Remittances Review
May, 2023
Volume: 8, No: 2, pp. 587-602
ISSN: 2059-6588 (Print) | ISSN 2059-6596 (Online)
remittancesreview.com

Received: 11 November 2022 Accepted: 15 March, 2023
DOI: https://doi.org/10.33182/rr.v8i2.36

Research on the application of mathematical model for evaluating the quality of physical education in colleges and universities

Chuanzhong Wu[1], Li Xu[2*], Cheng Li[2], Korobeynikava Lesia[2], Jun Tian[2], Yirun Gan[3]

Abstract

To address the question of whether the quality evaluation of physical education teaching in colleges and universities can be analyzed mathematically, this paper proposes an evaluation model of AHP-BPNN based on hierarchical analysis and BP neural network technology. Among them, hierarchical analysis is used to solve the problem of determining evaluation factors, selecting the evaluation factors contained in the index system, preserving those factors that are more important for the teacher evaluation model and removing those that have less influence on the evaluation results. Finally, the BP neural network algorithm is used to establish the teaching evaluation model to solve the problem of artificially assigned index weights, and also to solve the model problem of non-linear relationship between each evaluation index and teaching effect. The accuracy analysis of the model obtained that the average accuracy of the model of this paper on the evaluation factors of physical education teaching quality is 88.83%, and the accuracy of POE evaluation method, fuzzy evaluation method and gray correlation analysis method are 74.33%, 88.83% and 82.83% respectively. In the weight calculation and consistency test of the evaluation index system, the highest weight coefficient of teaching ability was 0.3367, the second highest weight coefficient of teaching attitude and the lowest weight coefficient of teaching effect were obtained. Therefore, the accuracy of the model in this paper is good, and the evaluation system established by the model concludes that schools should pay more attention to the teaching ability of teachers.

Keywords: *physical education quality evaluation, hierarchical analysis method, BP neural network, evaluation index, AHP-BPNN model*

Introduction

An important guarantee for cultivating socialist modern talents in the new era is the evaluation of teaching quality (Feng, 2021) (L. Zhang & Zhang, 2018). A scientific and objective teaching quality evaluation system is essential to improve the quality of classroom teaching and strengthen the institutionalized management of schools (Zheng & Chen, 2015) (J. Li, 2021). Improving the quality of teaching has become an important issue for every university (Han, 2022) (Liu, 2021). How to evaluate teachers' classroom teaching quality scientifically, objectively, comprehensively and fairly

[1] Xianda College of Economics and Humanities, Shanghai International Studies University, Shanghai, 202162, China
[2] National University of Physical Education and Sports of Ukraine, Kiev, 02000, Ukraine
[3] Department of Innovation and Entrepreneurship, Jiangsu Ocean University, Lianyungang, Jiangsu, 222000, China
Corresponding author: Li Xu (2211012@xdsisu.edu.cn)

May, 2023
Volume: 8, No: 2 pp. 587-602
ISSN: 2059-6588 (Print) | ISSN 2059-6596 (Online)

is crucial to grasp the status of teachers' performance of their duties, distinguish the different qualities and teaching levels of teachers, motivate teachers' teaching enthusiasm, promote teachers' continuous improvement of teaching methods, improve teaching quality and ensure the overall development of talent cultivation goals (Fan, 2020) (X. Zhang, Wei, & Han, 2021).

In the literature (Lei H 2014), American universities consider the differences between different courses when setting indicators, and make sure that the evaluation indicators can fit the corresponding courses as much as possible, and also consider the diversity of evaluation contents and subjects. The language of teaching quality evaluation indexes is easy to understand and close to students' reality, which truly reflects the concept of "student-oriented" education. The teaching quality evaluation indexes are systematic and comprehensive, and can evaluate all aspects of the teaching process.

In the literature (Jina L U 2010), the German approach to physical education emphasizes that assessment is closely related to the creation of a learning atmosphere, and that it must have a positive effect on the creation of a learning atmosphere and build students' confidence in learning physical education. Assessment should take into account not only the school but also the student's self-perception, the learning process is the focus of assessment, regular grades and performance should be measured together with final grades, etc.

In the literature (Fiselier & Longhurst, 2018), the UK government has adopted a series of methods and measures to ensure the quality of higher education, among which the establishment of the Quality Assurance Agency QAA is the most crucial, which includes two aspects of school quality and subject-specific quality assessment, and these two aspects include six specific assessment indicators, namely: teaching design, content and organization, teaching and learning Quality, Student Progress and Achievement, Student Counseling, Resource Utilization, and Quality Control and Enhancement.

The literature (T, 2010) New Zealand Curriculum Standards states that "currently observable values are not the only starting point for assessing students; more informative is the change in students' perspectives on 'additions and subtractions from health', especially in the assessment of curriculum programmes, where changes in students' perspectives on their ideas are a major criterion for assessment. " The curriculum standards also state that "assessment programs require teachers at the outset of their creation to ensure that the learning techniques and approaches they use have a positive impact on students and help them develop their individual strengths and effectiveness.

Teaching evaluation is an important element of assessment and literature (Safrankova & Sikyr, 2021) teachers select, organize and interpret the information data obtained to help the process of making decisions or value judgments about students, information that is a variety of quantitative or qualitative materials collected by teachers in the classroom. The literature (Gaertner, 2014) argues that the content of modern physical education assessment should be divided into several different aspects, such as students' physical form, students' bodily functions, students' own physical

Volume: 8, No: 2, pp. 587-602
ISSN: 2059-6588 (Print) | ISSN 2059-6596 (Online)

fitness, knowledge and skills, students' attitudes toward learning physical education, etc., through which the degree to which students can achieve their learning goals and the basic state of physical fitness they possess after physical education is evaluated.

The literature (Q. Li, 2013) strengthens the training of young teachers, firstly, it should pay attention to pre-service training and strengthen basic competency development and teacher ethics education. Secondly, we should actively create conditions to ensure investment and improve research ability. The last is to establish a sound incentive mechanism, improve material treatment and rewards, and fully motivate young teachers.

The literature (Zhao, 2017) shows that strengthening assessment is one of the ways to improve the quality of physical education in universities. The literature (Chen & Huang, 2018) proposed countermeasures to ensure teaching quality in six aspects, including conducting publicity and training, improving organization, creating a chain of objectives and standards, and creating an information platform.

This paper uses hierarchical analysis to pre-process the evaluation factors of teaching quality evaluation and simplifies the BP neural network structure. Then the AHP-BPNN comprehensive evaluation model is proposed to find the problems in teaching and students' learning needs, and then the direction of physical education teaching reform. Finally, in order to verify the practicality of the model and evaluation indexes in this paper, model accuracy analysis, weight calculation and consistency test of the evaluation index system, and empirical analysis were conducted.

Teaching evaluation model based on hierarchical analysis

Research on the application of hierarchical analysis in the screening of teaching evaluation indexes

The use of AHP to solve complex problems is well suited for dealing with such a complex problem as instructional evaluation.

Determination of the scale of proportionality

In AHP, when the hierarchical structure is established through the first step, the next step is to judge the relative importance of elements belonging to the same group two by two, layer by layer. If the i th element has the same importance as the j nd one relative to the upper-level factors, the scale of the i rows and j columns of the matrix is 1 when the judgment matrix is constructed later, if the i th element has a slightly stronger influence than the j th one relative to the upper-level factors, the scale of the i rows and j columns of the matrix is 3, and if the i th element has a slightly stronger influence than the j th one relative to the upper-level factors between the same and the i th element If the 9th element is slightly stronger than the j th element, the scale of the

i th row and j columns of the matrix is 2, and so on.

Hierarchy diagram

The first task of hierarchical analysis when dealing with a problem is the hierarchical decomposition of the target problem and then using the decomposed elements to build a model structure similar to a tree. The tree structure usually constructed is shown in Figure 1.

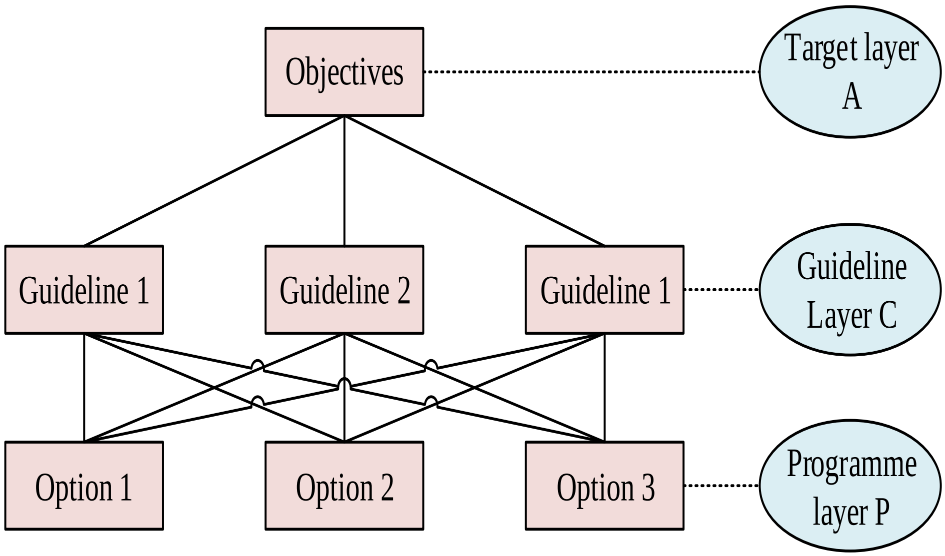

Figure 1: Hierarchical structure diagram

Target layer (O): There is only one target element.

Guideline Level (C): Intermediate steps broken down to reach the goal, carrying on from the top to the bottom, for the goal level as measures and for the measure level as targets.

Measure Layer (P): Various specific measures to achieve the goal, which is also a specific extension of the guideline layer.

The elements included in each layer and group are also not specified and can be the same or different. It mainly depends on the decomposition of the target problem. Establishing the teaching evaluation index system as shown in Table 1 from the literature and research, it is easy to find that the teaching evaluation index system consists of exactly 3 layers, taking the teaching evaluation index as the target layer, the teaching evaluation level 1 index as the guideline layer, and the teaching evaluation level 2 index as the program layer.

The judgment matrix is shown in Table 2, so that the decision variables are quantified.

Remittances Review
May, 2023
Volume: 8, No: 2, pp. 587-602
ISSN: 2059-6588 (Print) | ISSN 2059-6596 (Online)

Table 1: Teaching evaluation index system

Target layer	Criteria layer	Measure Layer
Teaching evaluation indicators (A)	Teaching attitude (C_1)	P_1 Actively respond to student learning needs
		P_2 Well-prepared, conscientious and committed to teaching
		P_3 Teaching and educating people, focusing on the overall development of students
	Teaching Level (C_2)	P_4 Familiar with the material, clear explanation and clear thinking
		P_5 Proficiency in the application of modern teaching methods
		P_6 Explain theoretical issues with practice, not boring
		P_7 Flexible and varied teaching methods to suit the characteristics of the class
		P_8 Effective use examples explained
		P_9 Good at managing classroom atmosphere and pacing
		P_{10} The contents of the lectures are linked to the frontiers and directions of the discipline
	Teaching Effect (C_3)	P_{11} Students grasp firmly and learn something
		P_{12} The content presented stimulated the students' thinking

Table 2: The table of judgment matrix

Target layer(A)	Guideline layer C_1	Guideline layer C_2	Guideline layer C_3
Guideline layer C_1	a_{11}	a_{12}	a_{13}
Guideline layer C_2	a_{21}	a_{22}	a_{23}
Guideline layer C_3	a_{22}	a_{32}	a_{33}

Volume: 8, No: 2 pp. 587-602
ISSN: 2059-6588 (Print) | ISSN 2059-6596 (Online)

One of the sum method, root method, and power method is usually used to determine the weights. The calculation process is as follows.

(1) Calculate the n th root of the multiplier of the elements of each row of the judgment matrix table W_i':

$$W_i' = \sqrt[n]{\prod_{j=1}^{n} a_{ij}} \tag{1}$$

(2) Normalize the square root vector using the formula to obtain an approximation of the eigenvector:

$$W_i = \frac{w_i'}{\sum_{i=1}^{n} w_i'} \tag{2}$$

As obtained from Table 2 and Equation 1:

$$W_1' = \sqrt[3]{\prod_{j=1}^{3} a_{1j}} = \sqrt[3]{a_{11} g a_{12} g a_{13}}$$
$$W_2' = \sqrt[3]{\prod_{j=1}^{3} a_{2j}} = \sqrt[3]{a_{21} g a_{22} g a_{23}}$$
$$W_3' = \sqrt[3]{\prod_{j=1}^{3} a_{3j}} = \sqrt[3]{a_{31} g a_{32} g a_{33}} \tag{3}$$

Then, according to the normalization process of Equation 2, the relative weights of each indicator can be obtained.

The relative weight of the criterion layer C_1 with respect to the target layer A is:

$$W_1 = \frac{\sqrt[3]{a_{11} \bullet a_{12} \bullet a_{13}}}{\sqrt[3]{a_{11} \bullet a_{12} \bullet a_{13}} + \sqrt[3]{a_{21} \bullet a_{22} \bullet a_{23}} + \sqrt[3]{a_{31} \bullet a_{32} \bullet a_{33}}} \tag{4}$$

The relative weight of the criterion layer C_2 with respect to the target layer A is:

$$W_2 = \frac{\sqrt[3]{a_{21} \bullet a_{22} \bullet a_{23}}}{\sqrt[3]{a_{11} \bullet a_{12} \bullet a_{13}} + \sqrt[3]{a_{21} \bullet a_{22} \bullet a_{23}} + \sqrt[3]{a_{31} \bullet a_{32} \bullet a_{33}}} \tag{5}$$

The relative weight of the criterion layer C_3 with respect to the target layer A is:

$$W_3 = \frac{\sqrt[3]{a_{31} \bullet a_{32} \bullet a_{33}}}{\sqrt[3]{a_{11} \bullet a_{12} \bullet a_{13}} + \sqrt[3]{a_{21} \bullet a_{22} \bullet a_{23}} + \sqrt[3]{a_{31} \bullet a_{32} \bullet a_{33}}} \tag{6}$$

The above method of calculating the evaluation weights for each level of the criterion layer is then

Volume: 8, No: 2, pp. 587-602
ISSN: 2059-6588 (Print) | ISSN 2059-6596 (Online)

repeated to calculate the relative weights of each evaluation indicator for each criterion layer and the measure layer attached to each criterion layer. As shown in Equation (7), that is, to determine whether the three elements related to the position among all elements in the matrix meet the following conditions:

$$a_{ij} = \frac{a_{ik}}{a_{jk}} (i, j = 1, 2, \ldots, n) \quad (7)$$

Where k takes any value within $1, 2, \ldots, n$. However, since Equation 7 is annoying to calculate, in practical applications, Equation (8) is generally used for the judgment of consistency of decision makers' thinking:

$$CI = \frac{\lambda_{\max} - n}{n - 1} \quad (8)$$

$\lambda_{\max}$ is the maximum feature root corresponding to feature vector W, while feature vector W is here the transpose of the row vector consisting of the relative weights of each criterion of criterion layer C with respect to all secondary indicators of target layer A or scheme layer with respect to the primary indicators of the same criterion layer. As here $W = (W_1, W_2, W_3)^T$, $\lambda_{\max}$ is calculated as:

$$\lambda_{\max} = \frac{1}{n} \sum_{i=1}^{n} \frac{(AW)_i}{W_i} \quad (9)$$

Where A is the row vector of all criteria in criterion layer C or the row vector of all secondary indicators in the target layer of the program layer relative to the same level of indicators in the criterion layer.

This paper also necessary to introduce the average random consistency index RI value of the judgment matrix, and the RI values are shown in Table 3.

Table 3: The RI value of mean consistency index

Order	1	2	3	4	5	6	7	8	9
RI	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45

When the order is greater than 2, denoted as CR, when:

$$CR = \frac{CI}{RI} < 0.10 \quad (10)$$

When the judgment matrix is considered to have satisfactory consistency.

Volume: 8, No: 2 pp. 587-602
ISSN: 2059-6588 (Print) | ISSN 2059-6596 (Online)

After the hierarchical single ranking, the weight vector of a set of elements to an element in the upper layer is obtained. Ultimately, the ranking weights of the elements, especially the ranking weights of each program in the bottom layer with respect to the target, in the teacher evaluation model indicator system, i.e., the ranking weights of each indicator of program level P with respect to target level A, are to be obtained. From the above calculation, the relative weights of each first-level indicator of the criterion layer C relative to the target layer A have been obtained. After ensuring that the judgment matrix has satisfactory consistency, it is assumed that the relative weights of all second-level indicators of the target layer relative to the same first-level indicator of the criterion layer in the program layer are: P_1, P_2, P_3 relative to the criterion layer C_1 are W_{11}, W_{12}, W_{13}; P_4—P_{10} relative to the criterion layer The weights of C_2 are W_{21}, W_{22}, W_{23}, W_{24}, W_{25}, W_{26}, W_{27}; P_{11}, P_{12} are W_{31}, W_{32} relative to C_3 the criterion layer. Then the weights of each evaluation index in the program level relative to the target level in the order of $P_1 - P_{12}$ are $W_1 \cdot W_{11}$, $W_1 \cdot W_{12}$, ..., $W_2 \cdot W_{23}$, $W_2 \cdot W_{24}$, ..., $W_3 \cdot W_{31}$, and $W_3 \cdot W_{32}$, respectively.

The combination consistency test can be performed layer by layer. If the consistency index for layer P is $CI_1^{(P)}, \cdots, CI_n^{(P)}$ (n is the number of factors in layer $p-1$) and the random consistency index is $RI_1^{(P)}, \cdots, RI_n^{(P)}$ (n is also the number of factors in layer $p-1$) the combined consistency ratio of layer P to layer 1 is:

$$CR^{(P)} = CR^{(P-1)} + \frac{CI^{(P)}}{RI^{(P)}} \tag{11}$$

where p takes any value within $3, 4, \ldots, n$, where :

$$CI^{(P)} = \left[CI_1^{(P)}, \ldots\ldots, CI_n^{(P)} \right] w^{(P-1)} \tag{12}$$

$$RI^{(P)} = \left[RI_1^{(P)}, \ldots\ldots, R_n^{(P)} \right] w^{(P-1)} \tag{13}$$

When CR is less than 0.1, the combination consistency test is passed. From equations (11), (12), and (13), we get:

$$\frac{CI^{(P)}}{RI^{(P)}} = \frac{\left[Cl_1^{(P)} \cdot \ldots\ldots Cl_n^{(P)} \right] w^{(P-1)}}{\left[Rl_1^{(P)}, \ldots.., Rl_n^{(P)} \right] w^{(P-1)}} = \frac{\left[CI_1^{(3)}, Cl_2^{(3)}, Cl_3^{(3)} \right] w^{(2)}}{\left[RI_1^{(3)}, RI_2^{(3)}, Rl_3^{((3)} \right] w^{(2)}} \tag{14}$$

Volume: 8, No: 2, pp. 587-602
ISSN: 2059-6588 (Print) | ISSN 2059-6596 (Online)

$$CR_{\text{Total}} = CR^{(2)} + \frac{\left[CI_1^{(3)} \cdot CI_2^{(3)} \cdot CI_3^{(3)}\right] w^{(2)}}{\left[RI_1^{(3)} \cdot RI_2^{(3)} \cdot RI_3^{(3)}\right] w^{(2)}} \quad (15)$$

In Equation (15), $CR^{(2)}$ indicates the stochastic consistency ratio of the criterion layer to the target layer, $CI_1^{(3)}$, $CI_2^{(3)}$ and $CI_3^{(3)}$ indicate the degree of deviation from consistency of the judgment matrix formed by the first-level indicators of the criterion layer (first-level indicator layer) and the measure layer (second-level indicator layer); $RI_1^{(3)}$, $RI_2^{(3)}$ and $RI_3^{(3)}$ indicate the average stochastic consistency of the judgment matrix formed by the first-level indicators of the criterion layer (first-level indicator layer) and the measure layer (second-level indicator layer).

Construction of AHP-BPNN model

In this article, BP neural networks are used for the determination of teaching evaluation models. The idea is to use the data collected from previous student-teacher evaluations to train a model for "teacher evaluation" by relying on the nonlinear mapping and memory functions of BP neural networks, and then, after the model is trained, input the pre-processed student-teacher evaluation data to obtain Once the model is trained, the final results of the teacher's evaluation are obtained by inputting the pre-processed student evaluations. Based on this idea, the flow chart of the teacher evaluation model using a combination of hierarchical analysis and BP neural network algorithm is shown in Figure 2.

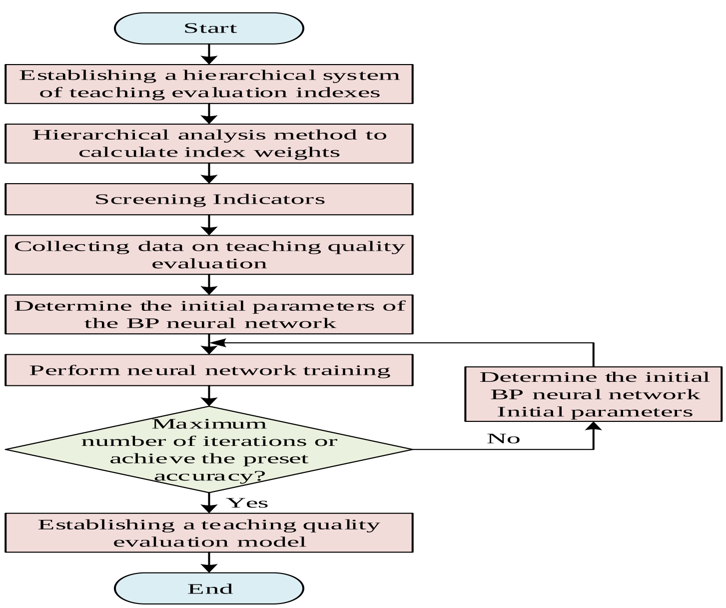

Figure 2: The flow chart of AHP-BPNN teaching evaluation model

Remittances Review
May, 2023
Volume: 8, No: 2 pp. 587-602
ISSN: 2059-6588 (Print) | ISSN 2059-6596 (Online)

Determination of the number of neural network layers and the number of nodes per layer

In this paper, we choose a three-layer BP network structure with only one hidden layer.

Input layer: Depends on the application. It is usually equal to the input data dimension of the training data.

Output layer: The choice of the number of nodes in the output layer is also determined by the application.

Hidden layer: The determination of the number of neurons in the hidden layer is more complicated and does not have clear and uniform guidelines like the input and output layers. The following are three commonly used BP neural network hidden layer neurons h selection formula:

$$h = \sqrt{n+m} + a \tag{16}$$

$$h = \log_2 n \tag{17}$$

$$h = \sqrt{n * m} \tag{18}$$

In the above formula, n and m are the number of neurons in the input and output layers of the BP neural network, respectively, and a is an integer between 1 and 10. For the determination of the number of neurons in the hidden layer, the method used in this paper is to use the first empirical formula and then determine the optimal number of nodes in the hidden layer by comparing the network performance indexes with different numbers of neurons in a certain range.

Common transfer functions of BP networks

Different transfer functions will lead to different BP neural network models, and the performance of different BP neural network models will be high or low. Commonly used transfer functions: log-sigmoid input is arbitrary, output is between zero and one, the function formula and image are shown in Figure 3. tan-sigmod input is arbitrary, output is between negative one and positive one, the function formula and image are shown in Figure 4. purelin input and output are arbitrary, the function formula and image are shown in Figure 5. In this paper, the sigmod transfer function is used for the hidden layer and the linear transfer function is used for the output layer.

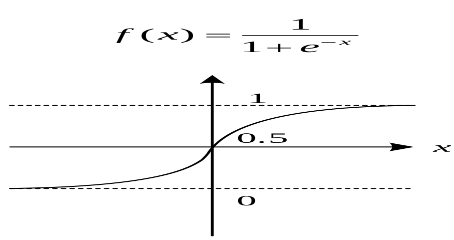

Figure 3: The transfer function of log-sigmoid

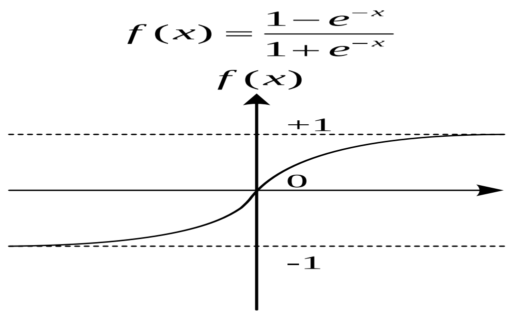

Figure 4: The transfer function of tan-sigmoid

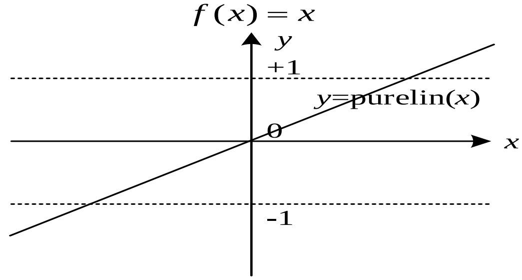

Figure 5: The transfer function of purelin

Results and analysis of the evaluation model of physical education quality in colleges and universities

Evaluation model accuracy analysis

In this paper, we compare and analyze the accuracy of POE evaluation method, fuzzy evaluation method, and gray correlation analysis method to verify the accuracy of the evaluation model, and the accuracy of the teacher's teaching attitude, teaching ability, and teaching effect among the three evaluation factors of physical education teaching quality, and the results are shown in Figure 6. the average accuracy of this paper's model for the evaluation factors of physical education teaching quality is 97.45% as can be seen from the pictures. The average accuracy of the fuzzy evaluation method on the evaluation factors of physical education teaching quality is 88.83%. The average accuracy of the gray-scale correlation evaluation method on the evaluation factors of physical education teaching quality is 82.83%. the average accuracy of the POE evaluation method on the evaluation factors of physical education teaching quality is 74.33%. It can be seen that the accuracy of the model of this paper on the evaluation factors of physical education teaching quality is much higher than that of the POE evaluation method, fuzzy evaluation method and grayscale correlation analysis method, which indicates that the accuracy of the model of this paper on the evaluation of teaching quality is high.

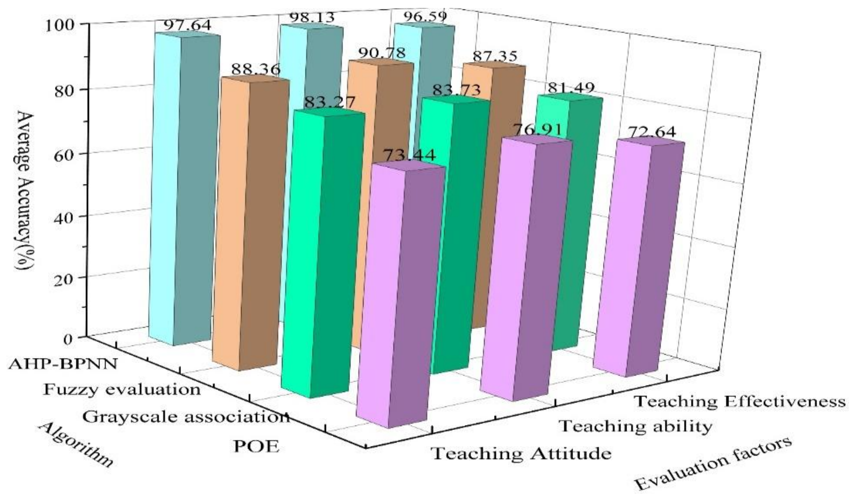

Figure 6: Evaluation method accuracy rate

Weight calculation and consistency test of the evaluation index system

The judgment matrix derived from each expert discussion was statistically analyzed using yaahp software for the judgment matrix of the criterion layer and each indicator layer, and the results of the weight assignment and consistency test for the criterion layer and each indicator layer are shown in Table 4, and the teaching effect module is shown in Table 5.

The evaluation system of teaching quality of college physical education teachers includes three guideline levels, eight primary indicators and 25 secondary indicators, including teaching attitude, teaching ability and teaching effect, among which the highest weight coefficient of teaching ability is 0.3367, the second highest weight coefficient of teaching attitude and the lowest weight coefficient of teaching effect. It indicates that in evaluating the teaching quality of college physical education teachers, the assessment of teaching ability should be more important and should be considered first.

Table 4: Weight assignment and consistency test results of the criterion layer (Consistency ratio: 0.0245)

Teaching Quality	**Teaching attitude**	**Teaching ability**	**Teaching Effectiveness**	W_i
Teaching attitude	1.16464	0.47284	0.36772	0.37106
Teaching ability	2.26527	0.94018	1.1133	0.42286
Teaching Effectiveness	0.52086	0.09953	0.41301	0.45479

Table 5: Weights of each indicator in the overall objective

Target layer	Guideline layer	Weights	Indicator Level	Weights
Quality of physical education in colleges and universities	Teaching attitude	0.3367	Class Preparation	0.1485
			Classroom performance	0.1882
	Teaching ability	0.5083	Professional theory level	0.0617
			Demonstration level	0.1284
			Use of teaching materials	0.2334
			Organizational level of teaching	0.0848
	Teaching Effect	0.1944	Classroom atmosphere	0.0461
			Improvement of students' ability	0.1483

Empirical Analysis

The evaluation of a sports program in a university in Anhui, China was conducted based on the evaluation results of 40 evaluators, and their evaluation scores were counted to obtain a judgment matrix. The AHP-BPNN model was used to calculate the three stages to obtain the evaluation set: $A=\{A_1,A_2,A_3\}=\{87.64,88.64,84.34\}$. Based on the synthesis rules of model theory, the three elements of the evaluation set were first reduced to one percent of the original to obtain:

$$A'=\{A_1',A_2',A_3'\}=\{0.8764,0.8864,0.8434\} \tag{19}$$

Construct the confidence function as follows:

$$m_1'(\alpha)=\begin{cases}0.8764 & t=\{\alpha\}\\ 0.1646 & t\neq\{\alpha\}\end{cases}$$

$$m_2'(\alpha)=\begin{cases}0.8864 & t=\{\alpha\}\\ 0.1075 & t\neq\{\alpha\}\end{cases}$$

$$m_3'(\alpha)=\begin{cases}0.8434 & t=\{\alpha\}\\ 0.1387 & t\neq\{\alpha\}\end{cases} \tag{20}$$

May, 2023
Volume: 8, No: 2 pp. 587-602
ISSN: 2059-6588 (Print) | ISSN 2059-6596 (Online)

According to the rules of evidence theory synthesis, we can obtain: $m(\alpha)=\begin{cases}0.8761 & t=\{\alpha\}\\ 0.1147 & t\neq\{\alpha\}\end{cases}$, the results of evidence synthesis are expanded 100 times to recover, $A=89.47$, and similarly, we can evaluate the teaching quality of sports performance in other institutions. The evaluation scores of 17 institutions are ranked to obtain the evaluation results, as shown in Figure 7. It can be seen that School A has the best teaching quality, and according to the evaluation requirements proposed by Anhui Education Department, three of them have excellent performance, nine have good performance, and five have qualified performance.

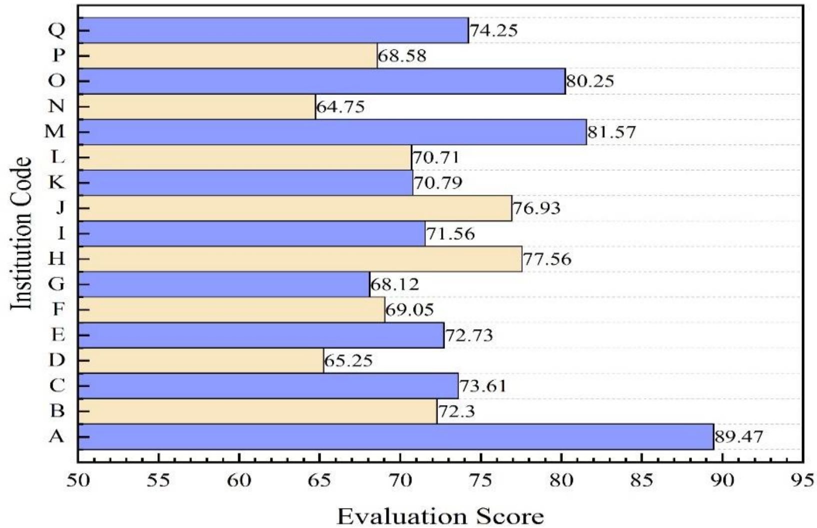

Figure 7: Evaluation of the quality of physical education teaching in 17 institutions

Conclusion

The evaluation model of AHP-BPNN proposed in this paper compares the importance of the relationship between the factors included in the quality of college physical education, and uses yaahp software to analyze the judgment matrix of the criterion layer and each indicator layer, so as to come up with a college physical education teaching evaluation index system that is easy to implement and can ensure scientificity.

To verify the effectiveness of the accuracy rate of this paper's model on the three evaluation factors of physical education teaching quality, namely teacher's teaching attitude, teaching ability and teaching effect, it was compared with POE evaluation method, fuzzy evaluation method and gray correlation analysis method. The average accuracy of this paper's model was obtained as 97.45%, and the accuracy of the other three methods were 74.33%, 88.83%, and 82.83% respectively, which shows that the accuracy of this paper's model on teaching quality evaluation is high.

In the weight calculation and consistency test of the evaluation index system, the highest weight coefficient of teaching ability is 0.3367, the weight coefficient of teaching attitude is 0.3367, and the lowest weight coefficient of teaching effect is 0.1944. It indicates that in the evaluation of the teaching quality of college physical education teachers, the assessment of teaching ability should be more important and should be given primary attention.

Funding

This research is supported by major projects of professional master's degree awarding unit cultivation and construction of Xianda College of Economics and Humanities, Shanghai International Studies University in 2022 (xdzd224246).

References

Chen, J., & Huang, H. (2018). Analytic hierarchy process of the evaluation system of physical education teaching quality in colleges and universities. *Educational Sciences: Theory & Practice, 18*(6).

Fan, P. (2020). RETRACTED: Application of deep learning and cloud data platform in college teaching quality evaluation. *Journal of Intelligent & Fuzzy Systems, 39*(4), 5547-5558.

Feng, B. (2021). Dynamic analysis of college physical education teaching quality evaluation based on network under the big data. *Computational Intelligence and Neuroscience, 2021*.

Fiselier, E. S., & Longhurst, J. W. (2018). A critical evaluation of the representation of the QAA and HEA guidance on ESD in public web environments of UK higher education institutions. *Implementing sustainability in the curriculum of universities: Approaches, methods and projects*, 223-246.

Gaertner, H. (2014). Effects of student feedback as a method of self-evaluating the quality of teaching. *Studies in Educational Evaluation, 42*, 91-99.

Han, Q. (2022). Using neural network for the evaluation of physical education teaching in colleges and universities. *Soft Computing, 26*(20), 10699-10705.

Jina L U , C.-W. L. I. (2010). Enlightenment by contrast between CHE universities ranking in Germany and teaching evaluation index in China. *Journal of Zhejiang University of Science and Technology*.

Lei H , G. X. U. (2014). Comparative study on the evaluation of classroom teaching quality——Based on the United States and South Africa comparative analysis of the evaluation of classroom teaching quality. *Primary & Secondary Schooling Abroad*.

Li, J. (2021). Evolutionary game research on the psychological choice of online shopping of fresh agricultural products based on dynamic simulation model. *Applied Mathematics and Nonlinear Sciences*.

Li, Q. (2013). Beyond summative evaluation: Improving the quality of teaching and learning in China's higher education. In *Survival of the Fittest: The Shifting Contours of Higher Education in China and the United States* (pp. 57-72): Springer.

Liu, S. (2021). Research on the teaching quality evaluation of physical education with intuitionistic fuzzy TOPSIS method. *Journal of Intelligent & Fuzzy Systems, 40*(5), 9227-9236.

Safrankova, J. M., & Sikyr, M. (2021). The evaluation of quality teaching methods in research at Czech Republic. *International Journal of Teaching and Education, 9*(1), 75-85.

T, M. (2010). Study of International Standards in Teaching Quality Evaluation (2) : The Role of ENQA in the Bologna Process. *Journal of Molecular Genetics 2*(2), 41-44.

Zhang, L., & Zhang, Y. (2018). *Evaluation of Multimedia Physical Education Quality in Colleges and Universities Oriented to Data Assimilation.* Paper presented at the 2018 International Conference on Robots & Intelligent System (ICRIS).

Zhang, X., Wei, Z., & Han, T. (2021). *PHP-based undergraduate data reporting and teaching quality evaluation information system.* Paper presented at the Journal of Physics: Conference Series.

Zhao, J. (2017). 98. Evaluation Index of Physical Education Teaching Quality Based on Index Clustering Method. *Boletín Técnico, ISSN: 0376-723X, 55*(12).

Zheng, Y., & Chen, Y. (2015). Research on evaluation model of university teachers' teaching quality based on BP neural network. *Journal of Chongqing university of technology (natural science), 29*(1), 85-90.