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A Methodological Study on the Quality Assessment of Online-Offline Blended Teaching in Physical Education Courses Using the Assignment Approach

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ABSTRACT

In order to overcome the shortcomings of traditional physical education teaching quality assessment methods, this paper proposes a hybrid online-offline physical education teaching quality assessment method based on the assignment method. The method utilizes the hierarchical analysis method (AHP) to initially assess the quality of hybrid physical education teaching, and introduces the improvement of the pull apart step method (ISD) to improve the assessment accuracy of the hierarchical analysis method. The AHP and ISD methods are weighted to form a comprehensive integrated assignment method to construct a hybrid physical education teaching quality assessment model. Finally, the accuracy of the teaching quality assessment model was tested by the plain Bayesian classifier (NBC). The questionnaire data from teachers and students of an engineering university were collected and applied to the model of this paper, and the final results show that the model of this paper can effectively realize the grade assessment of hybrid physical education teaching quality according to the obtained data. The simple Bayesian classifier used in this paper has obvious performance advantages compared with multiple linear regression (MLR) models. The application of the method in this paper can effectively meet the needs of teachers and students in mixed physical education teaching and learning, and at the same time, it can significantly improve students' physical education performance, which is highly welcomed by teachers and students in schools.

Keywords: assignment method, AHP, ISD, NBC, teaching quality assessment

1. Introduction

With the development of science and technology and the updating of educational concepts, the physical education teaching mode is also constantly being revolutionized and improved. The

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traditional physical education teaching mode is mainly based on school physical education classes, in which students conduct sports training and competitions [1-3]. As the traditional physical education teaching mode has problems such as time and space limitations, which makes it difficult for students to get sufficient exercise and guidance in sports training. The online-offline hybrid teaching mode came into being and became a new trend in current physical education teaching [4-7].

The online-offline blended teaching mode can provide a more personalized learning mode for each student. Students can learn independently through the online learning platform, and according to their own learning situation and needs for targeted training and guidance, to achieve better training results [8-11]. This teaching mode breaks the time and space limitations in the traditional teaching mode, students can study and train in sports at any time and any place, and are no longer subject to the restrictions of time and space of the school physical education class, which allows students to be more free to carry out physical education training, and can enhance the degree of student participation, students can communicate and interact with the teacher instantly, which improves the students' interest in the course and their learning motivation [12-15]. However, there are certain challenges in online and offline education, which requires colleges and universities to have certain technical equipment, teacher skills training, and enhanced management and supervision, and schools need to fully recognize the advantages and challenges of online and offline blended teaching mode, and actively promote the construction and application of online and offline blended teaching mode [16-19].

Literature [20] proposed an online-offline hybrid teaching quality evaluation method based on mobile edge computing and constructed an online-offline hybrid physical education teaching quality evaluation index system, revealing that this method can effectively improve the quality of online-offline hybrid teaching. Literature [21] describes the design and student evaluation of online and offline teaching in Chinese college students' physical education courses during the new coronary pneumonia period, and points out that the hybrid course effectively improves students' participation, and most of the students are supportive of it. Literature [22] describes the online-offline hybrid physical education teaching model, which breaks the time and space constraints of the traditional teaching model, meets students' individualized needs for physical education learning, and enhances students' enthusiasm for physical education teaching. Literature [23] examined the necessity and feasibility of online and offline hybrid teaching in the field of sports training, pointed out the problems of the traditional teaching mode, and put forward suggestions such as innovative teaching forms and course ideology. Literature [24], based on the serious impact of the outbreak of a new type of pneumonia on teaching, as well as the existence of many problems in network sports teaching, put forward a hybrid online-offline interactive sports teaching mechanism driven by the combination of educational information technology and practical subject knowledge. Literature [25] designed a teaching evaluation and performance prediction model under the hybrid teaching mode based on the hybrid teaching mode, and elaborated that the hybrid teaching mode is conducive to cultivating students' independent learning ability, stimulating students' love for physical education courses, and improving students' performance. Literature [26] analyzed the impact of the New Crown Pneumonia epidemic on the online and offline blended teaching methods of college students, and pointed out that factors such as technology quality and course content can have an impact on student performance, and the online and offline blended teaching methods have positively impacted student learning and are developing after the pandemic. Literature [27] emphasized the importance of information-based teaching methods in traditional teaching models, indicating that educational administrators should actively explore hybrid online and offline teaching methods and focus on aspects such as documentation of online resources and student engagement. The above study clearly indicates the positive impact of online and offline hybrid teaching mode on the teaching quality of physical education classes, in which students' interest, participation, and academic performance have been qualitatively improved, especially in the period of the New Crown epidemic outbreak, this teaching mode plays an important role.

This paper starts from the characteristics and existing problems of the online and offline hybrid sports teaching mode, analyzes the current problems of hybrid sports teaching in the teaching quality assessment method, and highlights the realistic need for the research of the teaching quality assessment method in this paper. According to the important status of quality assessment of physical education teaching and the characteristics of online and offline hybrid physical education teaching mode, the hybrid physical education teaching quality assessment index system is constructed. The weights of the indicators in the assessment system are calculated using the hierarchical analysis method, and the quality of hybrid physical education teaching is initially assessed. To address the subjectivity of the hierarchical analysis method, the improved pull-apart grade method is introduced, and the weight coefficients solved by it indicate the overall degree of variability of the assessment factors in all the indicators and the degree of interference with other assessment factors. The weights of assessment factors are calculated by using the comprehensive integrated assignment method weighted by hierarchical analysis method and improved pull-apart grade method, and the hybrid sports teaching quality assessment model is constructed. The assessment data are divided into training set and test set, and the plain Bayesian classifier is trained on the training set, and the accuracy of the hybrid sports teaching quality assessment model in this paper is tested by the test set data. Taking an engineering university as the research object, using the method of this paper to grade the quality of its hybrid physical education teaching, and measuring the practical application effect of the teaching quality assessment method of this paper by the satisfaction of the teachers and students of this university with the method of this paper and the change of students' physical education scores.

2. Characteristics and problems of the blended learning model

2.1. Characteristics of the blended learning model

2.1.1. Combining online and offline to build cooperative learning space. In the blended teaching model, building a learning atmosphere with good interactivity is an important part of enhancing learning effectiveness [28]. Students build learning communities to construct knowledge through cooperative learning and social interaction with peers and teachers. Blended teaching needs to take advantage of the blended learning environment to give timely feedback to learners in teaching, so that learners can get direct guidance from teachers and timely feedback from teachers and peers in the classroom, as well as targeted reviews, replies, and other feedback information through the online teaching environment.

2.1.2. Integration of teaching activities and teaching resources. Under the blended teaching model, multimedia teaching tools and resources such as teaching videos, website resources, online classrooms, online exercises, online quizzes, etc. are added to the daily teaching sessions, bringing more space for the design and development of teaching activities. Different types of courses have their own characteristics, and how to use different types of teaching resources requires understanding and analyzing teaching activities from the overall teaching plan. Therefore, there is no fixed pattern for the combination of teaching activities and teaching resources, and there is much room for teachers to “create”.

2.1.3. Multidimensional teaching quality assessment system. The most significant feature of the blended teaching mode is the combination of online and offline. Traditional teaching quality assessment centers around classroom teaching, and the assessment indicators and methods are relatively simple. However, the common teaching quality assessment method for courses adopting the blended teaching mode is to add online indicators on the basis of traditional teaching assessment, such as: the number of downloads of video materials, the number of visitors, the number of forum replies, the number of online quizzes, and the utilization rate of students' platforms, etc. The assessment of

teaching quality has shown a trend of diversification and multi-dimensionalization. Teaching quality assessment shows a trend of diversified indicators and multi-dimensional dimensions.

2.2. Problems with Blended Learning Models

2.2.1. Problem of organic combination of online and offline teaching and learning. In blended teaching, teaching activities such as content preview before class, assignment of learning tasks, release of micro-videos on important and difficult points, and post-tests are usually carried out online, which lacks the integration with other teaching links offline, and may give students the feeling of low relevance between online and offline. In addition, the classroom still follows the lecture-based teaching method, and the teaching design of common problems discussion, Q&A and commenting, students' explanation, results demonstration, and innovative application in the classroom is insufficient, and the design of students' participation is unscientific, which makes the students less enthusiastic.

2.2.2. Teaching quality assessment issues. The blended mode of teaching puts new demands on teachers' teaching ability. On the one hand, the curriculum has to be re-planned and pedagogically designed so as to make it more suitable for the new mode of teaching. On the other hand, new course resources have to be produced, which have greatly increased teachers' workload. However, the evaluation of teaching quality still follows the traditional and more crude way, which assesses the teaching quality of adopting the hybrid teaching mode according to some simple and superficial outcome indicators, resulting in the fact that the teachers' great amount of work is not accurately recognized, and the scientificity and reasonableness of the course design is not measured accordingly, which affects the teachers' motivation and the continuous construction of the courses.

3. Design of a comprehensive assessment model for the quality of hybrid physical education instruction

Quality evaluation of physical education teaching is an important link in the process of physical education teaching in schools. Whether the physical education teaching objectives are realized, whether the principles of physical education teaching are formulated reasonably, whether the students' learning behaviors are appropriate, and whether the learning effects are good need to be determined through the process of evaluation of the quality of physical education teaching. In view of the current teaching quality evaluation problems in online and offline blended physical education teaching, as well as the shortcomings that most of the existing teaching quality evaluation methods rely on experience to determine the masses and lack scientific theoretical and methodological basis, this paper proposes a comprehensive evaluation model of blended physical education teaching quality based on the assignment method, so as to objectively reflect the quality status of blended physical education teaching, and realize the accurate determination of the weight of the quality evaluation index of blended physical education teaching.

3.1. Establishment of a body of indicators for the assessment of teaching quality

In the teaching process, the online-offline blended teaching mode of physical education needs to follow the basic principle of the student as the main body, and implement the online-offline blended teaching mode with task-driven as the main line and problem-led as the guidance, which is mainly divided into online learning before class, offline learning during class, and after-class enhancement and expansion. According to the teaching objectives, course implementation stages and components, the online-offline blended teaching mode of sports is divided into three stages: pre-course preparation, in-course implementation and post-course testing.

The teaching evaluation index in the pre-course preparation stage is a crucial part of the teaching

evaluation system, which is directly related to the smooth progress of teaching activities and the improvement of teaching quality. Learning situation analysis plays an irreplaceable role in teaching activities. Learning situation analysis helps teachers to deeply understand the individual differences of each student's learning foundation, ability level, interests and learning habits. Through the analysis of learning conditions, teachers can predict the difficulties and obstacles that students may encounter in the learning process, and then prepare corresponding solutions or auxiliary materials in advance.

Teaching assessment indicators at the in-class implementation stage are the key link to measure the quality of teaching. At this stage, teaching assessment indicators usually involve both teacher's activities and student's activities. Teachers' activities usually include whether a variety of teaching methods are used to stimulate students' interest and motivation in learning. Whether the teaching methods are able to adjust the teaching strategies in a timely manner according to students' learning and feedback. Whether the teaching sessions are clear and organized, whether the time allocation is reasonable, and whether the teacher can creatively integrate teaching resources to make the teaching content richer and more vivid. Whether the teacher's language expression is clear and accurate, and whether he/she can attract students' attention. Students' activities usually refer to some performances in the course of class, including whether students actively participate in class discussions, ask and answer questions, and whether they are in a full learning state. Whether students can understand and master what they have learned, and whether they can apply what they have learned to solve problems. Whether students have a positive attitude towards learning and whether they can maintain their enthusiasm and interest in learning.

Teaching assessment indicators in the post-course testing stage usually focus on the students' knowledge mastery, the improvement of learning attitude and ability, and the teachers' teaching reflection and improvement. Through quizzes, assignments and examinations, students' mastery of what they have learned in class and the achievement of teaching objectives are assessed. Teachers should reflect on their own teaching process, discover problems and deficiencies in a timely manner, and put forward specific improvement measures based on the results of teaching reflection, such as adjusting teaching methods, optimizing teaching design, and strengthening teacher-student interaction, in order to improve teaching effectiveness. Assessment indicators are established according to the implementation stage as shown in Table 1.

Table 1. Evaluation index system

Target layer	Primary indicator	Secondary indicator
Quality assessment of sports teaching	Study affective analysis(A1)	Student will(A11)
		Student existing foundation(A12)
	Forecast appreciation(A2)	Teaching planning and strategy(A21)
		Preset learning target(A22)
		Collect feedback(A23)
	Teacher activity(A3)	Teaching attitude(A31)
		Teaching management(A32)
		Teaching content(A33)
		Teaching method(A34)
		Teaching effect(A35)
	Student activity(A4)	Learning attitude(A41)
		Degree of participation(A42)
		Explore innovation ability(A43)
	Student learning effect(A5)	Achievement of teaching goals(A51)
		Achievement of literacy goals(A52)

		Achievement of emotional goals(A53)
	Teacher's post class rectification(A6)	Analysis problem(A61)
		Adjust teaching strategy(A62)

3.2. Comprehensive and integrated assignment method

3.2.1. Hierarchical analysis. Hierarchical analysis method (AHP) is a decision-making method that accomplishes qualitative and quantitative analysis with different levels [29]. The following is the specific implementation process of hierarchical analysis method.

1) Create judgment matrix. Set the set of assessment factors at this level to have m assessment factor $v_1, v_2, \cdots, v_{m1}$, and compare the relative importance between each factor by domain experts two by two.

Set d_{ij} to be the importance value of v_i relative to v_j, as in equation (1):

$$v_i \ is \ compared \ to \ v_j \begin{bmatrix} As \ impor\tan t \ as \\ Less \ impor\tan t \\ Significantly \ impor\tan t \\ Extremely \ impor\tan t \\ absolutely \ impor\tan t \end{bmatrix}$$
$$Corresponds \ to \ d_{ij} = \begin{bmatrix} 1 \\ 3 \\ 5 \\ 7 \\ 9 \end{bmatrix} \tag{1}$$

If the comparison between v_i and v, is between levels, then the weight values scale 2, 4, 6, 8 are used.

Through equation (1), a weight judgment matrix is derived as in equation (2):

$$D = \left(d_{ij}\right)_{n\times n} \ d_{ij} = 1 / d_{ij} \tag{2}$$

2) Consistency test. Calculate the maximum eigenvalue of D as in equation (3):

$$DI = \frac{\alpha_{\max} - m}{m-1} \tag{3}$$

Where, $\alpha_{\max}$ maximum eigenvalue, m is the assessment factor. $DI = 0$, absolute consistency.DI is close to 0, there is relative consistency.The larger DI is, the less consistency there is.

Therefore the consistency ratio is defined again as in equation (4):

$$DK = \frac{DI}{KI} < 0.1 \tag{4}$$

where the reference value of KI is taken as $\left(0,0,0.58,0.9,1.12,1.24,1.32,1.41,1.45,1.48,1.51\right)$.

The corresponding eigenvector $\left(q_1, q_2, \cdots, q_m\right)$ is derived, and the eigenvector elements are normalized to obtain the weight set $\left(b_1, b_2, \cdots b_4\right)$, as in Eq. (5):

$$b_i = \frac{q_i}{\sum_{i=1}^{m} q_i}, DK = \frac{DI}{KI} < 0.1 \tag{5}$$

The solution of the eigenvectors can also be approximated using the power multiplication method, as in equation (6):

$$q_i = \left(\prod_{j-1}^{m} d_{ij} \right)^{1/m}, DK = \frac{DI}{KI} < 0.1 \tag{6}$$

3.2.2. Improvement of the graduation method. Since the hierarchical analysis method is susceptible to the interference of subjective factors, it cannot prevent the subjective localization of the evaluator, resulting in the inability of the hierarchical analysis method to accomplish high-precision evaluation. The overall degree of variation of each assessment factor in all indicators and the degree of interference with other assessment factors is expressed by the weight coefficients of the Improvement of Staging Method (ISD) solution, which is based on the objective origins of the information to stage the assessment objectives, and the process of the ISD algorithm is as follows.

1) Read the original data $A_{m\times n}$ with data from m rows and n columns.

2) Multiply each column of data from $A_{m\times n}$ by the weight coefficients obtained from the corresponding AHP method to obtain a new $A_n^* \times n$.

3) Set $R = A^{*T} A^*$, and after calculating the eigenvalue C and eigenvector U of R, find the corresponding eigenvector $U_{\max}$ of the largest eigenvalue $C_{\max}$.

4) Calculate the weights b_j as in equation (7):

$$b_j = \frac{U_{\max j}}{\sum_{j=1}^{m} U_{\max j}} \tag{7}$$

where the number of descriptive assessment factors is $j = 1, 2, 3, \cdots, m$.

3.2.3. Comprehensive Integrated Assignment Method (CIAM). The method of AHP and ISD weighting method is utilized to calculate the integrated weights of the assessment factors, to improve the correct rate of the weights of the assessment factors of the quality of physical education teaching, and the weights of the integrated integrated assignment method [30], as in equation (8):

$$\begin{gathered} b = e_1 b_1 + e_2 b_j \\ s.t. e_1 + e_2 = 1, e_1 > 0, e_2 > 0 \end{gathered} \tag{8}$$

where b_i and b_j denote the weights of AHP and ISD.

3.2.4. Teaching quality assessment model. Firstly, the weights of AHP are calculated by doing normalization for each assessment factor b_i, the weights of ISD are calculated by improving the pulling apart grade method b_j, and again, the comprehensive weights of the assessment factors are calculated by the method of using the AHP and ISD weighting method b, which realizes the comprehensive and integrated assignment of the weights and improves the correctness of the weights of the factors of the assessment of the quality of physical education teaching. On the basis of combining the above methods, the physical education teaching quality assessment model based on AHP-ISD is constructed as equation (9):

$$S = \sum_{i=1}^{n} bK_m \tag{9}$$

In the formula, b represents the comprehensive weight of the assessment factors, K_m represents the assessment value of the assessment factors, and the mixed physical education teaching quality assessment grade can be obtained through the above formula.

3.2.5. Teaching quality assessment tests. The data of assessment factors were divided into training set and sample set, and the training set data were used to create a plain Bayesian classifier [31], based on the test set data, to test the assessment accuracy of the AHP-ISD teaching quality assessment model.

The plain Bayesian classifier utilizes the Bayesian formula as in equation (10):

$$F(G \mid X) = \frac{F(G \mid X) * F(G)}{F(X)} \tag{10}$$

Where: $F(G \mid X)$ Conditional X under the a posteriori probability of G. $F(G)$: A priori probability of G. $F(G \mid X)$: A posteriori probability of X under condition G. A priori probability of $F(X)$.

4. Empirical studies

4.1. Data sources

In order to verify the validity and reliability of the algorithm in this paper, an engineering university was selected as the research object, and undergraduate students and current faculty members from various majors in each school were surveyed, and the self-administered questionnaire method was used to collect data. The relevant evaluation indexes involving the quality of blended physical education teaching were designed into a questionnaire, and then the questionnaire was randomly distributed to the respondents using stratified sampling method to allow them to complete the questionnaire independently, and the validity of each questionnaire was reviewed. A total of 390 questionnaires were sent out and 390 were recovered, with a recovery rate of 100% and 387 valid questionnaires, with a validity rate of 99.23%. Finally, all the data were divided into training set and test set according to 7:3.

4.2. Empirical analysis

4.2.1. Analysis of the results of the comprehensive evaluation. Based on the Likert scale formula to design the questionnaire, the hybrid physical education teaching quality evaluation index system consists of 6 primary indicators and 18 secondary indicators. It is divided into 4 measurement levels using semantic scales: good, good, fair, and poor, and its quality evaluation criteria are shown in Table 2.

Table 2. Quantitative grading standards for evaluation

Evaluation value	Comment	Grading
$x_i > 3$	Excellence	$E1$
$2 < x_i \le 3$	Good	$E2$
$1 < x_i \le 2$	General	$E3$
$x_i \le 1$	Bad	$E4$

The results of the AHP-ISD hybrid physical education teaching quality comprehensive evaluation vector are shown below:

$$\begin{aligned} A &= (0.117, 0.238, 0.224, 0.121, 0.237, 0.064) \begin{pmatrix} 0.238 & 0.522 & 0.002 & 0.238 \\ 0.088 & 0.139 & 0.474 & 0.299 \\ 0.285 & 0.322 & 0.026 & 0.367 \\ 0.295 & 0.038 & 0.278 & 0.389 \\ 0.015 & 0.418 & 0.239 & 0.328 \\ 0.023 & 0.181 & 0.351 & 0.445 \end{pmatrix} \\ &= (0.154, 0.282, 0.232, 0.334) \end{aligned} \tag{11}$$

The normalization is obtained:

$$A' = (0.153, 0.282, 0.231, 0.334) \tag{12}$$

The composite score values were graded as follows:

$$\begin{aligned} V_{A1} &= 4\times 0.238 + 3\times 0.522 + 2\times 0.002 + 1\times 0.238 = 2.760 \\ V_{A2} &= 4\times 0.088 + 3\times 0.139 + 2\times 0.474 + 1\times 0.299 = 2.016 \\ V_{A3} &= 4\times 0.285 + 3\times 0.322 + 2\times 0.026 + 1\times 0.367 = 2.525 \\ V_{A4} &= 4\times 0.295 + 3\times 0.038 + 2\times 0.278 + 1\times 0.389 = 2.239 \\ V_{A5} &= 4\times 0.015 + 3\times 0.418 + 2\times 0.239 + 1\times 0.328 = 2.120 \\ V_{A6} &= 4\times 0.023 + 3\times 0.181 + 2\times 0.351 + 1\times 0.445 = 1.782 \end{aligned} \tag{13}$$

Through the above calculation and combining with the evaluation criteria of hybrid physical education teaching quality in Table 2, it can be seen that the evaluation result of hybrid physical education teaching quality evaluation indexes of this engineering university is "good" belonging to grade $E2$. According to the size of the rating level of each index can be ranked, in which the "prediction of value-added" and "teacher correction after class" is a little lower than the other indexes, the actual results and the AHP-ISD results are shown in Figure 1. As can be seen from the figure, the difference between the AHP-ISD evaluation results used in this paper and the actual results is relatively small, indicating that the AHP-ISD method used in this paper has a certain degree of reasonableness in assessing the quality of hybrid physical education teaching.

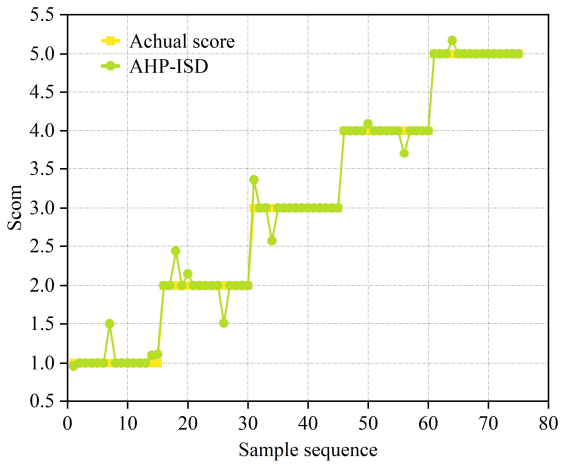


Fig. 1. AHP-ISD evaluation results

The overall score of the overall judgment is $V = 4\times 0.153 + 3\times 0.282 + 2\times 0.231 + 1\times 0.334 = 2.254$. It means that the overall quality of teaching hybrid physical education in this engineering university is "good" and belongs to level $E2$.

Figure 2 shows the results of the indicator weights calculated by AHP, ISD and AHP-ISD methods, respectively. From the figure, it can be seen that by combining AHP and ISD, the weight coefficients of the mixed physical education teaching quality evaluation indicators can be determined more precisely, which lays a better foundation for the high-precision evaluation of the simple Bayesian classifier.

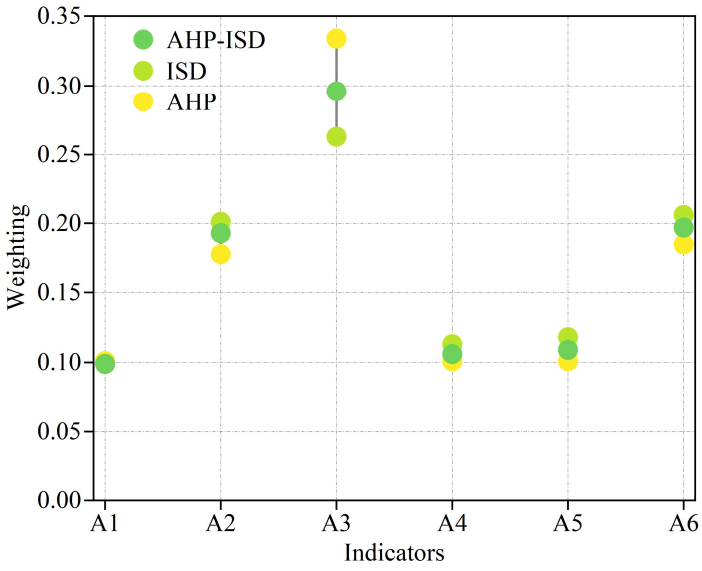
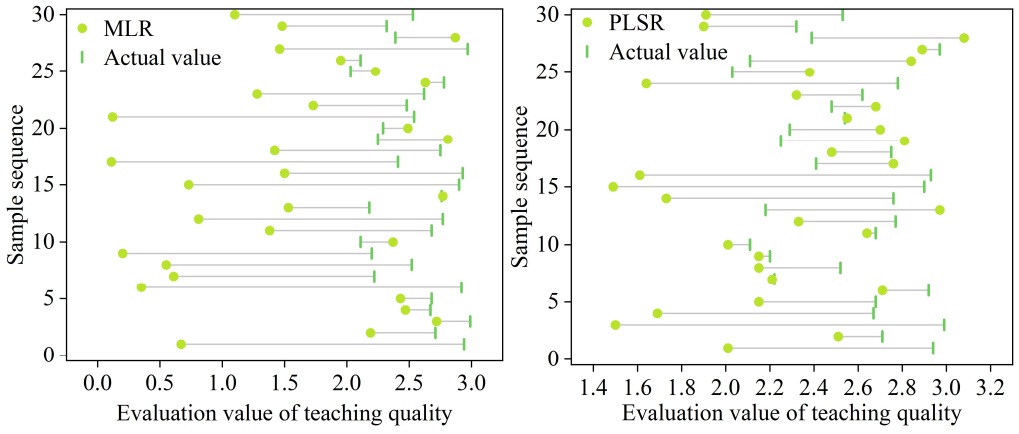
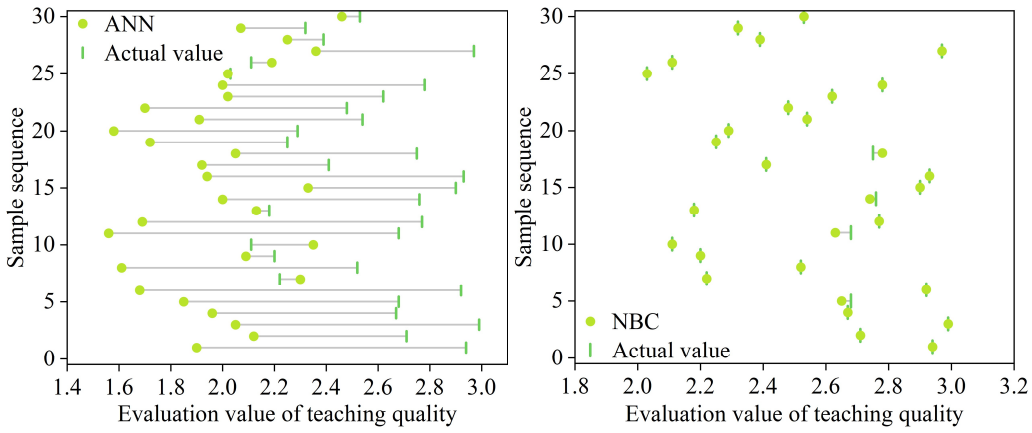


Fig. 2. Indicator weight of different methods

4.2.2. Classification Prediction Performance Analysis. In order to verify the classification prediction performance of the plain Bayesian classifier (NBC) in this paper, the multiple linear regression model (MLR), partial least squares regression model (PLSR), and artificial neural network model (ANN) are selected as the comparison methods to predict the hybrid physical education teaching quality evaluation value, and the results are shown in Figure 3, (a)-(d) represent the MLR, PLSR, ANN and NBC prediction results, and the gray line indicates the error between the predicted value and the true value. From the figure, it can be seen that there is an obvious distance between the predicted value and the true value of the three models of multiple linear regression, partial least squares regression and artificial neural network, and most of the gray lines are longer, which indicates that the predictive fitting effect of these three models is poor, and it is difficult to accurately assess the quality of mixed physical education teaching. In contrast, the predicted values of the plain Bayesian classifier used in this paper almost completely overlap with the true values, and the prediction accuracy of 30 samples reaches 86.67%. It fully verifies the superior performance of the plain Bayesian classifier in the prediction of mixed sports teaching quality assessment.



(a) MLR (b) PLSR



(c) ANN (d) NBC

Fig. 3. Prediction results of different models

The relative error, mean square error MSE, and CPU consumption of each model on the prediction samples are further used as comparison indexes to verify the performance of each model, and the obtained results are shown in Table 3. From the table, it can be seen that the multivariate linear model has the largest prediction error, the average relative error reaches 4.08%, but the model is relatively simple, the CPU consumption time is the least, and the partial least squares method consumes more CPU time because of the need to carry out an iterative algorithm when solving. The artificial neural network has the ability to approximate the nonlinear function, which improves the accuracy of solving the nonlinear function, but its shortcomings are also obvious: first of all, the complexity of the solution, the longest time-consuming, as can be seen in the table, the artificial neural network model average time-consuming 1.40s respectively for the multivariate linear model 46.67 times, for the partial least squares regression 3.04 times, for the simple Bayesian classification model of 17.50 times. . Second, the model is unstable, and the artificial neural network model performs local optimization when solving, which leads to the fact that the solution results are not unique and even differ greatly. The plain Bayesian model has high prediction accuracy, the average relative error is only 1.40%, and the CPU time consumption is very small, only 0.08 s. This is because the plain Bayesian model compromises the learning accuracy and model complexity, which makes the model have a better generalization ability, and improves the prediction accuracy of the unknown samples. At the same time, the plain Bayesian model performs global optimization when solving, which ensures that the solved solution is the only optimal solution. The model comparison results further demonstrate that the use of the plain Bayesian classification model in this paper can effectively realize the accurate assessment of the quality of hybrid physical education teaching.

Table 3. Comparison of predictive energy of different models(%)

	MLR			PLSR			ANN			NBC		
	RE	MSE	Time/s	RE	MSE	Time/s	RE	MSE	Time/s	RE	MSE	Time/s
1	4.24	0.01	0.048	4.18	0.14	0.651	2.44	0.06	1.266	2.06	0.01	0.063
2	4.39	0.03	0.039	3.23	0.12	0.254	4.65	0.11	1.037	1.66	0.04	0.116
3	4.06	0.09	0.033	4.54	0.07	0.226	2.87	0.05	2.450	1.61	0.02	0.138

4	4.42	0.16	0.048	3.95	0.20	0.877	4.49	0.10	2.217	0.87	0.03	0.072
5	4.44	0.19	0.021	4.28	0.11	0.045	4.42	0.14	1.851	1.92	0.04	0.011
6	4.54	0.14	0.039	3.84	0.02	0.338	3.94	0.06	0.905	1.34	0.02	0.065
7	3.84	0.17	0.006	3.77	0.02	0.814	2.26	0.09	0.907	0.78	0.02	0.002
8	3.55	0.11	0.010	3.63	0.05	0.301	2.45	0.13	0.387	0.99	0.02	0.059
9	4.67	0.17	0.005	2.52	0.17	0.293	2.17	0.08	2.041	2.13	0.03	0.040
10	3.63	0.06	0.003	2.98	0.15	0.594	2.55	0.11	0.302	0.65	0.01	0.082
11	3.99	0.15	0.017	2.74	0.14	0.410	3.56	0.13	1.603	0.81	0.03	0.033
12	4.17	0.08	0.030	2.96	0.11	0.322	4.51	0.13	2.014	1.41	0.02	0.154
13	4.86	0.18	0.047	4.53	0.17	0.880	3.52	0.06	2.592	1.93	0.01	0.047
14	3.46	0.13	0.049	3.68	0.09	0.145	3.42	0.13	2.392	1.73	0.01	0.144
15	3.01	0.07	0.021	3.14	0.13	0.841	3.85	0.04	1.073	1.96	0.02	0.109
16	3.52	0.11	0.019	4.57	0.15	0.337	2.21	0.08	0.354	0.86	0.04	0.044
17	3.79	0.03	0.020	4.45	0.17	0.476	3.87	0.13	2.00	1.93	0.04	0.074
18	4.61	0.05	0.005	4.15	0.04	0.304	4.62	0.05	1.706	1.18	0.03	0.094
19	4.61	0.12	0.008	2.59	0.15	0.668	4.24	0.06	1.118	0.94	0.03	0.131
20	4.55	0.18	0.031	2.96	0.14	0.895	2.75	0.05	1.065	1.06	0.03	0.091
21	4.77	0.02	0.026	3.04	0.20	0.430	4.56	0.05	0.317	1.78	0.02	0.134
22	3.51	0.11	0.039	3.22	0.13	0.518	4.28	0.06	2.554	1.33	0.00	0.050
23	4.37	0.02	0.038	2.79	0.11	0.161	2.86	0.04	0.415	1.47	0.02	0.080
24	3.86	0.14	0.015	4.13	0.16	0.626	3.76	0.07	0.100	0.68	0.01	0.018
25	4.52	0.11	0.026	4.58	0.14	0.023	4.25	0.14	1.329	1.44	0.01	0.127
26	4.27	0.02	0.032	3.13	0.01	0.381	4.72	0.14	0.977	1.32	0.04	0.137
27	3.76	0.15	0.035	4.03	0.19	0.469	4.77	0.03	1.801	0.74	0.04	0.116

28	3.93	0.19	0.035	3.96	0.03	0.196	4.71	0.13	2.543	1.45	0.02	0.089
29	3.79	0.12	0.002	2.82	0.01	0.502	3.29	0.11	2.376	2.13	0.03	0.073
30	3.23	0.14	0.024	3.59	0.06	0.857	4.14	0.15	0.285	1.77	0.02	0.068

4.2.3. Satisfaction and achievement analysis. In order to reflect the practical application effect of this paper's hybrid sports teaching quality assessment method, this paper's method is applied to the online-offline hybrid teaching of an engineering university's physical education course, and the teachers' and students' satisfaction with this paper's method as well as the students' physical education results before and after the application of this paper's method are used as the indicators to demonstrate the practicability of this paper's method in the hybrid sports teaching. Figure 4 shows the results of the survey of teachers' and students' satisfaction with this paper's method in this engineering university, and Figure 5 shows the statistical results of students' sports performance before and after the application of this paper's method. As can be seen from Figure 4, although the satisfaction of teachers and students with the teaching quality assessment method of this paper does not show obvious correlation, and the satisfaction of 50 teachers and students with the method varies, overall, the satisfaction of teachers and students of this engineering university with the hybrid physical education teaching quality assessment method proposed in this paper is between 90% and 100%, which indicates that the application of the method of this paper in this engineering university effectively meets the needs of the teachers and students of this university, and is unanimously and widely welcomed by the teachers and students. Figure 5 shows the changes in students' physical education scores before and after the application of this paper's method, from which it can be seen that before the application of this paper's method, the average value of students' physical education scores is about 58 points, which is below the passing line. After the application of the teaching quality assessment method in this paper, teachers adjusted the teaching content and teaching strategies in time according to the assessment results, and provided personalized blended physical education teaching for different students, and the students' physical education performance had a significant improvement, and the average score rose to 95.29 points. Satisfaction and achievement statistics show that the application of the method in this paper can significantly improve the quality of online and offline blended physical education teaching, promote students' physical education performance, and promote the quality and efficiency of online and offline blended physical education teaching.

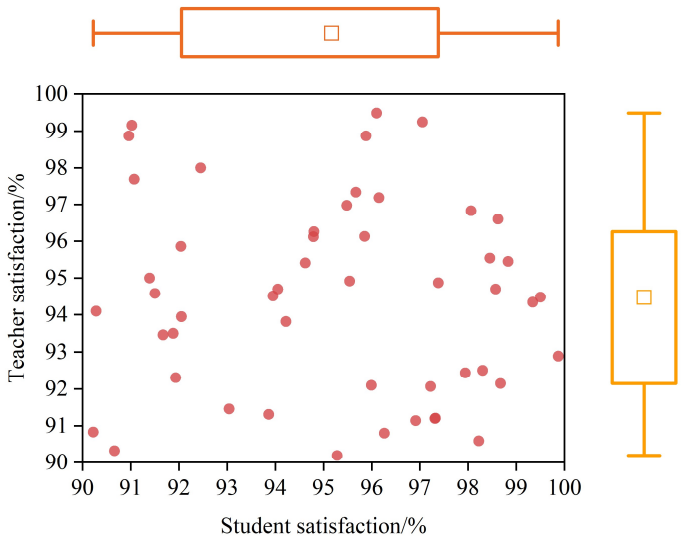


Fig. 4. Student and teacher satisfaction survey results

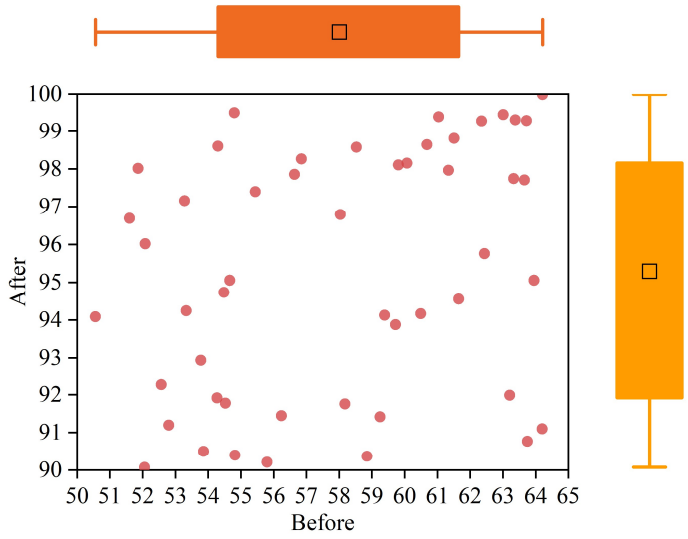


Fig. 5. Student performance statistics results

5. Conclusion

This paper constructs a comprehensive integrated assignment method based on the hierarchical analysis method and the improved pull-out grade method, and realizes the assessment of online and offline hybrid physical education teaching quality based on the assignment method. The research results show that the method of this paper can effectively calculate the value of hybrid sports teaching quality of an engineering university based on the collected teaching quality evaluation questionnaire data, and derive the hybrid sports teaching quality grade of this engineering university according to the teaching quality grade evaluation standard. In the algorithm performance test, the prediction accuracy of the simple Bayesian classification model used in this paper reaches 86.67% under 30 samples, which is significantly higher than that of models such as multiple linear regression. Moreover, the relative error of prediction, mean square error and CPU time consumed by the plain Bayesian classification show overall advanced performance in the test, which fully demonstrates the reasonableness of adopting the plain Bayesian classifier in this paper. Teachers and students of this engineering university are more than 90% satisfied with the teaching quality assessment method proposed in this paper, and after using the method of this paper for teaching practice, the average score of students' physical education performance in this university is increased from 58 to 95.29, which is as high as 64.29%. This further shows that the method of this paper is effective in practical application and can provide a strong driving force for the improvement of the quality of online-offline hybrid physical education teaching.

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