

Data Mining of Teaching Evaluation of College Physical Education Courses Based on Artificial Intelligence and Multimedia Technology

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ABSTRACT

Artificial intelligence (AI) and multimedia technology (MT) provide a new platform for college physical education (PE), which plays a positive role in promoting college PE. Combined with the actual situation, some discussions are made on the application of multimedia teaching technology in college PE teaching, in order to better serve the MT teaching of college PE teaching. The popularization and wide application of multimedia teaching technology in education and teaching have caused a series of changes in teaching concepts, teaching design, teaching methods, creative teaching, etc., preparing for the development of teaching. Starting from the teaching quality evaluation methods, the existing problems in the evaluation process were analyzed. These problems are reflected in the retrospective evaluation method, which is not scientific enough to summarize the evaluation results, and it is difficult to track and improve the teaching ideas. Teaching evaluation is a complex system that includes classroom teaching, sports facilities, sports activities, classroom teaching, physical health, supervision and management and many other aspects. Modern educational philosophy generally holds that the classroom teaching process should include formulating clear teaching objectives, selecting the most appropriate teaching methods and using scientific evaluation methods to collect information about correct answers. According to the construction of a comprehensive evaluation system of intelligent algorithm and AI technology, the quality of teaching evaluation has been improved by 21.4% after calculation.

Keywords: Artificial Intelligence, Multimedia Technology, College Physical Education Courses, Teaching Evaluation Data Mining and Analysis

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1. Introduction

Nowadays, the state pays more attention to education and increases various inputs, thus changing the quality of education in an unprecedented way. In order to improve the quality of classroom learning, measures to improve learning quality assessment methods based on AI and MT are proposed, and integration and management, quality assessment and subsequent use of advanced assessment methods are learned to develop and improve assessment systems, which enable real-time online assessment and encourage active participation in assessment courses, continuously monitoring training quality and training learning effects. In this way, the existing problems and deviations can be detected and resolved in a timely manner, so as to avoid the goal of continuously improving the teaching level.

With the development of the information age, AI and MT have developed rapidly. AI has brought great changes to life and has had a great impact on the field of education. Hassabis D believed that there is an intertwined history of neurology and AI, and today's exchanges and cooperation have become less common [1]. Bundy A argued that the field of explainable AI should be built on existing research and he reviewed related papers on these topics in philosophy, cognitive psychology, science, and social psychology [2]. Zucker J D believed that in AI, abstractions are used to illustrate different details in a language, or to move from one aspect to another [3]. Krittanawong C believed that AI is a field of computer science that aims to simulate human thought processes [4]. Through a similar invention of the AI revolution, Makridakis S believed that it can bring about widespread changes that affect all aspects of people's society [5]. Takahashi H considered how AI technology affects inequality, examining the breadth of AI technology [6]. Liu R believed that AI technology has attracted the attention of the industry. In practice, however, AI is facing challenges [7]. The above researches have more specific interpretations of AI and MT, but they are not related to college PE courses, nor do they talk about teaching evaluation data mining.

PE evaluation is based on teaching analysis, and a certain standard is used to make corresponding value judgments, mainly including the evaluation of PE teachers and students' evaluation of PE learning. Feng B discussed the ideological and political factors in the course from the implementation process through literature review [8]. Oliveira V P aimed to analyze the self-efficacy of college students majoring in sports in public higher education institutions and to correlate it with personal, academic and professional characteristics [9]. Mo D found that college students' overall satisfaction with PE is not high, mainly due to higher expectations for PE and lower satisfaction with teaching experience. Schools need to set up relevant PE courses from the perspective of needs and interests, establish a student-oriented teaching management concept, and adjust teaching arrangements, so as to improve PE hardware facilities and further guide [10]. Gao F studied the association rules in the teaching evaluation data of college students, gave a measurement method of the emotional value of unstructured teaching evaluation texts, and explored the semantic characteristics of high-quality and poor-quality course teaching evaluation texts. He took the teaching evaluation data of a university course as an example to conduct empirical research [11]. Zhai G found that in teaching, sentiment analysis can help educators discover in time how students really feel about the course [12]. Rehman S U's research provided decision support for exploring small class teaching, improving the teaching level of public basic compulsory courses, guiding students to correctly understand general education courses, improving teaching methods and standardizing teaching content according to students' needs [13]. Rodrigues M W proposed a sentiment analysis method that allows students to provide feedback to teachers on factors affecting classroom instruction [14]. These research works on data mining of teaching evaluation of PE courses in colleges and universities are relatively comprehensive, but they do not include knowledge of AI and MT.

Education evaluation aims to make scientific decisions on teachers' teaching process and teaching effect according to the goal of cultivating students and human-designed level, and provide teachers

with real feedback. In general classroom evaluation, classroom attendance and classroom listening are the main basis for evaluating teachers' teaching quality, which are very consistent. In order to make learning assessment more scientific and persuasive, the Internet technology can be combined with non-traditional learning assessment, enabling teachers to clearly and fairly assess the impact of learning and at the same time better understanding students' learning characteristics, so that the learning assessment function can be better and better. Therefore, under the background of AI and MT, creating a new and scientific education evaluation system is the main task of college education evaluation.

2. AI and MT and Data Mining Elements

1) Analysis of AI and MT elements. MT is a new technology developed in the 1990s and a new learning method emerging from modern learning technology [15]. It is a combination of text, graphics, images, videos and other media that are processed and controlled by a computer, the most important features of which are integration and interaction. In the fusion of sound, image, text and other information, its fusion is particularly obvious. At present, the development of MT has greatly improved the human-machine interface and expanded the scope of computers. It is often said that multimedia learning is just a learning aid. The improvement of MT performance is particularly evident in comprehensive information management, which can simultaneously increase the number of related teaching materials and display various types of information through audio, graphics, text, etc., rapidly increasing rate of knowledge transfer to students, as shown in Figure 1.

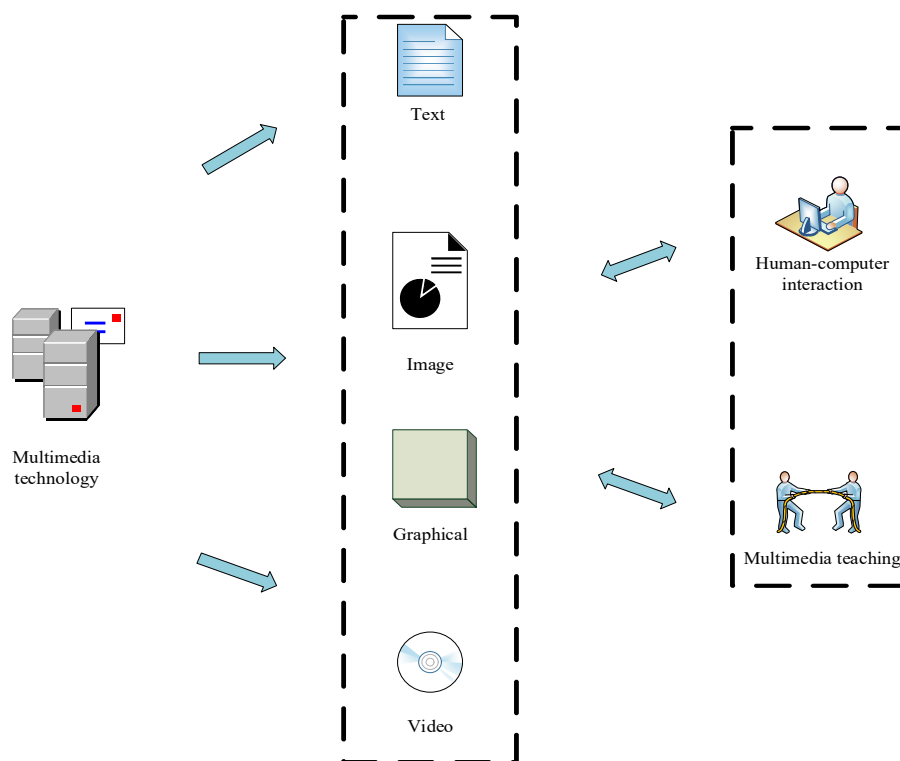


Fig. 1. Analysis of artificial intelligence and multimedia technology elements

2) Analysis of data mining elements. Data mining is a process of acquiring information and knowledge. As far as data mining is concerned, data is the platform which is mainly based on the principles of AI, machine learning and statistics. On the basis of data warehouse or data market, historical data is analyzed and evaluated, and the hidden relationship patterns in these data are found, which reflect the inherent characteristics of data and improves the abstraction degree of

information contained in data [16]. According to the rules that exist in the data, data mining is to discover information about each of the above patterns in real systems, and there are many data mining techniques associated with it, as shown in Figure 2.

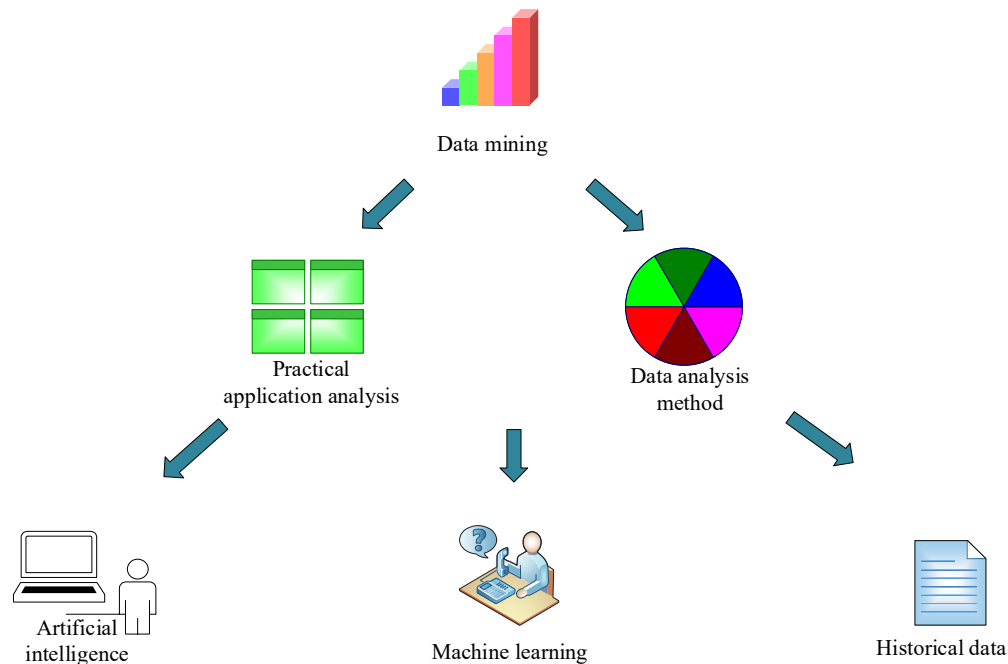


Fig. 2. Data mining element analysis

3. Elements of Teaching Evaluation of Physical Education Courses in Colleges and Universities

1) Analysis of teaching objectives. PE evaluation should focus on the development of learning and make full use of evaluation, supervision and incentive activities, focusing on setting goals and performance appraisal standards [17]. Evaluation elements should include learning objectives, learning content, teaching methods, learning environment, teacher behavior, student behavior and learning outcomes. Among these elements, the behavior of teachers and students is the main element of evaluation. Learning objectives are the learning outcomes achieved through learning, with full and limited impact in the classroom. Setting learning goals increases the level of problem solving that needs to be addressed to specify learning approaches, so the purpose of the tutorial is related to lighting for navigation classes, which is a tutorial. Compared with other elements of learning, learning objectives are informative and motivating, and play a role in assessing learning outcomes, as shown in Figure 3.

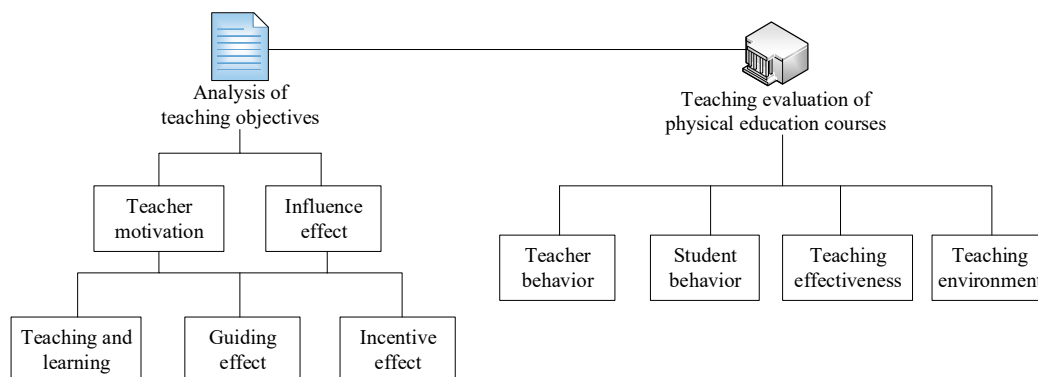


Fig. 3. Analysis of teaching objectives

2) Analysis of teaching methods. Teaching materials and methods are important elements of learning assessment. Special attention should be paid to whether the teaching method is appropriate, whether it conforms to the laws of knowledge, whether it is aimed at all students, whether it stimulates students' interest, whether it improves students' skills and physical fitness, whether it encourages students' open-mindedness and ability, or whether it uses modern teaching methods correctly and effectively. According to the different needs of teaching content, different teaching methods can be selected. Similar learning objectives, learning content, different teaching methods, or different degrees of use of the same method can lead to different learning outcomes and even larger gaps in learning outcomes.

4. Application of AI and MT in the Teaching Evaluation of Physical Education Courses in Colleges and Universities

1) Problems existing in the evaluation of teaching quality in colleges and universities. Evaluation methods are lagging behind. In the current quality evaluation of full-time education in colleges and universities, the main body of evaluation is supervision. The content of the teacher's evaluation is evaluated in the evaluation summary, and students fill in a paper form for evaluation at the end of each semester, most importantly due to the consistency at the end of each PE class. During the break, the specific content of teacher evaluation is refined, resulting in strong randomness in evaluation and independent observation, and the evaluation results are not fair and accurate, making it impossible to effectively evaluate the teaching content of other teachers according to the evaluation results, which cannot improve the quality of teaching. Therefore, there is still a lot of room for improvement [18].

2) Architecture of AI and MT system. This paper proposes a method and system framework for comprehensively evaluating the teaching quality of teachers' PE courses based on the technical support of AI, analyzing students' classroom behavior through PE course monitoring video, and combining with the content of teachers' teaching, so as to achieve the construction of a comprehensive PE teaching quality evaluation system based on AI technology. First of all, some hardware equipment is needed to support, mainly including classroom computer, camera, recording equipment and data analysis server. Video capture devices are usually placed in front of classrooms or worn by teachers, which are used to capture students' behaviors in the classroom in real time, so that the video analysis module can analyze students' behaviors. Recording equipment is used to record teachers' language knowledge. The collected audio and video information on the computer is collected for processing and analysis, as shown in Figure 4.

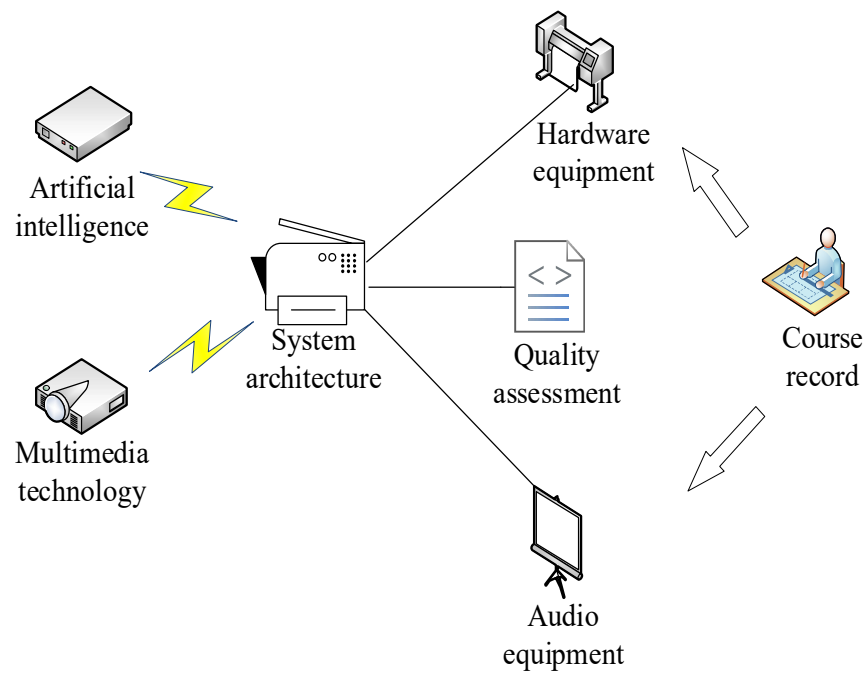


Fig. 4. Analysis of teaching means and method

3) Sentiment analysis of teachers based on AI and MT. Emotions are a direct reflection of the work of a person's inner world, reflecting an individual's sense of personality, as well as sensitivity and competitiveness [19]. When surprised, whether it's personal approval, disgust, love, disgust, sadness, or joy for the content, these feelings produce invisibly in every student's heart, which has a great guiding and encouraging effect on students' perception and understanding. Information transfer and speech emotion recognition are emerging technologies in recent years, relying on AI and MT [20]. Its operating system can greatly improve the possibility of human-computer interaction. The college sports knowledge base stores information related to PE and the neural network training provides training information. The neural network training model is used to analyze the content of teachers' teaching and support emotional states, as shown in Figure 5.

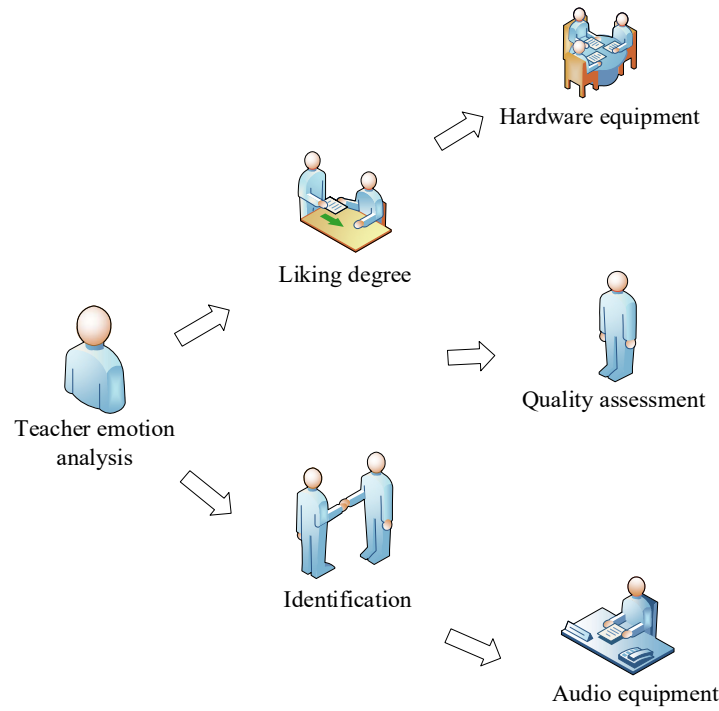


Fig. 5. Teacher sentiment analysis based on artificial intelligence and multimedia technology

5. Application of Analytic Hierarchy Process Algorithm in Teaching Evaluation of Physical Education Courses in Colleges and Universities

Analytic Hierarchy Process (AHP) is very useful for solving problems that are difficult to fully quantify. The construction of the class structure model is generally divided into three levels. With the help of the pairwise comparison method, the evaluation index matrix is constructed according to the different order of evaluation. For n evaluation indicators, the weight comparison judgment matrix can be expressed as Formula 1 and Formula 2:

$$P_n = P_{n_1} + F \sum_{n=1} \text{sim}(\alpha^2, \beta^2) \times (P_n - P_{n_1}) \quad (1)$$

$$P = \frac{1}{\sum_{n=1} \text{sim}(p - p^2)} \quad (2)$$

In Formula 1 and Formula 2, P is the target and F is the element. α , β represent vectors and structures, respectively. Through the pairwise comparison method, the judgment matrix of the evaluation indexes is constructed according to the order of the evaluation indexes. For n evaluation indicators, the weight comparison judgment matrix can be represented.

$$\text{sim}(P_n) = \sum_{i=1}^n f(\alpha_i^n - \beta^2) \quad (3)$$

$$\text{sim}(p_n) = \frac{\sum_{i=1} (p_i - p_j)(p_i - p_j)}{\sum_{i=1} (p_i - p_j)^2 \sum_{i=2}^n (p_n - p_i)^2} \quad (4)$$

The consistency test judgment index is as Formulas 5 and 6:

$$p_n = \frac{1}{q_n} \sum p_{n,i-1}, p_i = \frac{1}{q_n} \sum p_{i,j-1} \quad (5)$$

$$p_{n,i} = \frac{\sum_{i=1}^n \text{sim}(\alpha, \beta) P}{\sum_{i=2}^n \text{sim}(\alpha, \beta)} \quad (6)$$

In order to enhance the accuracy of the PE evaluation index weight, this paper adopts the method of AHP weighted measurement to carry out the comprehensive weight. Its comprehensive weight expression is as Formulas 7-9:

$$\text{sim}(\alpha, \beta) = \frac{\sum_{i=1}^n (p_i^2 - p_j)(p_i^2 - p_j)}{\sqrt{\sum_{i=1}^n (p_i - p_j)^2}} \quad (7)$$

$$\text{sim}(\alpha, \beta) = \frac{\sum_{i=1}^n (p_i - p_j)}{\sqrt{\sum_{i=1}^n (p_i - p_j)^2 \sum_{i=1}^n (p_i - p_j)^2}} \quad (8)$$

$$P_{ij} = \frac{\sum_{i=1}^n \text{sim}(\alpha, \beta) T_{ij}}{\sum_{i=1}^n (P)} \quad (9)$$

Therefore, the problem of the optimal classification plane is transformed into an optimization problem as Formulas 10-12:

$$\alpha, \beta = p_{i,j} = \sum_{i=1}^n f_n f_i \quad (10)$$

$$\frac{1}{P_{i,j}} = -2p_{i,j} + 2\alpha_i \quad (11)$$

$$\frac{1}{P_{i,j}} = -2\alpha_n + \beta_j \quad (12)$$

Since the AHP algorithm is susceptible to independent factors and cannot avoid the subjective opinions of the evaluators, this method cannot perform more accurate process evaluations. In the advanced scoring method, the weighting factor is the total score of the indicator over all. According to the objective information source, the scoring items are selected, and the algorithm process is as Formulas 13-15:

$$P_{i,j} = \alpha_{n,m} + \beta(p_{x,y} - p_{n,m}) \quad (13)$$

$$P_{x,y} = \alpha_{x,y} + \beta(p_{n,m} - p_{x,y}) \quad (14)$$

$$P = \alpha\beta(x_i, y_n) \sum_{n=1}^n \frac{q_i}{q_n} \quad (15)$$

6. Practical Application Results of the Algorithm

In order to further investigate the teaching evaluation data of PE teaching in colleges and universities, relying on AI and Internet technology, a method and system framework for comprehensively evaluating the teaching quality of teachers' PE courses were constructed. Through the faster collection of evaluation information through the system architecture, communication can be accelerated and information exchange between teaching courses and teaching objectives can be promoted. In order to further understand the structure of teaching evaluation of PE courses in colleges and universities and students' cognition of teaching evaluation, the teachers and students of

four colleges and universities, named A, B, C, D respectively, were surveyed and interviewed in the form of questionnaires. The content of the survey was mainly summarized into four points, namely students' curriculum identification, teaching survey methods, teaching methods, and students' learning behaviors. From these four points, the direction that students and teachers needed to improve on the current PE teaching evaluation was investigated, with the sample size of 400. The survey situation is shown in Table 1.

Table 1. Directions that students and teachers need to improve the current physical education teaching evaluation

	A	B	C	D
Student curriculum identity	17%	26%	32%	42%
Teaching investigation methods	21%	18%	27%	29%
Teaching devices	42%	45%	52%	44%
Student learning behavior	38%	61%	41%	53%

Among them, the directions that students and teachers need to improve the current PE teaching evaluation included students' curriculum identification, teaching investigation methods, teaching devices, and students' learning behavior. The specific statistics are shown in Figure 6.

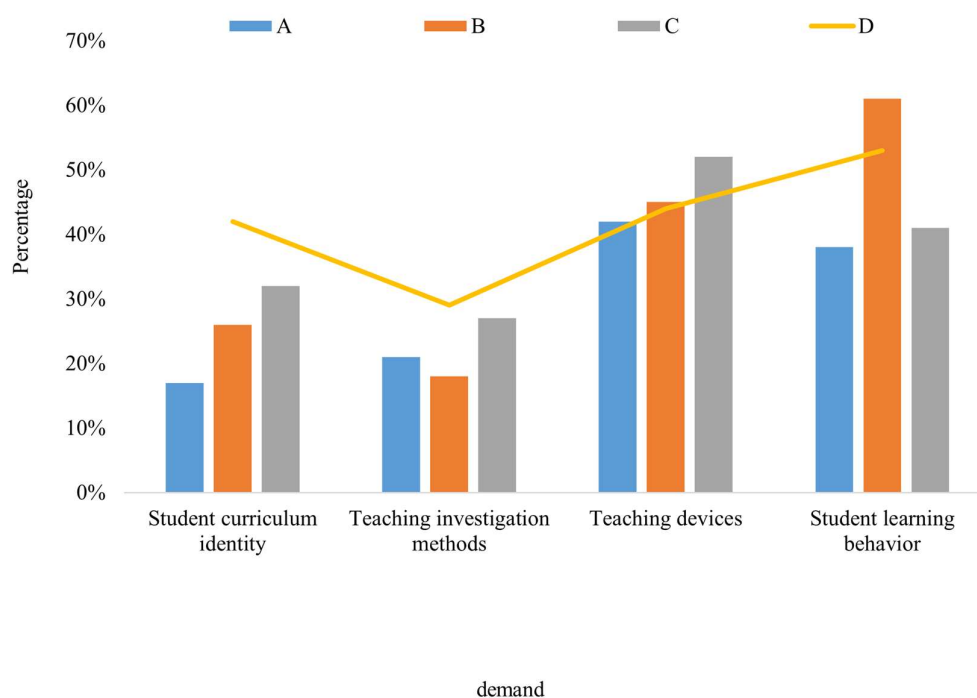


Fig. 6. Directions that students and teachers need to improve the current physical education teaching evaluation

According to Figure 6, in teaching activities, there are still many problems and methods of learning evaluation. Therefore, it is necessary to pay more attention to curriculum evaluation, support teachers' active reflection, stimulate students' enthusiasm for learning, and improve the quality of work while improving the overall teaching quality. With the in-depth advancement of high-quality education and the reform of new courses, more and more attention has been paid to teaching evaluation methods, which has a multi-faceted impact on teaching, improving teachers' knowledge level, improving teaching quality, and promoting teachers' development.

In order to test the method and system framework for comprehensively evaluating the teaching quality of college teachers' PE courses created by AI and MT, this paper investigated six colleges and universities for evaluation and testing. The degree of recognition of the teaching evaluation model and the evaluation results of teachers and students in colleges and universities were tested. The evaluation results were embodied in the effect of the method and system architecture of comprehensively evaluating the teaching quality of teachers' PE courses on the evaluation of PE courses. The number of samples was 1200, and the evaluation results were divided into four levels: satisfied, good, average, and not interested. The specific results are shown in Figure 7.

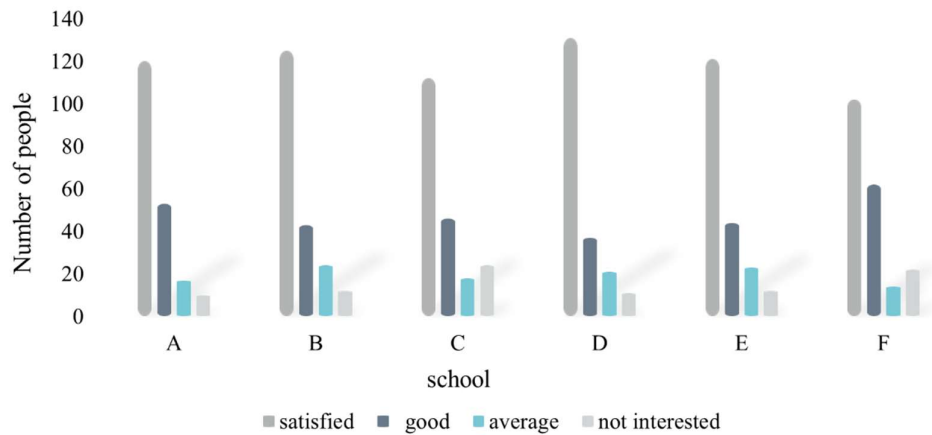


Fig. 7. Recognition degree of the teaching evaluation mode and the evaluation results

As shown in Figure 7, the teachers and students of the six colleges and universities still had a relatively high degree of recognition of the method and system architecture of the teaching quality of the new college PE courses, most of whom were satisfied. Among them, the teachers and students of the two schools B and D had the highest satisfaction with the methods and system architecture of the teaching quality of the new college PE courses, while there were very few students with low satisfaction and no interest. The method of comprehensively evaluating the teaching quality of PE courses in colleges and universities based on AI and MT was very popular and loved by teachers and students, which has played a great role in improving the quality of teaching and the content of teaching courses.

In order to examine the difference between the method of comprehensively evaluating the teaching quality of PE courses in colleges and universities and the traditional teaching evaluation, the teaching efficiency of a comprehensive college under two teaching evaluation modes was investigated. A total of 400 teachers and students were surveyed, and the changes are shown in Figure 8.

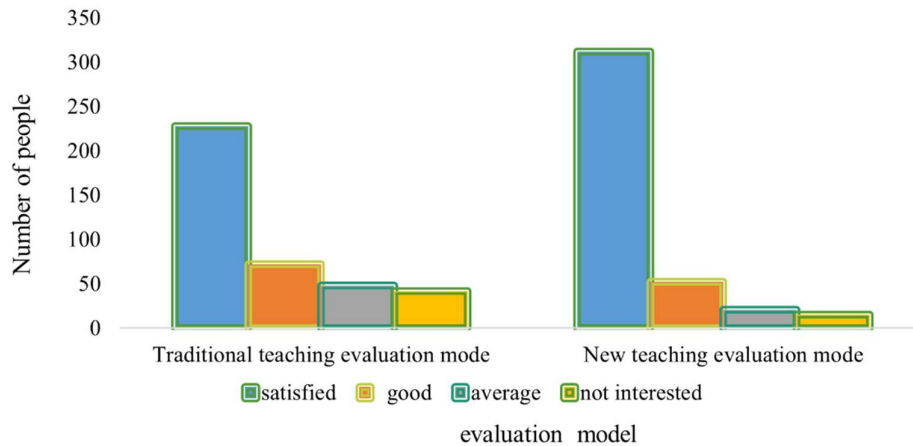


Fig. 8. Teaching efficiency under the two teaching evaluation modes

It can be seen from the bar chart in Figure 8 that both teaching evaluation modes showed a state of floating up and down, but this state was a normal mode. Comparing the two kinds of teaching evaluation, the traditional teaching evaluation mode was relatively old-fashioned, and the recognition of teachers and students for traditional teaching evaluation was relatively low, fluctuating greatly, while the new teaching evaluation model had fluctuations that were little, and the evaluation efficiency was higher.

The development of anything requires a process. Figure 9 shows the specific changes of teachers and students in the improvement of teaching courses, teaching methods, and students' learning behaviors in the six comprehensive colleges under the new teaching evaluation model in 2021.

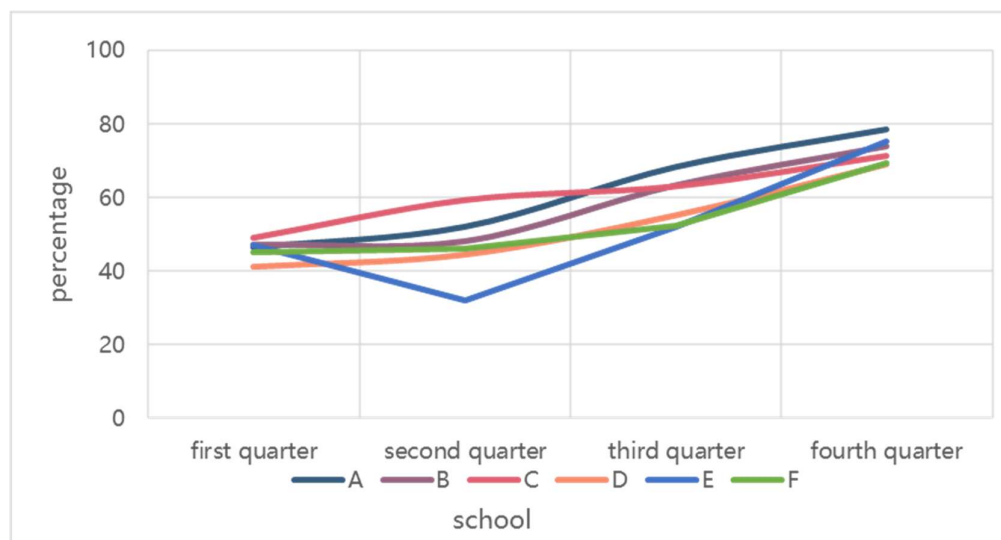


Fig. 9. Specific changes of teachers and students under the new teaching evaluation mode

According to the bar chart in Figure 9, in 2021, teachers and students of these six colleges and universities believed that the quality of teaching and students' enthusiasm for class were improving, and the overall trend was showing a continuous upward trend. During the first quarter and the second quarter, teachers and students of the three colleges B, C, and F believed that the improvement had slowed down, which may be due to the fact that the new teaching evaluation courses made teachers and students uncomfortable. However, with the passage of time, students gradually accepted the method and system framework for comprehensively evaluating the teaching quality of

teachers' PE courses, and the teaching quality also improved. According to the construction of a comprehensive evaluation system for the quality of PE courses based on intelligent algorithms and AI technology, the quality of teaching evaluation of PE courses in colleges and universities has increased by 21.4% after calculation.

7. Conclusions

As the most important part of current teaching work, teaching evaluation can not only determine students' understanding of actual learning content, but also help teachers understand learning goals and learning objectives. This paper first defined the definition of learning assessment and conducted an in-depth analysis of the problem of learning assessment. On this basis, practical strategies for improving learning evaluation were proposed. Classroom teaching evaluation has a very clear supervision function. Through correct teaching evaluation, teachers can be encouraged to change their teaching thinking, so that teachers can innovate teaching in the classroom, formulate planning methods, and modify classroom teaching methods, facilitating face-to-face learning while improving teaching quality to ensure continuous improvement in learning levels. Classroom teaching is a structured, diverse and complex process. Through teaching evaluation, teachers can better understand students' learning and understanding of teaching skills, and analyze the evaluation results, so that teachers can better improve the overall teaching method. In the classroom, it is necessary to meet the appropriate learning content to help students develop their strengths and avoid weaknesses, thus developing in an all-round way.

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