiveness is constructed. After the weight of each index is set differently, the evaluation of MOOC teaching quality is realized by AHP fuzzy comprehensive evaluation method. In the test results, the evaluation results show high reliability.

Keywords: AHP fuzzy integrated evaluation method; Evaluation of MOOC teaching effectiveness; Preliminary evaluation index system; Weight;

0 Introduction

With the advancement of technology and the popularization of the Internet, large-scale open online courses (MOOC) have become an innovative approach in the field of education, providing a large amount of learning resources for learners worldwide. However, with the rapid development of MOOC platforms, how to evaluate and ensure their teaching quality has become an important issue. Traditional teaching quality assessment methods often focus on teacher qualifications, curriculum design, teaching content, and other aspects, while neglecting students' experience and feedback during the learning process. Therefore, developing a comprehensive, objective, and effective MOOC teaching quality evaluation method has become an urgent need.

For the actual teaching work, it is highly imperative to undertake reforms and optimizations in the pertinent teaching aspects, in conjunction with an emphasis on teaching quality. In view of this, the research on the evaluation of teaching quality has attracted more and more attention [1-2] . MOOC (Massive Open Online Curriculum), as a modern distance education method, has been widely applied globally. With the continuous development of internet technology, the advantages of MOOC teaching mode have gradually become prominent, attracting more and more attention from students and educational institutions. However, with the continuous increase in the number of MOOC courses, how to ensure teaching quality has become an urgent issue. The current methods commonly used for MOOC teaching quality evaluation are mostly questionnaire surveys based on user feedback or single indicator evaluation, which have the problems of strong subjectivity, inaccurate and comprehensive evaluation results[3-4]. The continuous progress of Internet technology has led to further enhancements in the evaluation method for online teaching quality in higher vocational colleges, particularly with the integration of big data [5-6] . As an extension and expansion of the application of information technology, a scientific teaching quality evaluation index system has been constructed with the help of the characteristics of big data analysis technology, which improves the reliability of the evaluation results to some extent, but shows some shortcomings in accuracy [7-9] . In addition, the evaluation of teaching effectiveness in colleges and universities based on rough set theory has also been widely used. Under this evaluation method, FCM method is first used to cluster the existing teaching quality evaluation data, and the evaluation of teaching effectiveness is constructed by using the analysis results. In the in-depth analysis of the weights of evaluation subjects [10-11] , rough set theory is introduced, which the improvement significantly mitigates the influence of human subjective factors on the reliability of evaluation results. However, this method requires high quality of objective data, so it exists in the application stage. Combined with the above analysis, it can be seen that building a more scientific and reasonable teaching quality evaluation method is still a realistic problem that needs to be studied emphatically [12-13] .

Combined with the above analysis, this paper takes MOOC teaching as the research object, puts forward a method for evaluating teaching quality based on AHP fuzzy comprehensive evaluation method, and analyzes and verifies the application effect of the design evaluation method through comparative testing. AHP (Analytic Hierarchy Process) is a decision analysis method that combines qualitative and quantitative analysis, which can effectively handle complex decision problems. The fuzzy comprehensive evaluation rule can handle fuzziness, comprehensively consider various factors, and is suitable for complex teaching quality evaluation problems. Combining these two methods can make up for the shortcomings of traditional teaching quality evaluation methods and provide new solutions for MOOC teaching quality evaluation.

1 MOOC teaching quality evaluation method design

1.1 MOOC teaching quality evaluation index setting

In order to ensure that the designed MOOC method for evaluating teaching quality based on AHP fuzzy comprehensive evaluation method can meet the actual application requirements to the maximum extent, and the final evaluation result has high reliability [14-15] , this paper first makes a deep research and Fenix on the setting of MOOC teaching quality evaluation index. Among them, in the initial stage of drawing up the evaluation index framework, this paper fully considers the development of the main models adopted in the evaluation index system of education quality monitoring, combines the unique value orientation and structural logic [16-17] of CIPP model, and its strong applicability and reliability in the field of teaching quality monitoring and evaluation, and constructs the first-level evaluation index [18-19] from the perspectives of comprehensiveness and systematicness of MOOC teaching. Among them, the specific first-level evaluation indicators cover the background, input, process and results of MOOC teaching, as shown in Table 1.

Table 1 Preliminary evaluation index system of MOOC teaching quality

Primary indicators	Secondary indicators	Third level indicators
background	Practical Plan Practical environment	Training objectives, professional characteristics, teaching plan, practical teaching system, feedback on internship and training, and integration of college and kindergarten.
input	Funding investment Teaching staff	Investment in practical facilities and venues, investment in internship base construction funds, investment in internship practice funds, investment in teacher practical teaching, and investment in teacher training and training.
process	Teaching management Teaching implementation	The setting of practical teaching courses, monitoring mechanism for practical teaching quality, evaluation and feedback mechanism, information technology teaching, practical teaching methods, and practical teaching methods.
result	Student comprehensive literacy Student comprehensive evaluation	Innovation ability, design ability, collaboration ability, self-evaluation, guidance teacher evaluation, employer evaluation.

Combined with the initial index system of MOOC teaching quality shown in the above table, this paper delves further into the specific indicators associated with teaching quality evaluation, including merger, increase, decrease and modification [20-21] . Specifically, the indicators of "training objectives" and "professional characteristics" are merged, and the merged evaluation index is "teaching objectives positioning"; Combine the indicators of innovation ability, design ability and cooperation ability, and the combined evaluation index is professional ability; The indicators of "feedback of practice training", "monitoring mechanism of practical teaching quality" and "evaluation feedback mechanism" are merged, and the merged evaluation indicator is "monitoring feedback mechanism of practical teaching quality"; Delete the evaluation index of "information teaching", take "individual quality" as a new evaluation index, and change the index of "practical teaching system" to "cooperation between colleges and universities to build a practical teaching system".

On this basis, the evaluation index of MOOC teaching quality is shown in Table 2.

Table 2 MOOC teaching quality evaluation index system

Primary indicators	Secondary indicators	Third level indicators
Teaching background	Teaching plan	Positioning of teaching objectives Teaching plan
	Teaching environment	Establishing a Practical Teaching System through Campus Cooperation Collaborating with institutions and participating in the entire process of practical teaching
Teaching investment	Funding investment	Investment in teaching facilities and venues Investment in teaching base construction funds Investment in teaching practice funds
	Teaching staff	Teacher's practical teaching investment Teacher training and investment in training
Teaching process	Teaching management	Design of practical teaching courses Feedback mechanism for monitoring the quality of practical teaching
	Teaching implementation	Practical teaching methods Practical teaching methods
Teaching achievements	Student comprehensive literacy	Professional competence Individual quality
	Student comprehensive evaluation	Self evaluation Instructor evaluation Employers' evaluation

According to the way shown in Table 2, the construction of MOOC teaching quality evaluation index system is realized, which provides a reliable implementation basis for the subsequent evaluation work and ensures the reliability of the evaluation results.

1.2 Related Acquisition of MOOC Teaching Quality Evaluation Indicator Data

The MOOC teaching quality evaluation indicators can also be further refined and adjusted based on the characteristics and needs of specific courses. At the same time, certain indicators can also be added or deleted according to the needs of actual teaching quality evaluation. When obtaining indicator data through actual correlation, the data is processed into multi-dimensional matter elements based on the subordinate level of the indicator. The multi-dimensional matter elements used can be represented as:

$$R = N\begin{bmatrix} c_1 & n_1 \\ c_2 & n_2 \\ \vdots & \vdots \\ c_n & n_n \end{bmatrix}^2 \quad (1)$$

Among them, R represents the selected multidimensional matter element, N represents the number of indicators processed by the multidimensional matter element, c_n represents the indicator features, and n_n represents the sub features decomposed. By utilizing the formalized features of this multidimensional matter element, the number of matter elements can be quantified into multiple levels of matter elements. The quantification process can be expressed as:

$$S = R\begin{bmatrix} c_1 & v_1 \\ c_2 & v_2 \\ \vdots & \vdots \\ c_n & v_n \end{bmatrix} \quad (2)$$

Among them, S represents the parameter for quantitative processing, v_n represents the numerical score of the indicator, and the meaning of the other parameters remains unchanged. In order to control the completeness of data domain data within attribute classes and expand the numerical distance of processing management data, the numerical relationship can be expressed as:

$$p(x) = \left| x - \frac{a+b}{2} \right| \quad (3)$$

Among them, $p(x)$ represents the calculated distance parameter, x represents the real domain points of attribute values, and a 、 b represents the extension parameters of different attribute categories. Using the numerical distance formed by the above processing as the quantitative range, establish a primary correlation of MOOC teaching quality evaluation index data, and the numerical relationship can be expressed as:

$$k(x) = \frac{p(x)}{D(X_0) + b} \quad (4)$$

Among them, $k(x)$ represents the primary correlation numerical relationship constructed, $D(X_0)$ represents the bit value processing function, and b represents the quantitative parameter. Using the primary correlations obtained from the above organization, the classical domain of the associated data is extracted, and the extraction process can be expressed as:

$$J = \frac{\sum_{j=1}^{N} p_j}{\sum_{j=1}^{n} k_j} \quad (5)$$

Among them, J represents the extracted classical domain parameter, p_j represents the node domain function of the parameter, k_j represents the attribute category parameter, and the meaning of the other parameters remains unchanged. Organize the data association relationships after the above association processing, and use the AHP entropy weight method to calculate the evaluation results of MOOC teaching quality.

1.3AHP Fuzzy Comprehensive Evaluation Model

(1) Build evaluation criteria

According to the theory of fuzzy mathematics, when evaluating any MOOC teaching quality evaluation index based on evaluation set elements, the results obtained are not presented through affirmation or negation, and their membership degree can be described through fuzzy sets, which is $[0,1]$. In the process of evaluating the quality of online and offline MOOC teaching, it is necessary to first divide the evaluation result interval, obtain a quantitative evaluation level, and generate a membership function based on this. During actual evaluation, the evaluation scores of different MOOC teaching quality evaluation indicators are obtained through expert survey method, and the conversion between MOOC teaching quality evaluation results and membership degree is achieved based on interval membership function. To ensure the scientificity of the MOOC teaching quality evaluation results, it is necessary to scientifically divide the evaluation levels and scoring intervals.

(2) Obtaining teaching quality ratings

The common MOOC teaching quality rating is based on the analysis results of different evaluation indicators by experts, which is the weighted evaluation expert survey method to obtain evaluation data. This method does not consider expert experience, which leads to certain deficiencies in the scientific nature of the evaluation result set. Moreover, experts have certain deficiencies and blind spots in their understanding of online and offline MOOC teaching, and based on this, confidence index can be introduced into the specific evaluation process.

To ensure the scientificity of the MOOC teaching quality evaluation results, expert levels are divided based on the expert information participating in the research, corresponding coefficients are set, and the expert weights are determined using equation (6):

$$z_r = \frac{m_r}{\sum_{r=1}^{n} \left(m_r n_r \right)} \quad (6)$$

Among them, m_r and n_r respectively represent the coefficients corresponding to the number of experts at any level.

Introducing confidence index $d\left(0 < d \leq 1\right)$ into the expert judgment process means that if an expert has high information about the given evaluation result, a value of d_r can be set as 1. If the given evaluation result is uncertain, a value of d_r can be set as any number between $\left[0,1\right]$. From this, we can obtain an expert's rating of T for a certain MOOC teaching quality evaluation indicator:

$$T = \frac{z_r s_r d_r}{\sum_1^n d_r} \quad (7)$$

Among them, s_r represents the evaluation result of an expert on any MOOC teaching quality evaluation indicator. By dividing expert weights and providing accurate analysis based on their own identification based on s_r, combined with expert weights and indicator weights, the final MOOC teaching quality evaluation results can be closer to the actual MOOC teaching quality situation, thereby preventing the problem of lack of information judgment results having a negative impact on the final MOOC teaching quality evaluation results.

By counting the scores of all experts on any MOOC teaching quality evaluation indicator, the final evaluation result of that MOOC teaching quality evaluation indicator can be obtained [22].

(3) Constructing Fuzzy Membership Matrix

The distance between the MOOC teaching quality evaluation indicators obtained based on expert research method and the evaluation result interval is inversely proportional to the degree of membership, that is, the farther the distance between the quality and the evaluation result interval, the lower the degree of membership, which is consistent with the characteristics of the normal distribution function. Based on this, the membership function is set as a normal distribution function, and x represents the quantitative value set by the expert for any MOOC teaching quality evaluation indicator, The membership function formula is described as follows:

$$r\left(x\right) = \exp\left[-\frac{\left(x-a\right)^2}{\partial^2}\right] \quad (8)$$

Among them, a and ∂ represent the intermediate values of different MOOC teaching quality evaluation results intervals and the parameters that follow the normal distribution, respectively.

Under the condition that the quantification value set by the expert is consistent with the a value, the membership value is 1. Under the condition that the quantification value is the endpoint value on both sides of the MOOC teaching quality evaluation result interval, the MOOC teaching quality evaluation result has a significant ambiguity feature. Therefore, its membership degree can be defined for the adjacent two MOOC teaching quality evaluation results interval, which is consistent, both 0.5. From this, the following formula can be obtained:

$$r(x) = \exp\left[-\frac{(x_1 - a)^2}{\partial^2}\right] = \exp\left[-\frac{(x_1 - x_2)^2}{4\partial^2}\right] = 0.5 \quad (9)$$

Among them, x_1 and x_2 are the two endpoint values of the MOOC teaching quality evaluation result interval, which will be brought into the actual evaluation calculation process to determine parameter ∂ for different MOOC teaching quality evaluation result intervals.

The main feature of the normal distribution membership function is that the closer the distance between the results of the MOOC teaching quality evaluation interval, the higher the degree of membership; However, optimization needs to be implemented for the evaluation result interval on both sides. The detailed process is to convert the membership function on both sides of the MOOC teaching quality evaluation result level into a straight line with a continuous membership degree of 1 by raising and lowering the half gradient [23-24].

By determining the membership degree of different MOOC teaching quality evaluation levels and normalizing the evaluation results, a single factor membership matrix for the comprehensive evaluation of MOOC teaching quality can be obtained:

$$R_i = \begin{bmatrix} r_{i11} & r_{i12} & \cdots & r_{i1n} \\ r_{i21} & r_{i22} & \cdots & r_{i2n} \\ \vdots & \vdots & \vdots & \vdots \\ r_{im1} & r_{im2} & \cdots & r_{imn} \end{bmatrix} \quad (10)$$

(4) Fuzzy comprehensive evaluation

By combining the weight vector obtained through fuzzy analytic hierarchy process with the membership matrix of comprehensive evaluation, a fuzzy comprehensive evaluation matrix for the three-level evaluation indicators of online and offline MOOC teaching quality is determined. The formula is described as follows:

$$Z_i = w_i \times R_i = (w_{i1}, w_{i2}, \cdots, w_{in}) \times \begin{bmatrix} r_{i11} & r_{i12} & \cdots & r_{i1n} \\ r_{i21} & r_{i22} & \cdots & r_{i2n} \\ \vdots & \vdots & \vdots & \vdots \\ r_{im1} & r_{im2} & \cdots & r_{imn} \end{bmatrix} \quad (11)$$

Based on the above description, the MOOC teaching quality evaluation results can be determined:

$$P = w \cdot \left(P_1, P_2, \cdots, P_m\right)^T \quad (12)$$

On this basis, the corresponding MOOC teaching quality evaluation process can be expressed as shown in Figure 1.

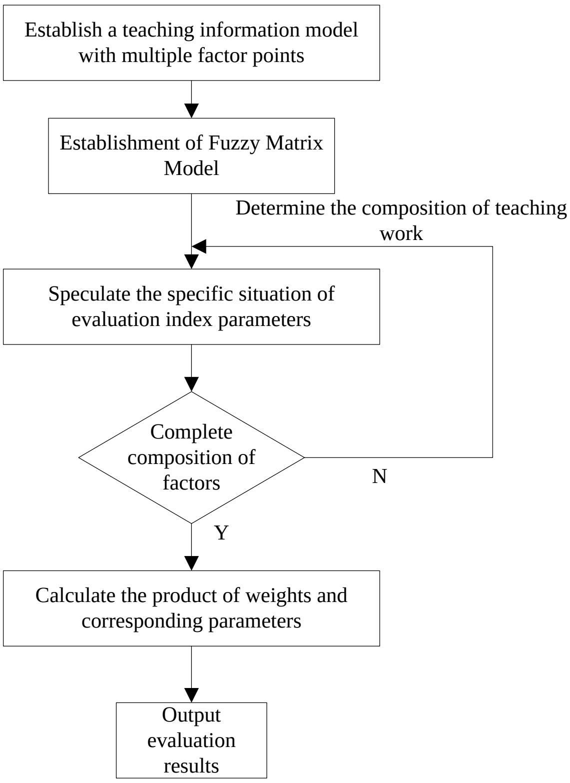

Figure 1 MOOC teaching quality evaluation process

According to the way shown in Figure 1, on the basis of judging the composition of specific factors in MOOC teaching, the evaluation of MOOC teaching quality is realized by combining the weight parameters calculated by Equation (1), and the specific evaluation result is the sum of the products of index weights and corresponding parameters [25].

According to the way shown above, the accurate evaluation of MOOC teaching quality can be realized.

2 Application testing

2.1 test preparation

When analyzing the MOOC teaching quality evaluation method designed in this paper based on AHP fuzzy comprehensive evaluation method, a comparative test was carried out. Among them, the control group participating in the test was the method for evaluating teaching quality based on BP neural network, the teaching quality evaluation method based on big data and the teaching quality evaluation method based on rough set theory.

For the specific teaching test, this paper carried out a comparative test based on the teaching content of the optical part of senior high school physics elective 3-4. Among them, 162 students and 6 teachers participated in the test. In terms of teaching content, it mainly includes two parts, namely, the integration of subject knowledge under MOOC education concept and the teaching goal of physics in senior high school under national curriculum standards. In terms of teaching objectives, students' teaching work is carried out from four angles of core literacy.

2.2 Test results and analysis

Based on the above-mentioned test environment, the relationship between the evaluation results and the actual situation under different test and different evaluation methods is compared and analyzed. Among them, the specific test results are shown in Table 3.

Table 3 Comparison Table of Test Results of Different Methods

Detecting and evaluating method	R^2		MAE		MSE	
	min	max	min	max	min	max
BP Neural Network Teaching Quality Evaluation Method	0.8166	0.9245	1.56	3.36	1.15	3.49
Teaching Quality Evaluation Method for Teaching	0.8482	0.9105	2.02	3.15	2.13	3.44
Evaluation Method for Big Data Quality of Rough Set Theory	0.8326	0.8985	2.96	3.17	2.83	3.20
This article designs a teaching quality evaluation method	0.9122	0.9450	1.26	2.25	1.13	2.56

Combined with the test results shown in Table 3, the application effects of three different methods are analyzed, and it can be found that they all show different characteristics. Among them, under the BP neural network teaching quality evaluation method, the R^2 of MOOC teaching quality evaluation results shows obvious fluctuation, and the difference between the minimum value and the maximum value reaches 0.1079, and the minimum value is only 0.8166, which is at a low level, and the corresponding MAE and MSE are also low. In the test results of big data teaching quality evaluation method, the fluctuation degree of different evaluation indexes is relatively small, among which the differences between the minimum value and the maximum value of R^2 , MAE and MSE are 0.0623,1.13 and 1.31, respectively. Although the stability is obviously improved compared with the BP neural network teaching quality evaluation method, the overall level is low, and the maximum value of R^2 is only 0.9105. In the test results of rough set theory teaching quality evaluation method, the stability of R^2 , MAE and MSE has been further improved, and the difference between the minimum value and the maximum value is stable within 1.0, but there are the same shortcomings as the big data of the method. In contrast, the value of R^2 is always above 0.91, and the maximum value reaches 0.9450, which is greater than the BP neural network teaching quality evaluation method 0.0205, the big data teaching quality evaluation method 0.0345 and the rough set theory teaching quality evaluation method 0.0465 respectively, indicating that the evaluation results are highly reliable. MAE is stable within 2.30, and the minimum value is only 1.26, which is lower than BP neural network teaching quality evaluation method 0.30, big data teaching quality evaluation method 0.76 and rough set theory teaching quality evaluation method 1.70 respectively, indicating that the overall accuracy of the evaluation results is high; MSE is stable within 2.60, and the minimum value is only 1.13, which is lower than BP neural network teaching quality evaluation method 0.02, big data teaching quality evaluation method 1.00 and rough set theory teaching quality evaluation method 1.70 respectively, indicating that the overall stability of evaluation results is high.

3 Conclusion

To provide a scientifically effective method for evaluating and measuring the quality of MOOC teaching, this paper puts forward the research on MOOC teaching quality evaluation method based on AHP fuzzy comprehensive evaluation method. By establishing a hierarchical structure model and determining corresponding indicator systems, a comprehensive evaluation framework is provided for the evaluation of MOOC teaching quality. Using the AHP fuzzy comprehensive evaluation method, calculate the weights of each evaluation indicator, accurately reflect the importance of each indicator to teaching quality, and avoid bias in subjective evaluation. Based on the AHP fuzzy comprehensive evaluation method, the weights of various evaluation indicators and specific measurement results are comprehensively calculated to obtain the final teaching quality score, providing an objective and comprehensive teaching quality evaluation result. This approach significantly enhances the reliability, effectiveness, and stability of the evaluation results. The design and research of the MOOC teaching quality evaluation method in this paper aim to provide valuable insights and guidance for enhancing and advancing actual teaching practices.

References

[1] Yang Y H .Research on the Teaching Quality Management of"Xindi Applied Piano Pedagogy"[J]. Journal of Contemporary Educational Research, 2022, 6(7):80-87.

[2] Wang J , Yang H .Research on online evaluation method of MOOC teaching quality based on decision tree-based big data classification[J].International journal of continuing engineering education and life-long learning, 2023,33(1):10-22.

[3] Lindgreen A , Di Benedetto C A , Brodie R J ,et al.Teaching: How to ensure quality teaching, and how to recognize teaching qualifications[J].Industrial marketing management, 2022,100(Jan.):A1-A5.

[4] Huang X , Huang X , Wang X .Construction of the Teaching Quality Monitoring System of Physical Education Courses in Colleges and Universities Based on the Construction of Smart Campus with Artificial Intelligence[J].Hindawi Limited, 2021,2021(Pt.37): 9907531.1- 9907531.11.

[5] Backhaus J , Koenig S , Westphale S .Quantifying teaching quality in medical education: The impact of learning gain calculation[J].Medical Education, 2022, 56(3):312-320.

[6] Bijlsma H J E , Glas C A W , Visscher A J .Factors related to differences in digitally measured student perceptions of teaching quality[J].School Effectiveness and School Improvement, 2022, 33(3):360-380.
[7] Ogbuanya T C , Shodipe T O .Workplace learning for pre - service teachers' practice and quality teaching and learning in technical vocational education and training: key to professional development[J].The Journal of Workplace Learning, 2022,34(4):327-351.
[8]SchbelSrenSchferJulianHausladenGeorg.Research through Design under Systematic Quality Criteria: Methodology and Teaching Research[J].Dimensions, 2021, 1(1):99-110.
[9] Zhang N , Tan L , Li F ,et al.Development and application of digital assistive teaching system for anatomy[J].Virtual Reality & Intelligent Hardware, 2021, 3(4):315-335.
[10] Suleiman A R M , Amarasinghe D , Kathuria P ,et al.Incorporating patient safety into early undergraduate medical education: teaching medical students to perform surgical time outs during anatomy[J].BMJ Open Quality, 2021, 10(1):e001229.
[11] Zhu F X .Preliminary Study on the Training Mode of Chinese Pharmacy Professionals Based on the National Standard of Teaching Quality[J].Asian Agricultural Research, 2022, 14(9):67-69.
[12] Yan J .Improving Classroom Teaching Quality of Architectural CAD Through the Integration of Competition Content[J]. World Architecture, 2023, 7(1):25-29.
[13] Wen X .Research on the teaching quality evaluation model of distance education in colleges based on analytic hierarchy process[J].International journal of continuing engineering education and life-long learning, 2022,32(6):769-810.
[14] Li X .A new evaluation method for English MOOC teaching quality based on AHP[J].International journal of continuing engineering education and life-long learning, 2022,32(2):201-215.
[15] Han Z .A Fuzzy Logic and Multilevel Analysis-Based Evaluation Algorithm for Digital Teaching Quality in Colleges and Universities[J].Scientific Programming, 2021,2021(Pt.11):7026531.1-7026531.7.
[16] Litke E , Boston M , Walkowiak T A .Affordances and constraints of mathematics-specific observation frameworks and general elements of teaching quality[J].Studies In Educational Evaluation, 2021, 68(1):100956.
[17] Qin L .Research on the Construction of Evaluation System of Intelligent Classroom Teaching Quality in Colleges and Universities under the Information Technology Environment[J].Journal of Physics: Conference Series, 2021, 1744(3):032164.
[18] Bodroza B , Teodorovic J , Josic S .Validation of scales for measuring factors of teaching quality from the dynamic model of educational effectiveness[J].Psihologija, 2021,55(00):10-10.
[19] Mensissusanto M , Lian B , Putra A Y .The Influence of Principal Leadership and Work Motivation on Teaching Quality of Teachers in Ogan Komering Ulu Timur (OKUT) Vocational School[J]. 20212(2):319-332.

[20] Lazarides R , Fauth B , Gaspard H ,et al.Teacher self-efficacy and enthusiasm: Relations to changes in student-perceived teaching quality at the beginning of secondary education ☆[J].Learning and Instruction, 2021, 73(8):101435.

[21] Sendra A ,Natàlia Lozano-Monterrubio, Prades-Tena J ,et al.Developing a Gameful Approach as a Tool for Innovation and Teaching Quality in Higher Education[J].International Journal of Game-Based Learning, 2021, 11(1):53-66.DOI:10.4018/IJGBL.2021010104.

[22] Liu P , Wang X , Teng F .Online teaching quality evaluation based on multi-granularity probabilistic linguistic term sets[J].Journal of Intelligent and Fuzzy Systems, 2021, 40(2):1-20.DOI:10.3233/JIFS-202543.

[23] Kyriakides E , Tsangaridou N , Charalambous C Y ,et al.Toward a More Comprehensive Picture of Physical Education Teaching Quality: Combining Generic and Content-Specific Practices[J].Journal of Teaching in Physical Education, 2021, 40(2):1-11.

[24] Lin H , You J , Xu T .Evaluation of Online Teaching Quality: An Extended Linguistic MAGDM Framework Based on Risk Preferences and Unknown Weight Information[J].Symmetry, 2021, 13(2):192.

[25]Qi, P C, Guo Q S, Dong Z M, et al. Evaluation of System-of-Systems Integration for Ground Unmanned Combat System Based on Fuzzy-AHP [J]. Computer Simulation, 2022, 39(11):1-6.