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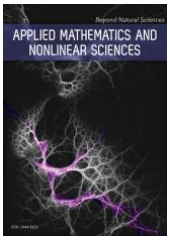

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Construction of Digital Evaluation Model for Teacher Literacy in Colleges and Universities and Its Optimization Strategy

Yu Yang[1,†], Zequn Shi[2], Kaiming Wang[1]

1. Jiangxi Modern Polytechnic College, Nanchang, Jiangxi, 330095, China.
2. Jiangxi Youth Vocational College, Nanchang, Jiangxi, 330045, China.

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Abstract

In this paper, by sorting out the principles followed by some scholars in constructing the evaluation index system of teacher literacy in colleges and universities, combined with the actual situation of teacher literacy in a college or university, the preliminary selection of teacher literacy evaluation indexes is made. The Delfel method must be used to screen the preliminary selection of evaluation indicators and then determine the teacher literacy evaluation index system. With the help of a hierarchical analysis algorithm, calculate the weight value of each index, formulate the evaluation factor set and comment set, and construct a fuzzy evaluation model. Adopt the model of this paper to explore the current situation of teacher literacy development. The comprehensive evaluation matrix of the three-level indicators in the teacher literacy evaluation index system of the school is 3.7519, 6.2918, 3.353, 3.407, and 3.1964. Based on the principle of maximum affiliation, the evaluation results of teacher literacy in the school are good, and at the same time, it maps out that there is a problem of teacher literacy in colleges and universities, and in order to promote the college and university teachers to have excellent literacy, it puts forward two optimization strategies, namely, teacher training and a sound appraisal mechanism. To promote the excellent quality of college teachers, two optimization strategies are proposed, namely, teacher training and sound assessment mechanisms.

Keywords: Dufour Method; Hierarchical Analysis; Fuzzy Evaluation Model; Teacher Quality.
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†Corresponding author.
Email address: Y13879147252@163.com

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1 Introduction

Teachers are the primary resources for educational development, and the professional level of some teachers needs to be upgraded to meet the needs of talent cultivation in the new era. Since teacher literacy is a key factor affecting the quality of education and students' development, it has become the focus of the academic field of education [1-4]. In China, with the deepening of education reform and the development of society, the study of teacher literacy has experienced a shift from initial exploration to in-depth practice, and the field has received widespread attention, with many scholars exploring the connotation, composition and cultivation methods of teacher literacy from different perspectives and levels [5-8]. At the same time, the development of informationization and digital technology has brought new expansion and deepening of teacher literacy research [9].

With the rapid development of digital technology, especially in the field of higher education, we are witnessing a major shift in the way of education [10]. In this context, digital technology in higher education has not only changed the way of delivering educational content and students' learning but also prompted a change in the roles of teachers, who are no longer only the transmitters of knowledge but have become the guides, designers, and evaluators [11-13]. This shift has put forward new requirements for teacher literacy. Teacher literacy, as a collection of teacher competencies, including knowledge, skills and attitudes, plays a decisive role in teaching effectiveness and quality [14-16]. In the digital era, teachers not only need to maintain traditional teacher literacy but also must master new technical skills and understand and utilize new teaching methods to adapt to the rapidly changing teaching environment. Therefore, the study of teacher literacy assessment in the digital era is of great significance in understanding teachers' teaching practices, promoting teachers' professional development, and providing a theoretical basis for educational policy-making [17-20].

In this paper, the expert questionnaire is prepared, 10 experts are selected to form the audit members, and the calculation formulas for expert positive coefficient, expert authority coefficient, arithmetic mean, and coefficient of variation are given. The reference's preliminary formulation of teacher literacy evaluation indicators can be combined with the above formula to screen the teacher literacy evaluation indicators and determine the final university teacher literacy evaluation index system. Based on the hierarchical relationship between evaluation indexes, construct the judgment matrix and obtain the evaluation index weights through hierarchical single sorting and consistency testing. Set up the evaluation factor set and comment set, and convert the original index data into an evaluation matrix using the normalization principle. Construct the fuzzy evaluation model, use the model to evaluate and analyze the development of teacher quality in colleges and universities, and put forward targeted optimization strategies for the teacher quality problems arising from the analysis results.

2 Research on a model for evaluating teacher quality in higher education institutions

2.1 Principles of construction

When constructing the evaluation index system, certain principles need to be followed to better ensure the scientific nature, effectiveness, and feasibility of the evaluation index system [21]. Combining the principles followed by some scholars in constructing the evaluation index system of college teachers' literacy, the principles of constructing the evaluation index system of college teachers' literacy are shown in Table 1. According to the information in the table, combined with the evaluation index system of this paper, the construction of the digital evaluation index system of college teachers' literacy should follow the principles of wholeness, orientation, scientificity, and measurability in order to ensure that the evaluation index system has the wholeness of the structure, the orientation of the goal, the scientificity of the content, and the measurability of the method.

Table 1. Evaluation index system construction principle

Principle	Scholar name							
	S1	S2	S3	S4	S5	S6	S7	S8
Scientificity	√	√	√	√	√	√	√	√
Orientation	√	√	√	√	√	√	√	√
Scientific characteristics		√				√		
Operability		√	√	√	√	√	√	
Practicability	√		√	√		√		
Purposefulness				√				
Wholeness				√				
Impartiality								
Feasibility			√				√	
Temporality								√
Policy policy								√
Comprehensiveness							√	
Refining							√	
Acceptability	√							

2.2 Construction of Evaluation Indicator System Based on Deferral Method

2.2.1 The Deferral Method

This study uses this method to screen and complete the weighting of indicators, which is one of the most commonly used scientific research methods [22]. In this study, a questionnaire designed in advance was distributed to experts at a university, and each of them gave their opinions and judgments on the same academic issue. To prevent the influence of other experts' opinions, anonymity is used to express opinions, and there is no connection between the experts. In the end, each expert's suggestions are summarized, and the results show a high degree of convergence of their suggestions after repeated questionnaire filling.

2.2.2 Development of expert questionnaires

In this study, the first round of the Delphi method consultation questionnaire was prepared after modifications to the indicators based on the interview method and after discussion and consultation. This questionnaire contains the appropriateness questionnaire for the construction of primary, secondary and tertiary indicators and the description of connotations and the indicators were modified through the first round of consultation, followed by the distribution of the next round of questionnaires until the experts' opinions were consistent, and a total of two rounds of Delphi method consultation were carried out in this study.

2.2.3 Composition of expert members

In the Delphi method, the selection of experts is particularly important. The selection of expert members is mainly based on the content of the topic, and this study follows the following two conditions when selecting experts: first, they are familiar with the research content of teacher literacy,

and they can have unique insights into the relevant research content of the topic. The second reason is that they have a certain amount of research in the field related to teacher literacy and have more theoretical knowledge and rich experience.

2.2.4 Expert activation factor

The expert positivity factor is the recovery rate of the expert advice questionnaire, expressed as C_j, and is calculated using the formula shown below:

$$C_j = \frac{M_j}{M} \tag{1}$$

Where, M_j is the number of expert advice questionnaires recovered and M is the total number of expert advice questionnaires distributed. The study concluded that when the recovery rate of the expert consultation questionnaire reaches more than 65%, it can be used for analysis and statistics, and more than 80% indicates that the designed expert consultation questionnaire is very good. The positive coefficient of experts in this study meets the requirements and can be used for research and analysis of teacher literacy in higher education.

2.2.5 Expert authority factor

The degree of authority of experts refers to the degree of experts' knowledge of the evaluation indicators of this study, reflecting whether the results of this expert consultation are reliable and authoritative. The degree of expert authority is expressed by the authority coefficient (Cr), which is determined by the experts' familiarity with the evaluation indicators (Cs) and the basis of judgment (Ca). Due to the large number of indicators and experts, both Cs and Ca here are taken as average values, and the calculation formula is:

$$Cr = \frac{Ca + Cs}{2} \tag{2}$$

$$C_a = \sum \left(M_j * W_j \right) / M \tag{3}$$

$$C_s = \sum \left(M_j * W_j \right) / M \tag{4}$$

Where M_j is the frequency of experts' judgment based on self-assessment, W_j is the grade assignment, and M is the total number of experts. The experts' familiarity with the evaluation indexes Cs is divided into five grades: very familiar, familiar, more familiar, general, and unfamiliar, so as to derive the experts' knowledge of college teachers' literacy.

2.2.6 Arithmetic mean

The arithmetic mean represents the degree of concentration of experts' opinions on the content of the evaluation indicators of teacher literacy in colleges and universities; the larger the arithmetic mean, the greater the importance of the content of the evaluation indicator; when the arithmetic mean score

reaches 70% of the total score (greater than 3.5), it means that the evaluation indicator has a higher degree of importance. The formula is (5):

$$M = \frac{X1 + X2 + X3 + \cdots + X_n}{n} \tag{5}$$

Where M is the arithmetic mean of the indicator and n is the number of experts.

2.2.7 Coefficient of variation

The coefficient of variation is the ratio of the standard deviation to the mean, which reflects the degree of dispersion of the expert evaluation results, and the smaller the coefficient of variation, the smaller the degree of dispersion of the expert evaluation results, and when the coefficient of variation is less than 0.25, it indicates that the evaluation indexes have reached the corresponding degree of harmonization. The formula is (6):

$$V_j = \frac{S_j}{M_j} \tag{6}$$

Where V_j denotes the coefficient of variation of the j indicator and S_j denotes the standard deviation of the j indicator, calculated by the formula (7):

$$S_j = \sqrt{\frac{n}{n-1}\sum_{i=1}^{n}\left(X_{ij} - M_j\right)^2} \tag{7}$$

M_j indicates the arithmetic mean of the j indicators, calculated as (8):

$$M_j = \frac{1}{n}\sum_{i=1}^{n} X_{ij} \tag{8}$$

X_{ij} indicates the score of the ind expert on the j indicator, and n indicates the number of indicators.

2.3 Calculation of evaluation indicator weights

2.3.1 Hierarchical Analysis

As one of the more commonly used methods in decision analysis, the hierarchical analysis method takes into account the basis of qualitative indicators while combining quantitative indicators and analyzes them in the hierarchical solution, which is conducive to the clarity of the indicator judgment and the accuracy of the proportion of the weight [23]. Roughly, it includes the following three steps: firstly, a questionnaire survey is conducted, in which the indexes under study need to be scored according to different degrees of importance, and in addition to collecting the necessary relevant data and information, the judgment matrix can also be set up by relying on the collected information. The matrix can be used to calculate and determine the relative weight values between the elements, and the general calculation and judgment process needs to be carried out hierarchically. The validation process is employed to determine if the consistency test is met based on this basis. In order to obtain

the specific weights needed in this paper, the calculations above are multiplied by the calculated weights.

2.3.2 Hierarchical modeling

The first step of hierarchical analysis is to establish a hierarchical structural model: each relevant factor of the thing is decomposed into a number of levels according to different attributes from top to bottom, and the uppermost level is the target level, usually only one factor, which is the evaluation index of college teachers' literacy in this study. The lowest level is usually the program or object level, which corresponds to the third-level indicators of the evaluation index system constructed in this study; the middle can have one or several levels, usually, the criterion level, which corresponds to the second-level indicators of the evaluation index system.

2.3.3 Constructing judgment matrices

The scales and meanings of the hierarchical analysis method are shown in Table 2. The judgment matrix A consists of a_{ij}. The method of constructing the judgment matrix in the hierarchical analysis method is the consistent matrix method, which takes two elements to compare each time and can be expressed as:

$$A=\left(a_{ij}\right)_{n\times n} \tag{9}$$

Table 2. The scale and meaning of the analytic hierarchy process

Scale	Explain
1	The two factors, C and D, are equally important compared to the C and D
3	The two factors, C and D, are slightly more important than D
5	The two factors, C and D, C is more important than D
7	The two factors, C and D, C is very important than D
9	The two factors, C and D, C is extremely important than D
2,4,6,8	Other
Reciprocal	$a_{ij}=1/a_{ij}$

2.3.4 Hierarchical Single Ordering and Consistency Tests

Compute the simple geometric mean $\overline{W_t}$ of the elements in each row of row vector B_i of judgment matrix A, which can be expressed as:

$$\overline{W_t}=\sqrt[n]{\prod_{j=1}^{n}a_{ij}} \tag{10}$$

Where B_i is the i nd row vector of the judgment matrix and a_{ij} is determined by subsection 2.3.3.

For the judgment matrix W after weight processing of judgment matrix A, normalization is performed for vector $\overline{W}=\left(\overline{W_1},\overline{W_2},\overline{W_3},\cdots,\overline{W_n}\right)^T$. That is:

$$W_i = \frac{\overline{W}_t}{\sum_{i=1}^{n} \overline{W}_t} \tag{11}$$

$$W = \left(W_1, W_2, W_3, \cdots, W_n\right)^T \tag{12}$$

Choose the largest eigenvalue $\lambda_{\max}$ of the judgment matrix W. i.e:

$$B_i W = B_i \lambda_i \tag{13}$$

$$\lambda_{\max} = \sum_{i=1}^{n} \frac{B_i \cdot W}{n \cdot B_i} \tag{14}$$

Where B_i is the i nd row vector of the judgment matrix and $\lambda_{\max}$ is the largest eigenvalue of W.

Calculate CI to test the consistency of the judgment matrix A. i.e:

$$CI = \frac{\lambda_{\max} - n}{n-1} \tag{15}$$

Where CI is the consistency indicator.

$CI = 0$ that the factor ordering is in the nature of perfect consistency, CI the closer to 0, the more consistency is shown, and CI the larger, the more serious the inconsistency is shown [24]. In order to quantify the magnitude of consistency CI, an average random consistency indicator RI was introduced using CR and calculated CR, i.e:

$$CR = \frac{CI}{RI} \tag{16}$$

2.4 Fuzzy evaluation models

In the process of designing the evaluation of teacher literacy in colleges and universities, the specific evaluation factors of teacher literacy in colleges and universities should be analyzed first. The authors determine the specific set of evaluation factors based on the actual needs of research in college education. On top of that, we have to set the weight proportion of each evaluation factor in its overall evaluation process. For the set of rubrics determined in the needs analysis, it is also necessary to determine the value of each rating scale and get the arithmetic formula to get the evaluation fuzzy evaluation method model. Then the samples can be collected to get the evaluation results.

2.4.1 Determination of the set of evaluation factors

An evaluation factor set is a set consisting of each evaluation factor of the subject to be evaluated as an element [25]. Generally, it is necessary to establish an evaluation factor set based on the characteristics of the subject to be evaluated and the evaluation criteria learned in the needs analysis. We divide the evaluation factor set into two levels of evaluation indicators. We first get the first-level evaluation factor set as:

$$U=\{U_1,U_2,\cdots,U_m\} \tag{17}$$

The first-level evaluation indicators are subdivided so that second-level evaluation factors can be identified:

$$U_1=\{U_{11},U_{12},\cdots,U_{1n}\} \tag{18}$$

$$U_2=\{U_{21},U_{22},\cdots,U_{2n}\} \tag{19}$$

$$U_m=\{U_{m1},U_{m2},\cdots,U_{mn}\} \tag{20}$$

2.4.2 Determining the rubric set

The set of rubrics was determined on the basis of a wide range of suggestions from teachers and students and taking into account the characteristics of each evaluation factor. Based on the actual research, five grades were determined: excellent, good, fair, poor, and poor.

The corresponding scores for specific sets of rubrics are excellent 5 points, good 4 points, average 3 points, poor 2 points, and poor 1 point.

2.4.3 Construction of the evaluation matrix

Suppose that an indicator U_i has four sub-level indicators and each sub-level indicator factor is assigned a corresponding weight vector, $W_i=(W_{i1},W_{i2},W_{i3},W_{i4})^T$. If n experts are invited to vote on each sub-level indicator according to the set of rubrics, and assuming that a total of m_{ij} experts chose tranche j for indicator i, it is possible to derive the probability that the group of experts chose tranche j for this indicator as m_{ij}/n. Based on the probability statistics of the number of experts choosing different rubrics for this indicator, the row matrix for the evaluation of the j th sub-level indicator for indicator U_i is derived:

$$\begin{aligned} R_{ij}&=(r_{j1},r_{j2},r_{j3},r_{j4},r_{j5}) \\ &=(m_{j1}/n,m_{j2}/n,m_{j3}/n,m_{j4}/n,m_{j5}/n) \end{aligned} \tag{21}$$

Obviously $\sum_{j=1}^{5} r_{ij}=1$, the resulting evaluation matrix for Indicator U_i is shown below:

$$R_i=\begin{bmatrix} R_{i1} \\ R_{i2} \\ R_{i3} \\ R_{i4} \end{bmatrix}=\begin{bmatrix} r_{11} & r_{12} & r_{13} & r_{14} & r_{15} \\ r_{21} & r_{22} & r_{23} & r_{24} & r_{25} \\ r_{31} & r_{32} & r_{33} & r_{34} & r_{35} \\ r_{41} & r_{42} & r_{43} & r_{44} & r_{45} \end{bmatrix} \tag{22}$$

2.4.4 Fuzzy evaluation

The indicator system is divided into three levels. When the expert evaluation of the three levels of indicators is completed, each of the second-level indicators can be constructed as described above evaluation matrix, for the first item of the second-level indicators can be constructed evaluation matrix, for the first i second-level indicators can be constructed evaluation matrix R_i, then for the second-level indicators have:

$$\begin{aligned} B_i &= W_i^T R_i \\ &= \left(w_{i1}, w_{i2}, w_{i3}, w_{i4}\right)\left(R_{i1}, R_{i2}, R_{i3}, R_{i4}\right)^T \\ &= \left(b_1, b_2, b_3, b_4, b_5\right) \end{aligned} \tag{23}$$

If the sum of the B_i components is not 1, the corresponding normalization is required, $b_i^{'} = b_i / \sum_{j=1}^{s} b_i \left(i = 1,2,3,4\right)$ and the vector $B_i^{'}$ is used to represent the results of the expert group's evaluation of the i th secondary indicator:

$$B_i^{'} = \left(b_1^{'}, b_2^{'}, b_3^{'}, b_4^{'}, b_5^{'}\right) \tag{24}$$

The same process allows for the evaluation of each indicator at the first level, and thus the evaluation of the overall objective of the activity:

$$M = \left(M_1, M_2, \cdots, M_n\right)\left(w_1, w_2, \cdots, w_n\right)^T \tag{25}$$

3 Evaluation analysis and optimization strategy of teachers' quality in higher education institutions

3.1 Analysis of the evaluation indicator system

3.1.1 Basic analysis of experts

Selecting 20 expert teachers from five universities in a city, the basic situation of experts was analyzed as shown in Table 3. There are 12 males and 8 females among them. Analyzing from the age level, 10.00% of the experts are under 30 years old, 20.00% of the experts are between 31 and 40 years old, 30.00% of the experts are between 41 and 50 years old, 20.00% of the experts are between 51 and 60 years old and 20.00% in total of the experts who are more than 60 years old. In terms of working experience, less than 5 years accounted for 10.00%, 6 to 10 years accounted for 30.00%, 11 to 15 years accounted for 30.00%, 16 to 20 years accounted for 10.00%, and more than 20 years accounted for 20.00%; analyzed at the level of academic qualifications, all of them were masters and above; analyzed in terms of titles, among which, the full-senior titles accounted for 40.00%, the associate senior titles accounted for 50.00%, and the intermediate titles accounted for 10.00%.

Table 3. Expert basic situation statistical analysis

Parameter	Grouping	Number	Frequency
Gender	Man	12	60.00%
	Female	8	40.00%
Age	Under 30	2	10.00%
	31-40	4	20.00%
	41-50	6	30.00%
	51-60	4	20.00%
	Over 60	4	20.00%
Working life	Over 5 years	2	10.00%
	6-10 year	6	30.00%
	11-15 years	6	30.00%
	For 20 years	2	10.00%
	Over 20 years	4	20.00%
Educational background	Doctor	6	30.00%
	Master	6	30.00%
	Undergraduate	4	20.00%
	Junior college and	4	20.00%
Job title	Positive level	8	40.00%
	Subrank	10	50.00%
	Intermediate	2	10.00%
	Primary	0	0.00%
	Absence	0	0.00%
	Other	0	0.00%

3.1.2 Analysis of experts' positive coefficients

The degree of experts' positivity is shown in Table 4. The validity of the results of this study is directly influenced by the degree of experts' positivity and the progress of this study. The recovery rate of the questionnaire can reflect the degree of positivity of the experts. A total of 40 questionnaires were distributed in this study, of which 20 were sent out in the first round, and 18 questionnaires were recovered, with a recovery rate of 90.00%; in the second round, questionnaires were distributed to 20 experts and 16 questionnaires were recovered, with a recovery rate of 80.00%. The experts were interested and willing to cooperate with the research questions, as evidenced by the return rate of more than 70.00% for both rounds of questionnaires.

Table 4. Expert positive statistical analysis

Rotation	Questionnaire number	Number of recovery questionnaires	Questionnaire effective recovery
1	20	18	90.00%
2	20	16	80.00%

3.1.3 Expert authority factor analysis

According to formulas (2), (3) and (24), the expert authority coefficient is analyzed, and the quantitative table of the degree of familiarity of expert consultation and the quantitative table of the strength of the basis of expert judgment are determined on the basis of reference to the literature as well as expert consultation. The degree of expert authority is directly proportional to the degree of reliability of the consulting experts and the value range of Cr floats between 0 and 1. It is generally believed that when $Cr < 0.3$, the degree of expert authority is not high, so it is not considered. When the expert authority coefficient of $Cr \geq 0.7$, indicating that the expert in the field of research authority is high, the results have a certain degree of reliability. The dimensions of expert judgment basis are theoretical knowledge, practical basis, peer understanding, and intuitive judgment, and the grades of expert judgment basis are high, medium, and low. The frequency of self-assessment of expert judgment basis in the first round is shown in Table 5, the frequency of self-assessment of expert judgment basis in the second round is shown in Table 6, and the statistics of expert familiarity self-assessment is shown in Table 7, in which B~F in the table are very familiar (assigned 1), familiar (assigned 0.8), generally familiar (assigned 0.8), generally familiar (assigned 0.8), and generally familiar (assigned 0.8), and generally familiar (assigned 0.8). 0.8), generally familiar (assigned value 0.6), unfamiliar (assigned value 0.4), and very unfamiliar (assigned value 0.2). The synthesis of Table 5, Table 6 and Table 7 shows that the first round of expert judgment is based on:

$$C_a = \sum M_j * W_j / M = (0.3*10 + 0.2*6 + \cdots + 0.1*2) / 20 = 0.8$$

And the second round of expert judgment is based on:

$$C_a = \sum M_j * W_j / M = (0.3*10 + 0.2*4 + \cdots + 0.1*4) / 20 = 0.87$$

Results of the first round of expert familiarity:

$$C_s = \sum M_j * W_j / M = (1*8 + \cdots + 0.2*2) / 20 = 0.86$$

Results of the second round of expert familiarity:

$$C_s = \sum M_j * W_j / M = (1*6 + \cdots + 0.2*0) / 20 = 0.88$$

Results of the first round of expert authority coefficients:

$$Cr = (Ca + C_s) / 2 = (0.80 + 0.86) / 2 = 0.83$$

Results of the second round of expert authority coefficients:

$$Cr = (Ca + C_s) / 2 = (0.87 + 0.88) / 2 = 0.875$$

According to the calculation, it can be seen that both rounds of expert authority coefficients are greater than 0.7, indicating that this expert consultation is reliable and authoritative.

Table 5. Experts judge the frequency of self-evaluation

Judgment	height		Medium		Low	
	Value	Frequency	Value	Frequency	Value	Frequency
Theoretical knowledge	0.3	10	0.2	6	0.1	4
Practical basis	0.5	12	0.4	2	0.1	6
Peer understanding	0.1	8	0.1	8	0.1	4
Intuitive judgment	0.1	14	0.1	2	0.1	4

Table 6. The second round of experts judged the frequency of self-assessment

Judgment	height		Medium		Low	
	Value	Frequency	Value	Frequency	Value	Frequency
Theoretical knowledge	0.3	10	0.2	4	0.1	6
Practical basis	0.5	16	0.4	2	0.1	2
Peer understanding	0.1	12	0.1	4	0.1	4
Intuitive judgment	0.1	8	0.1	8	0.1	4

Table 7. Experts are familiar with the frequency of self-evaluation

N	B		C		D		E		F	
	Value	Frequency	Value	Frequency	Value	Frequency	Value	Frequency	Value	Frequency
1	1	8	0.8	4	0.6	4	0.4	2	0.2	2
2	1	6	0.8	6	0.6	6	0.4	2	0.2	0

3.1.4 Initial formulation of an evaluation indicator system

The initial formulation of the evaluation index system is shown in Table 8. The development of teachers' educational literacy has always been a hot topic in the education sector, and the quality of teachers' literacy development is the foundation of education development. With the progress of society, the development of teachers' own development and professional requirements is constantly improving. It is important to evaluate teachers' educational literacy from the perspective of comprehensive development. Based on reviewing a large amount of literature and consulting relevant experts, this paper follows the principles of scientific comprehensiveness, systematic operability and timeliness and initially proposes to construct 3 first-level indexes, 9 second-level indexes and 27 third-level indexes.

Table 8. The first formulation of the evaluation index system

Primary index	Symbol	Secondary index	Symbol	Tertiary index	Symbol
Professional literacy	A	Education concept	A1	Education thought	A11
				Educational outlook	A12
				Practical view	A13
		Professional knowledge	A2	Subject knowledge	A21
				Education knowledge	A22
				Practical knowledge	A23
		Professional ability	A3	Teaching and training ability	A31
				Curriculum performance	A32
				Teaching ability	A33
		Occupational ethics	A4	Love your career	A41
				Love students	A42
				Excellent quality	A43
Humanistic literacy	B	Humanistic knowledge	B1	Literary knowledge	B11
				Philosophical knowledge	B12
				Historical knowledge	B13
		Humanistic feelings	B2	Education respect	B21
				Education interest	B22
				Education temperament	B23
		Humanistic character	B3	Master watch	B31
				humanism	B32
				Humanistic education	B33
Scientific literacy	C	Scientific love	C1	Scientific consciousness	C11
				Scientific attitude	C12
				Scientific values	C13
		Scientific cognition	C2	Scientific knowledge	C21
				Scientific thinking	C22
				Scientific skill	C23

3.1.5 First round of indicator screening

After the first round of expert questionnaires was collected, Excel and SPSS.23.0 were used to organize and calculate the relevant data. The specific results are as follows:

1) Screening of first-level indicators

The first round of expert questionnaire-level indicator-related data statistics is shown in Table 9. According to the basis of indicator screening in this paper, the importance of the indicator judging criteria, that is, the average value of each indicator is greater than 3.5, the coefficient of variation is less than 0.25, the indicator is retained, and vice versa, the indicator is considered to be removed. The average value of all the first-level indicators is greater than 3.5. The scalar coefficients are less than 0.25, which meets the requirements for the retention of

the indicator, so it is determined that the first-level indicators of literacy in college teachers are professional literacy, humanistic literacy, and Scientific literacy.

Table 9. The first round of expert questionnaire level indicators related data statistics

Primary index	Symbol	Mean Value	Standard deviation	Variation coefficient
Professional literacy	A	4.77	0.43	0.090
Humanistic literacy	B	4.49	0.46	0.102
Scientific literacy	C	4.45	0.47	0.106

2) Screening of secondary indicators

The statistical table of data related to the secondary indicators of the first round of the expert questionnaire is shown in Table 10. Through the data in Table 10, it can be seen that the mean value and coefficient of variation of the secondary indicators satisfy the standard requirements, and all the secondary indicators are retained without generating indicators to be eliminated.

Table 10. The first round of experts questionnaire secondary index data

Secondary index	Symbol	Mean Value	Standard deviation	Variation coefficient
Education concept	A1	4.27	0.59	0.138
Professional knowledge	A2	3.65	0.53	0.145
Professional ability	A3	3.87	0.33	0.085
Occupational ethics	A4	3.65	0.47	0.129
Humanistic knowledge	B1	3.61	0.52	0.144
Humanistic feelings	B2	3.79	0.35	0.092
Humanistic character	B3	3.98	0.58	0.146
Scientific love	C1	3.93	0.44	0.112
Scientific cognition	C2	3.95	0.58	0.147

3) Screening of tertiary indicators

Table 11 demonstrates the screening of tertiary indicators in the first round of the expert questionnaire. The data show that the concept of practice (A13: 4.15, 1.36, 0.328), knowledge of practice (A23: 4.25, 1.45, 0.341), ability to teach and research (A33: 3.99, 1.34, 0.336), excellent quality (A43: 4.06, 1.53, 0.377), and knowledge of history (B13: 3.98, 1.31, and 0.329) satisfied the arithmetic mean requirement but not the coefficient of variation requirement. Therefore, these five secondary levels were eliminated, while all the remaining secondary indicators were retained. Further screening is needed to ensure that the evaluation indicators are more rational.

Table 11. The first round of expert questionnaire level three index screening

Tertiary index	Symbol	Mean Value	Standard deviation	Variation coefficient
Education thought	A11	4.16	0.47	0.113
Educational outlook	A12	3.81	0.51	0.134
Practical view	A13	4.15	1.36	0.328
Subject knowledge	A21	4.25	0.53	0.125
Education knowledge	A22	4.26	0.57	0.134
Practical knowledge	A23	4.25	1.45	0.341
Teaching and training ability	A31	3.88	0.45	0.116
Curriculum performance	A32	3.76	0.59	0.157
Teaching ability	A33	3.99	1.34	0.336
Love your career	A41	4.28	0.39	0.091
Love students	A42	3.74	0.46	0.123
Excellent quality	A43	4.06	1.53	0.377
Literary knowledge	B11	3.98	0.42	0.106
Philosophical knowledge	B12	4.23	0.31	0.073
Historical knowledge	B13	3.98	1.31	0.329
Education respect	B21	4.13	0.31	0.075
Education interest	B22	4.26	0.51	0.12
Education temperament	B23	4.14	0.34	0.082
Master watch	B31	3.87	0.47	0.121
Humanism	B32	4.27	0.52	0.122
Humanistic education	B33	3.85	0.42	0.109
Scientific consciousness	C11	3.91	0.52	0.133
Scientific attitude	C12	4.22	0.34	0.081
Scientific values	C13	3.78	0.48	0.127
Scientific knowledge	C21	4.27	0.48	0.112
Scientific thinking	C22	4.26	0.53	0.124
Scientific skill	C23	3.66	0.39	0.107

3.1.6 Second round of indicator screening

1) Screening of first-level indicators

According to the mean, standard deviation, and standard deviation calculation formula, the first-level indicators were screened in the second round. Table 12 shows the results of the second round of screening of first-level indicators. Table 12 shows that professional literacy (A: 4.29, 0.45, 0.105), humanistic literacy (B: 3.88, 0.59, 0.152), scientific literacy (C: 3.65, 0.44, 0.121) meet the requirements for indicator retention, and all the first-level evaluation indicators are retained.

Table 12. The second round of index screening results

Primary index	Symbol	Mean Value	Standard deviation	Variation coefficient
Professional literacy	A	4.29	0.45	0.105
Humanistic literacy	B	3.88	0.59	0.152
Scientific literacy	C	3.65	0.44	0.121

2) Screening of secondary indicators

Using data analysis software, the secondary index screening data in the expert questionnaire was counted, and Table 13 presents the status of the secondary index screening. It can be seen that the mean value of educational philosophy (A1), professional knowledge (A2), professional competence (A3), professional ethics (A4), humanistic knowledge (B1), humanistic sentiment (B2), humanistic character (B3), scientific sentiment (C1), and scientific cognition (C2) is greater than 3.5, and at the same time the coefficient of variation is lower than 0.25, so there is no need to exclude them.

Table 13. Secondary index screening data

Secondary index	Symbol	Mean Value	Standard deviation	Variation coefficient
Education concept	A1	4.52	0.59	0.131
Professional knowledge	A2	4.24	0.43	0.101
Professional ability	A3	4.14	0.55	0.133
Occupational ethics	A4	3.69	0.52	0.141
Humanistic knowledge	B1	4.04	0.58	0.144
Humanistic feelings	B2	3.78	0.46	0.122
Humanistic character	B3	4.01	0.51	0.127
Scientific love	C1	3.84	0.38	0.099
Scientific cognition	C2	4.21	0.51	0.121

3) Screening of third-level indicators

Based on formulas (6), (7), and (8), the results of the screening of tertiary indicators in the expert consultation questionnaire were obtained, and the values of the screening of tertiary indicators are shown in Table 14. Since the four tertiary indicators of educational temperament (B23: 3.89, 1.53, 0.393), humanistic education (B33: 4.28, 1.37, 0.32), scientific values (C13: 4.21, 1.32, 0.314), and scientific skills (C23: 4.24, 1.14, 0.269) did not satisfy the conditions for indicator retention. They were excluded. Finalize the evaluation index system for college teachers' literacy.

Table 14. The number of indexes screened by the tertiary index

Tertiary index	Symbol	Mean Value	Standard deviation	Variation coefficient
Education thought	A11	4.09	0.33	0.081
Educational outlook	A12	3.76	0.39	0.104
Subject knowledge	A21	3.69	0.45	0.122
Education knowledge	A22	3.77	0.44	0.117
Teaching and training ability	A31	3.91	0.51	0.13
Curriculum performance	A32	3.81	0.3	0.079
Love your career	A41	4.29	0.35	0.082
Love students	A42	3.82	0.43	0.113
Literary knowledge	B11	3.83	0.35	0.091
Philosophical knowledge	B12	4.03	0.53	0.132
Education respect	B21	3.76	0.57	0.152
Education interest	B22	4.03	0.38	0.094
Education temperament	B23	3.89	1.53	0.393
Master watch	B31	4.15	0.49	0.118
humanism	B32	4.08	0.35	0.086
Humanistic education	B33	4.28	1.37	0.32
Scientific consciousness	C11	4.11	0.35	0.085
Scientific attitude	C12	4.22	0.46	0.109
Scientific values	C13	4.21	1.32	0.314
Scientific knowledge	C21	4.24	0.52	0.123
Scientific thinking	C22	3.68	0.33	0.09
Scientific skill	C23	4.24	1.14	0.269

3.1.7 Final evaluation indicator system

After two rounds of index screening, the preliminary evaluation indexes finally get the evaluation index system of college teachers' literacy, and the evaluation index system of college teachers' literacy is shown in Table 15. The evaluation index system consists of 3 first-level indicators, 9 second-level indicators and 18 third-level indicators, which provides theoretical support for the following analysis.

Table 15. The evaluation index system of teachers' literacy in colleges and universities

Primary index	Symbol	Secondary index	Symbol	Tertiary index	Symbol
Professional literacy	A	Education concept	A1	Education thought	A11
				Educational outlook	A12
		Professional knowledge	A2	Subject knowledge	A21
				Education knowledge	A22
		Professional ability	A3	Teaching and training ability	A31
				Curriculum performance	A32
		Occupational ethics	A4	Love your career	A41
				Love students	A42
Humanistic literacy	B	Humanistic knowledge	B1	Literary knowledge	B11
				Philosophical knowledge	B12
		Humanistic feelings	B2	Education respect	B21
				Education interest	B22
		Humanistic character	B3	Master watch	B31
				humanism	B32
Scientific literacy	C	Scientific love	C1	Scientific consciousness	C11
				Scientific attitude	C12
		Scientific cognition	C2	Scientific knowledge	C21
				Scientific thinking	C22

3.2 Analysis of evaluation indicator weights

3.2.1 Analysis of the weights of the three levels of indicators

Using the hierarchical analysis algorithm, the weights of the three-level indicators in the evaluation index system determined above are calculated, and the results of the weights of the three-level indicators are shown in Table 16. As shown in Table 16, subject knowledge (A21: 0.0934) > educational concepts (A12: 0.0873) > curriculum implementation ability (A32: 0.0829) > educational interest (B22: 0.0768) > scientific thinking (C22: 0.071) > love of profession (A41: 0.0699) > scientific attitude (C12: 0.0699) > love of Students (A42: 0.0666)>Respect for Humanities (B32: 0.0627)>Educational Thinking (A11: 0.0553)>Educational Knowledge (A22: 0.0542)>Educational Respect (B21: 0.0522)>Teaching and Training Ability (A31: 0.0431)>Scientific Knowledge (C21: 0.0348)>Teaching for the Teachers (B31: 0.0323) > Scientific awareness (C11: 0.0238) > Philosophical knowledge (B12: 0.0155) > Literary knowledge (B11: 0.0143), which fully explains the degree of influence of the three-level indicators on the literacy of college teachers.

Table 16. Three level index weight results

Tertiary index	Symbol	Weighting	Rank
Education thought	A11	0.0553	10
Educational outlook	A12	0.0873	2
Subject knowledge	A21	0.0934	1
Education knowledge	A22	0.0542	11
Teaching and training ability	A31	0.0431	13
Curriculum performance	A32	0.0829	3
Love your career	A41	0.0669	7
Love students	A42	0.0666	8
Literary knowledge	B11	0.0143	18
Philosophical knowledge	B12	0.0155	17
Education respect	B21	0.0522	12
Education interest	B22	0.0768	4
Master watch	B31	0.0323	15
humanism	B32	0.0627	9
Scientific consciousness	C11	0.0238	16
Scientific attitude	C12	0.0669	6
Scientific knowledge	C21	0.0348	14
Scientific thinking	C22	0.0710	5

3.2.2 Weighting analysis of secondary indicators

Like subsection 3.2.1, Table 17 shows the results of the secondary indicator weights. The data show that professional knowledge (A2: 0.1476) > educational philosophy (A1: 0.1426) > professional ethics (A4: 0.1335) > humanistic sentiment (B2: 0.129) > professional competence (A3: 0.126) > scientific knowledge (C2: 0.1058) > humanistic character (B3: 0.095) > scientific sentiment (C1: 0.0907) > Humanistic knowledge (B1: 0.0298), and it can also be seen that specialized knowledge has the greatest influence on the literacy of college teachers.

Table 17. Secondary index weight results

Secondary index	Symbol	Weighting	Rank
Education concept	A1	0.1426	2
Professional knowledge	A2	0.1476	1
Professional ability	A3	0.126	5
Occupational ethics	A4	0.1335	3
Humanistic knowledge	B1	0.0298	9
Humanistic feelings	B2	0.129	4
Humanistic character	B3	0.095	7
Scientific love	C1	0.0907	8
Scientific cognition	C2	0.1058	6

3.2.3 Weighting analysis of tier-1 indicators

Using the same method, the weights of the first-level evaluation indicators are calculated, and the results of the weights of the first-level evaluation indicators are shown in Table 17. The data show that professional literacy (A: 0.5497) > humanistic literacy (B: 0.2538) > scientific literacy (C: 1965), which perfectly explains the mechanism of the role of the first-level indicators in influencing the literacy of college teachers.

Table 18. The results of the first level evaluation index

Primary index	Symbol	Weighting	Rank
Professional literacy	A	0.5497	1
Humanistic literacy	B	0.2538	2
Scientific literacy	C	0.1965	3

3.3 Fuzzy Evaluation Analysis of Teacher Quality in Colleges and Universities

3.3.1 Development of a rubric

Table 19 shows the evaluation frequency table of college teachers' literacy, dividing the literacy of teachers in a college into five grades, respectively excellent, good, average, poor, and poor, that is, to establish the set of rubrics $V=\{v_1,v_2v_3,v_4,v_5\}$. The five rubrics are assigned the value of 5, 4, 3, 2, 1. In order to validate the validity of the model constructed above, the teachers of a college are selected as the object of the study, and the 20 education experts evaluate the teachers to be evaluated grade by grade and then aggregated, and finally calculated the fuzzy evaluation results of college teachers' literacy according to the comprehensive evaluation formula and the principle of maximum affiliation degree.

Table 19. The frequency of evaluation of teachers' literacy in colleges and universities

Tertiary index	Symbol	Excellence (5)	Good (4)	General (3)	Passing (2)	Difference (1)
Education thought	A11	4	4	8	2	2
Educational outlook	A12	4	6	2	4	4
Subject knowledge	A21	6	6	2	2	4
Education knowledge	A22	4	6	2	6	2
Teaching and training ability	A31	4	4	4	6	2
Curriculum performance	A32	2	10	2	2	4
Love your career	A41	4	6	4	2	4
Love students	A42	2	6	4	6	2
Literary knowledge	B11	6	6	2	4	2
Philosophical knowledge	B12	6	6	2	4	2
Education respect	B21	2	8	4	4	2
Education interest	B22	4	6	4	4	2
Master watch	B31	6	4	4	2	4
humanism	B32	4	8	2	2	4
Scientific consciousness	C11	6	6	2	4	2
Scientific attitude	C12	2	8	4	2	4
Scientific knowledge	C21	2	6	4	4	4
Scientific thinking	C22	4	4	4	4	4

3.3.2 Comprehensive evaluation results

According to formula (25), the fuzzy evaluation results of teacher literacy in colleges and universities are calculated, and the comprehensive evaluation results of three-level indicators are shown in Table 20. Through the data in Table 19, the comprehensive evaluation results of the three-level indicators are:

$$\begin{aligned} M &= \left(M_1, M_2, \cdots, M_n\right)\left(w_1, w_2, \cdots, w_n\right)^T \\ &= \left[3.7519, 6.2918, 3.353, 3.407, 3.1964\right] \end{aligned}$$

Finally, based on the principle of maximum affiliation, the evaluation results of college teacher quality are good, and its data reflect 6.2918. Although college teacher quality can be the current educational need, in order to further improve college teacher quality, the following will be based on the results of the analysis and put forward the corresponding optimization strategy of college teacher quality.

Table 20. Three level indexes comprehensive evaluation results

Tertiary index	Symbol	Excellence	Good	General	Passing	Difference
Education thought	A11	0.2212	0.2212	0.4424	0.1106	0.1106
Educational outlook	A12	0.3492	0.5238	0.1746	0.3492	0.3492
Subject knowledge	A21	0.5604	0.5604	0.1868	0.1868	0.3736
Education knowledge	A22	0.2168	0.3252	0.1084	0.3252	0.1084
Teaching and training ability	A31	0.1724	0.1724	0.1724	0.2586	0.0862
Curriculum performance	A32	0.1658	0.829	0.1658	0.1658	0.3316
Love your career	A41	0.2676	0.4014	0.2676	0.1338	0.2676
Love students	A42	0.1332	0.3996	0.2664	0.3996	0.1332
Literary knowledge	B11	0.0858	0.0858	0.0286	0.0572	0.0286
Philosophical knowledge	B12	0.093	0.093	0.031	0.062	0.031
Education respect	B21	0.1044	0.4176	0.2088	0.2088	0.1044
Education interest	B22	0.3072	0.4608	0.3072	0.3072	0.1536
Master watch	B31	0.1938	0.1292	0.1292	0.0646	0.1292
humanism	B32	0.2508	0.5016	0.1254	0.1254	0.2508
Scientific consciousness	C11	0.1428	0.1428	0.0476	0.0952	0.0476
Scientific attitude	C12	0.1338	0.5352	0.2676	0.1338	0.2676
Scientific knowledge	C21	0.0696	0.2088	0.1392	0.1392	0.1392
Scientific thinking	C22	0.284	0.284	0.284	0.284	0.284
Comprehensive evaluation results		3.7519	6.2918	3.353	3.407	3.1964

3.4 Strategies for optimizing teacher literacy

3.4.1 Teacher training

Short-term face-to-face and distance network training can be used to conduct teacher literacy training in colleges and universities. Short-term training formats include regular training, on-the-job training, and thematic lectures. Educational technology training centers can organize relevant physical

education subject experts and computer software experts to jointly develop network courses and actively develop excellent teaching application software according to the teaching practice in colleges and universities. Distance network teaching includes various forms, such as campus network teaching and inter-campus network teaching, etc. Distance network teaching helps teachers receive online training by means of a virtual classroom environment, and the learning time is more flexible, which is in line with the actual needs of college teachers and promotes the enhancement of college teachers' quality.

3.4.2 Sound assessment mechanisms

Professional literacy, humanistic literacy, and scientific literacy skills are the necessary qualities of future teachers, as teachers in colleges and universities should have a sense of urgency and professionalism in order to better assess and evaluate the information literacy skills of teachers. Then, first of all, we must establish and improve the assessment mechanism, only constant and rigorous assessment and evaluation to avoid the assessment of the formalities to achieve the purpose of improving the literacy of physical education teachers. Colleges and universities must create two mechanisms: the incentive mechanism's results and the assessment and evaluation mechanism. For teachers who can apply information technology to physical education teaching through training and learning and who have achieved teaching results, certain material incentives should be given so as to make the mechanism incentive-oriented and form a virtuous circle.

4 Conclusion

This paper synthesizes the Delfel method, hierarchical analysis algorithm, and fuzzy evaluation model to explore the current situation of teacher literacy development in colleges and universities. Using the Delfel method to complete the construction of the evaluation model of college teacher literacy, based on the hierarchical analysis method to derive the weights of the evaluation indexes, followed by the construction of the fuzzy evaluation model. The fuzzy evaluation model serves to assess and analyze the current state of teacher literacy development in colleges and universities. The comprehensive evaluation of three-level indicators of teacher literacy in colleges and universities (3.7518, 6.2918, 3.353, 3.407, and 3.1964), based on the principle of maximum affiliation, indicates that the evaluation results of teacher literacy in a university are good. However, it also highlights some current problems and shortcomings in teacher literacy in these institutions. In order to improve the development of teacher literacy in colleges and universities, the optimization strategy of teacher literacy in colleges and universities is proposed from the two perspectives of teacher training and sound assessment mechanism, so as to achieve the purpose of improving teacher literacy in colleges and universities and the quality of teaching and learning in colleges and universities.

References

[1] Özdemir, T. Y., Demirkol, M., & Polat, H. (2019). Teaching as a professionalism through teachers' perspective. Turkish Online Journal of Qualitative Inquiry, 10(3), 296-320.

[2] Tatto, M. T. (2021). Professionalism in teaching and the role of teacher education. European Journal of Teacher Education, 44(1), 20-44.

[3] Menter, I., & Flores, M. A. (2021). Connecting research and professionalism in teacher education. European Journal of Teacher Education, 44(1), 115-127.

[4] Saraya, A., Mardhatillah, A., & Fitriani, E. N. (2023). Educational Supervision of The Efforts Made Madrasah Family in Mts Al-Ihsan in Increasing The Professionalism of Teachers Teacher Professionalism. Cendekia: Jurnal Pendidikan dan Pembelajaran, 17(1), 16-29.

[5] Mayer, D., & Mills, M. (2021). Professionalism and teacher education in Australia and England. European Journal of Teacher Education, 44(1), 45-61.

[6] Dodillet, S., Lundin, S., & Krüger, J. O. (2019). Constructing professionalism in teacher education. Analytical tools from a comparative study. Education Inquiry, 10(3), 208-225.

[7] Feng, L., & Sass, T. R. (2017). Teacher quality and teacher mobility. Education Finance and Policy, 12(3), 396-418.

[8] Nikou, S., & Aavakare, M. (2021). An assessment of the interplay between literacy and digital Technology in Higher Education. Education and Information Technologies, 26(4), 3893-3915.

[9] Pinto, M., & Leite, C. (2020). Digital technologies in support of students learning in Higher Education: literature review. Digital education review, (37), 343-360.

[10] Deneen, C. C., & Hoo, H. T. (2023). Connecting teacher and student assessment literacy with self-evaluation and peer feedback. Assessment & Evaluation in Higher Education, 48(2), 214-226.

[11] Alenezi, M., Wardat, S., & Akour, M. (2023). The need of integrating digital education in higher education: Challenges and opportunities. Sustainability, 15(6), 4782.

[12] Ingersoll, R. M. (2020). Misdiagnosing the teacher quality problem. In The state of education policy research (pp. 291-306). Routledge.

[13] Gotch, C. M., & McLean, C. (2019). Teacher outcomes from a statewide initiative to build assessment literacy. Studies in Educational Evaluation, 62, 30-36.

[14] Pharis, T. J., Wu, E., Sullivan, S., & Moore, L. (2019). Improving Teacher Quality: Professional development implications from teacher professional growth and effectiveness system implementation in Rural Kentucky High Schools. Educational research quarterly, 42(3), 29-48.

[15] Tamsah, H., Ilyas, J. B., & Yusriadi, Y. (2021). Create teaching creativity through training management, effectiveness training, and teacher quality in the covid-19 pandemic. Journal of Ethnic and Cultural Studies, 8(4), 18-35.

[16] Mellati, M., & Khademi, M. (2018). Exploring teachers' assessment literacy: Impact on learners' writing achievements and implications for teacher development. Australian Journal of Teacher Education (Online), 43(6), 1-18.

[17] la Velle, L., & Reynolds, K. (2020). Reframing the professionalism of teachers. In Education system design (pp. 213-223). Routledge.

[18] Gaikwad, S., Wadegaonkar, A., Mitra, G., & Chakravarty, D. (2023). Assessment literacy, current assessment practices and future training: Reflections of teachers in Higher Education. International Journal of Learning, Teaching and Educational Research, 22(7).

[19] Xu, Y., & Brown, G. T. (2017). University English teacher assessment literacy: A survey-test report from China. Papers in Language Testing and Assessment, 6(1), 133-158.

[20] Rogers, A. P., Reagan, E. M., & Ward, C. (2022). Preservice teacher performance assessment and novice teacher assessment literacy. Teaching Education, 33(2), 175-193.

[21] Chunzhong Li,Wenliang Ju & Shiwei Chu. (2024). Design and application of a quality evaluation index system for sustainable cultivation of big data professionals in universities based on Bloom cognitive domain classification method. Discover Sustainability(1),175-175.

[22] Nabi Moradpour,Ahmad Pourahmad,Keramatollah Ziari,Hossein Hataminejad & Ayyoob Sharifi. (2024). Downscaling urban resilience assessment: A spatiotemporal analysis of urban blocks using the fuzzy Delphi method and K-means clustering. Building and Environment111898-111898.

[23] Mariadoss Stephen & Augustin Felix. (2023). Enhanced sugeno fuzzy inference system with fuzzy AHP and coefficient of variation to diagnose cardiovascular disease during pregnancy. Journal of King Saud University - Computer and Information Sciences(8),

[24] C.Y. Lam & A.M. Cruz. (2024). Topological network and fuzzy AHP modeling framework for the suitability analysis of evacuation shelters: A case study in Japan. International Journal of Disaster Risk Reduction104696-104696.

[25] Shayea Ghadeer Ghazi,Zabil Mohd Hazli Mohammed,Albahri A. S.,Joudar Shahad Sabbar,Hamid Rula A.,Albahri O. S.... & Sharaf Iman Mohamad. (2024). Fuzzy Evaluation and Benchmarking Framework for Robust Machine Learning Model in Real-Time Autism Triage Applications. International Journal of Computational Intelligence Systems(1).