

Research Article

Effectiveness Evaluation of Physical Education Flipped Classroom Teaching Based on Knowledge Construction

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Traditional teaching methods have faced unprecedented challenges as a result of educational reform, but it also presents limitless opportunities. The development of the flipped classroom teaching mode provides inspiration for the development of a PE teaching mode. This paper connects PE teaching with the “flipped classroom” teaching mode and designs an evaluation system for PE flipped classroom teaching based on the perspective of knowledge construction. The weight values of the contents of all levels of the evaluation dimensions of classroom teaching effectiveness are established in this paper, as well as the conceptual model and data table structure of the system database. In addition, using literature, questionnaires, and case studies, this paper investigates the effectiveness and application ideas of the “flipped classroom” teaching mode in PE classes. Experiments show that this method has an evaluation accuracy of 95.37 percent, which is about 13 percent higher than traditional methods. It is feasible and practicable in some ways. Additionally, flipping the classroom can increase student engagement, improve test scores, and increase teacher satisfaction. This study is expected to promote the use of the “flipped classroom” teaching mode in PE classes at colleges and universities, thereby speeding up the reform of PE education.

1. Introduction

PE education has become a vital aspect of the college education system in China as educational reform in colleges and universities has progressed [1]. The old PE teaching model will not be able to meet the needs of future talent development. The most important link in PE teaching reform is the construction of PE teaching mode, and research on the construction of PE teaching mode will help promote PE teaching reform in China [2]. With the rise and development of the new era of network technology in recent years, the teaching mode of “flipped classroom” has rapidly gained popularity around the world, and it has gradually become popular in PE classes. The introduction of the flipped classroom teaching mode [3] provides inspiration for the development of a PE teaching mode. Teachers’ core value in the new teaching mode is no longer previous teaching and learning, and their role as knowledge transmitters is clearly weakened. As a result, the role of teachers will inevitably

change as the classroom changes [4]. Before class, teachers develop teaching resources, organise classroom teaching, guide students’ learning, communicate emotions in class, and promote students’ personalised learning after class [5]. Although there have been some successes as a result of relevant personnel’s ongoing exploration of the flipped classroom mode, there are still some issues [6]. For example, the classroom concept is outdated; individualization and teaching scheme characteristics are lacking; and students’ choice is limited, resulting in a lack of pertinence and characteristics.

The main goal of PE classroom instruction is for students to master as much sports knowledge and skills as possible. The ability of students to master knowledge and skills in class, as well as the extent to which they master knowledge and skills, is a key indicator of PE teaching effectiveness. Not only can flipping the classroom increase student-teacher interaction and personalised learning time, but also it can introduce a brand-new “mixed learning method” [7].

Flipped classroom has strong integration, interaction, and docking as an innovative teaching mode, which can significantly improve the quality of classroom teaching [8]. Teachers' value and status in the flipped classroom must be redefined in comparison to the traditional classroom. In order to better cultivate students' comprehensive ability, effective inversion of content focuses on imparting knowledge points, choosing more diverse carriers to deliver, providing students with self-study before class, helping students solve existing doubts or problems in class, guiding students to ask questions, and involving students in choosing various teaching activities after class. In higher education, the quality of classroom instruction is critical [9]. The impact of computer intelligence on the effectiveness of flipped classroom teaching not only is beneficial for improving teaching quality but also has far-reaching implications for developing high-quality talent [10]. This paper evaluates the effectiveness of PE flipped classroom teaching from the perspective of knowledge construction, based on constructivism's basic ideas. The following are some of its innovations:

- (1) Based on the theory of knowledge construction, this paper evaluates the effectiveness of PE flipped classroom teaching. And from the angle of "control-value" theory, it analyses and studies the effectiveness of flipped classroom. It is novel and exploratory to some extent.
- (2) This paper proposes a model for evaluating teaching effectiveness, as well as a concrete implementation algorithm. This algorithm can evaluate the effectiveness of teaching in an automated, reasonable, and effective manner. Furthermore, this paper examines and discusses how to integrate the effectiveness of the flipped classroom into PE classroom teaching in colleges and universities by utilising a variety of methods such as literature review, investigation and research, data statistics, case study, experience summary, and others.

2. Related Work

Based on the basic proposition of constructivist teaching thought, Lo C et al. conducted research on flipped classroom teaching from the perspective of knowledge construction [11]. Tsai CW et al. explored the nature of "knowledge" and "learning," analysed several key factors affecting the construction of knowledge and skills, and then put forward some suggestions for improving the effectiveness of flipped classroom teaching [12]. Long T and others pointed out that, for the new learning method of flipped classroom, both teachers and students must adapt, but students are the main body of teaching. Participating in teaching through learning is the key to students' learning. Watching videos, checking materials, and discussing with each other are essential processes in this model [13]. Sergis et al. drew on the existing experience of flipped classroom at home and abroad and constructed a flipped classroom teaching model in colleges and universities according to the characteristics of subject

teaching specialty [14]. Hoshang et al. believe that, in the flipped classroom learning project, students are mainly trained to learn independently. Students obtain relevant learning content through various channels and sort out relevant knowledge through personal search and exploration [15]. Martina et al. studied the effectiveness of flipped classroom teaching in schools in the network environment [16]. Landi et al. expounded on three aspects of PE flipped classroom teaching strategies based on an overview of the relevant characteristics of the PE flipped classroom, the impact of PE flipped classroom teaching on students' physical health, and the PE flipped classroom teaching strategy based on students' healthy development. The purpose is to explore effective strategies for PE flipped classroom teaching based on the healthy development of students [17]. Based on a brief analysis of the positive role of flipped classroom in college teaching, Beatty et al. focused on analysing the problems existing in the application of flipped classroom in college teaching and proposed targeted optimization countermeasures [18]. Zheng et al. believe that the application of the flipped classroom teaching model to subject teaching should focus on the integration of various teaching methods. However, some teachers are still relatively weak in this aspect, which directly affects the application of the flipped classroom teaching model [19]. Persky et al. pointed out that, in order to more effectively apply the flipped classroom teaching mode in college teaching, it is necessary to continuously optimize and improve the application mechanism of the flipped classroom teaching mode and strive to improve the level of standardization, efficiency, and systematization [20].

This paper proposes a new research perspective and method based on related literature research on PE flipped classroom teaching. This paper examines the effectiveness of PE flipped classroom instruction from the standpoint of knowledge construction. The overall structure and function of the effectiveness evaluation system are designed and explained using demand analysis, as well as the public login module, data acquisition module, comprehensive effectiveness evaluation module, and statistical query module. The system function and performance tests have also been completed to ensure the system's feasibility. The experiment verifies the system's stability and reliability, as well as the expected function.

3. Methodology

3.1. The Development and Implementation of PE Flipped Classroom Teaching from the Perspective of Knowledge Construction. "Flipping the classroom" refers to students receiving a learning resource package created and uploaded by teachers via the Internet before class, allowing them to learn and master theoretical knowledge ahead of time, a mode of interactive discussion between teachers and students in class, allowing students to internalise knowledge and improve teaching effectiveness. Flipping the classroom is a new approach to traditional classroom instruction. The new "flipped class" PE teaching mode not only completely subverts the traditional PE teaching method but also

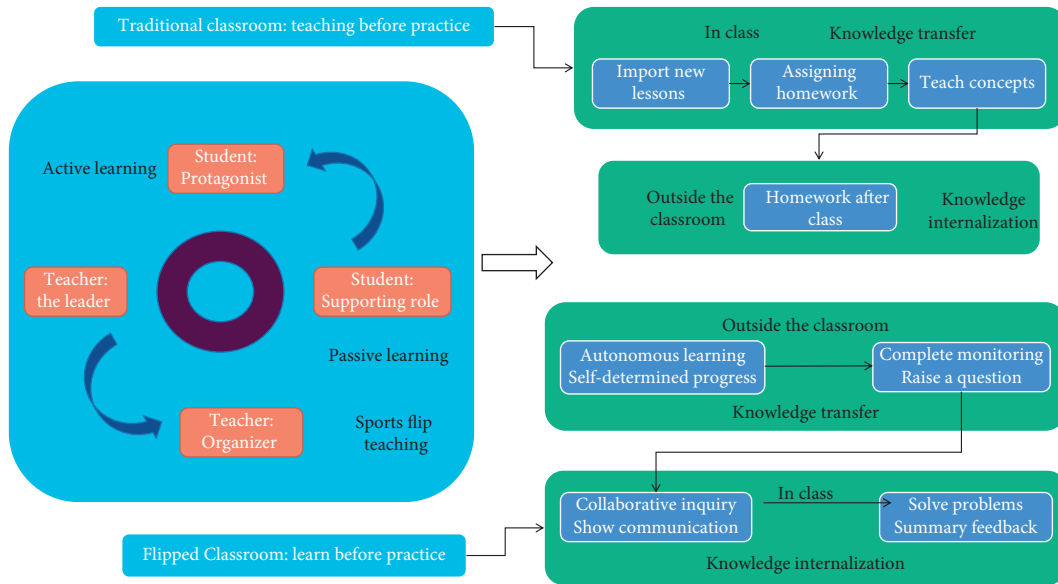


FIGURE 1: Changes in the flipped classroom.

significantly improves the teaching effect of PE class and improves students' overall health [21]. It can also help teachers and students play a more positive role in the classroom by making teaching activities more integrated, interactive, and efficient. In the application of "flipped classroom" in teaching, information technology is critical. The use of the "flipped classroom" teaching mode requires the use of the Internet and computer technology, as well as the implementation of flipped classroom teaching and learning by creating an open teaching environment with information circulation. As a result, computers and certain information technology capabilities are required for students' learning, teachers' production, and guidance. Simultaneously, the "flipped classroom" teaching mode requires PE teachers to devise and implement more scientific and effective teaching strategies and complete more teaching tasks in a shorter amount of time.

Efforts should be made to promote the integration of flipped classroom teaching methods in PE teaching in colleges and universities in order to achieve better results. It is critical to make the classroom teaching mode the main line, with traditional and modern teaching methods as needed. Teachers should have a preliminary understanding of each student's sports level and interest items in the "flipped classroom" teaching mode in order to know fairly well and thoroughly implement the teaching method of "teaching students in accordance with their aptitude" [9, 23]. The successful implementation of the "flipped classroom" teaching mode necessitates not only the provision of hardware but also the active learning of students prior to class. With the goal of improving classroom interaction, "flipping the classroom" encourages students to prepare course content independently before class using teaching videos provided by teachers and to bring doubts into the classroom for discussion and exploration. The change of flipped class is shown in Figure 1.

Because preclass learning requires learners to spend a lot of time and energy and there is no teacher's restraint and supervision in the learning process, "flipping the classroom" is undoubtedly a challenge to students' ability. This teaching mode requires students to have more time and energy, higher self-study ability, and self-control. This requires that schools should pay attention to the assignment of students' after-school tasks and ensure that students can participate in the teaching mode of "flipped classroom" so as to achieve the teaching effect of "flipped classroom" [23]. "Flipping the classroom" flips the teaching procedure of the traditional teaching mode and turns the traditional classroom "teacher-centered" into a "paradise" for interactive discussion between teachers and students with "learning activities as the center." The application of flipped classroom teaching mode in PE teaching in colleges and universities is conducive to the construction of a teaching system combining "online" and "offline." It can give full play to students' autonomy, make students more involved in classroom teaching, and inspire students' thinking. From the perspective of movement technology construction, students' knowledge learning should be an autonomous activity. Students' knowledge, ability, and attitude are not from scratch but based on an existing knowledge structure. The existing experience in action technology is always the starting point of new action technology construction. Students should give "diversified" feedback to PE teachers according to their respective training programs.

The use of the "flipped classroom" in PE classes raises the bar for teachers' ability to organise their classrooms. Classroom teaching is organised around teacher-student interaction, which necessitates interactive materials, and classroom discussion necessitates learners preparing discussion materials ahead of time [24]. As a result, learners must study and think about the learning content before class, as well as identifying and solving problems based on the knowledge points presented by teachers, as well as

consulting materials. Record problems that students are unable to understand and solve in real time and wait for them to be solved in class, providing material for classroom interaction. In PE teaching, the natural environment of the playground is combined with the psychological environment of the students. Abstract teaching content is not conducive to learners' knowledge construction, and formal teaching out of context is bound to be boring. Students can only master and apply knowledge when they are placed in a safe and comfortable environment and try their hardest to gain experience and construct knowledge in practical tasks [25]. The concept of "flipping the classroom" emphasises teaching students according to their abilities. Students differ in terms of their learning abilities and interests. According to the specific situation of students, teachers should divide students into groups with similar learning interests and abilities, and students should learn in groups.

Students can properly conduct autonomous training according to video explanations and have enough time to communicate with teachers in "flipped classroom" mode, allowing them to study in a targeted manner. At the same time, through interaction, we can pay more attention to students' physical health and learning emotional problems. PE teachers are well aware of the role and function of positive learning emotion in PE instruction. Turning over the development of PE emotion [26] in the classroom can help students' cognitive levels improve and make the construction of knowledge and motor skills easier and more solid, thus improving classroom teaching effectiveness. Flipping the classroom teaching mode from "teacher-centered" to "student-centered" emphasises students' subjective initiative and is people-oriented. This is a critical component in putting the concept of quality education into practice. College and university PE teachers should gain a better understanding of this and actively pursue the path of effectively implementing the flipped classroom teaching mode in the classroom.

3.2. Construction of Effectiveness Evaluation System for PE Flipped Classroom Teaching. Teaching effectiveness is a dynamic and developing concept. Efficient learning indicates that the smaller the input-output ratio of students per unit time, the higher the efficiency; that is to say, students invest a small amount of time and get relatively more learning results. Generally speaking, the effectiveness of teaching means that teachers and students work together to achieve the expected teaching goal, complete the expected teaching task, and obtain the expected teaching effect. The effectiveness evaluation of flipped classroom teaching plays a major role in the whole teaching evaluation system because classroom is the main way for students to acquire knowledge, and the quality of teaching is the key for students to master a course well. The evaluation of teaching effectiveness of flipped class is mainly to objectively summarize the effective scope and laws of flipped class, point out how to make flipped class more effective in guiding the implementation of flipped class, and improve its pertinence and effectiveness so as to maximise the efficiency and benefit of flipped classroom teaching. The structure of the PE flipped classroom

teaching effectiveness evaluation system constructed in this paper is shown in Figure 2.

The teaching effectiveness evaluation system based on the perspective of knowledge construction mainly consists of five modules. They are public login interface module, data collection module, effectiveness comprehensive evaluation module, statistical query result module, and system maintenance module. According to the demand, the system needs to manage the information of teachers and students, including major, class, and other pieces of information besides basic information, so the basic information maintenance includes major, class, and teacher and student information management. Academic affairs office is realized by data entry and batch import. The effectiveness evaluation module is the core part of the system, which is mainly responsible for preprocessing the collected data in the database, forming an information table, learning inference rules by attribute reduction according to the information table, and using evaluation rules to obtain decision rules.

The teaching process is a random process. Students in a class are divided into four grades: excellent, good, medium, and poor. The ratio of students in each grade to the total number of students is used as a state variable, which is expressed by a vector as follows:

$$A(t) = (x_1(t), x_2(t), x_3(t), x_4(t)). \quad (1)$$

Among them, t represents the t th exam, $t \in \mathbb{N}$. We have

$$\sum_{i=1}^4 x_i(t) = 1. \quad (2)$$

It can be approximated that $x_i(t)$ is a homogeneous Markov chain. Assuming that, after the first test, the number of excellent, good, middle, and poor students of n students in a class is

$$n_i (i = 1, 2, 3, 4). \quad (3)$$

Then, the vector is

$$A(1) = \left(\frac{n_1}{n}, \frac{n_2}{n}, \frac{n_3}{n}, \frac{n_4}{n} \right). \quad (4)$$

If after the first test, the n_1 students who originally got the best grades still maintain the top grades, there are n_{11} students, and the good, medium, and poor students are n_{12} , n_{13} , and n_{14} . By analogy, the transition situation matrix is composed as

$$P_{4 \times 4} = \begin{bmatrix} \frac{n_{11}}{n_1} & \frac{n_{12}}{n_1} & \frac{n_{13}}{n_1} & \frac{n_{14}}{n_1} \\ \frac{n_{21}}{n_2} & \frac{n_{22}}{n_2} & \frac{n_{23}}{n_2} & \frac{n_{24}}{n_2} \\ \frac{n_{31}}{n_3} & \frac{n_{32}}{n_3} & \frac{n_{33}}{n_3} & \frac{n_{34}}{n_3} \\ \frac{n_{41}}{n_4} & \frac{n_{42}}{n_4} & \frac{n_{43}}{n_4} & \frac{n_{44}}{n_4} \end{bmatrix}. \quad (5)$$

P is the one-step transition probability matrix.

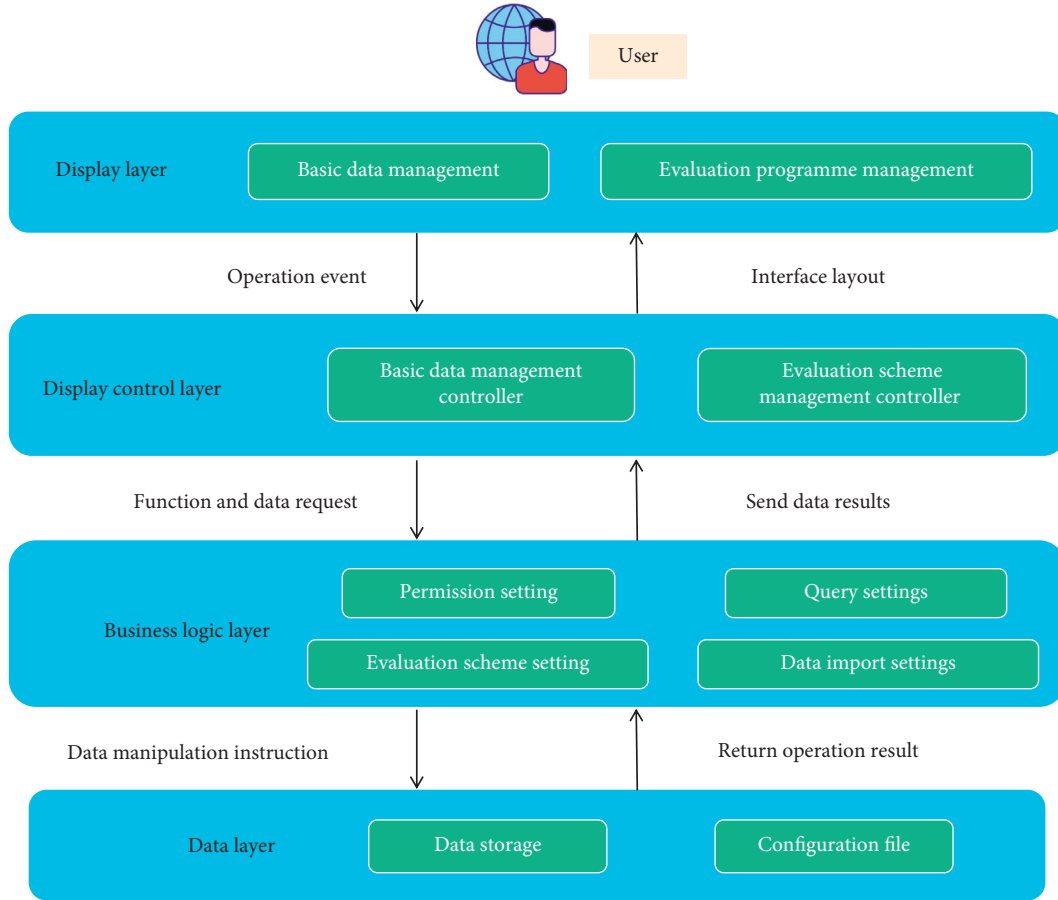


FIGURE 2: The structure of the PE flipped classroom teaching effectiveness evaluation system.

In addition to entering the data of teachers, majors, and classes, you can also enter these data records in Excel files in advance and import these data into the system database through the data import function. The imported data format needs to be set in advance, and the imported data format is generally fixed, but at the beginning of the new semester, the format is often fine-tuned. Because there are many types of attributes in each data table, many attribute types are general or remark data, so it is difficult to mine them. Therefore, this system mainly extracts the related attributes from the basic information table and the employee title table and forms a training set to generate decision trees and related rules. Other data tables only participate in teaching evaluation as attributes of data mining. After the establishment of the hierarchical structure model, aiming at the factors of the previous level, the factors of the next level are compared with each other pairwise, and the relative importance degree is obtained. According to this, the form of matrix is written to complete the judgment matrix. When users use the system, they first need to enter their user name and password to log in. If they are illegal users, the system will quit the login operation. If they are legal users, the system will further judge the user's rights and then guide the users into the corresponding management module. Different management modules have different levels of management authority. In order to realize the convenience of operation of the system,

users do not need to complete the corresponding settings in the system during operation and need to complete the settings of the imported data format through some configuration files, which are generally stored in files such as Web.XML. Given a knowledge representation system $S = \langle U, R, V, f \rangle$ for each subset $X \subseteq U$ and an indistinguishable relation B , the upper and lower approximation sets of X are defined by the basic set of B as follows:

$$\begin{aligned} B_*(X) &= \cup \{Y_i | (Y_i \in U | \text{IND}(B) \wedge Y_i \subseteq X)\}, \\ B^*(X) &= \cup \{Y_i | (Y_i \in U | \text{IND}(B) \wedge Y_i \cap X \neq \emptyset)\}. \end{aligned} \quad (6)$$

Among them, $U | \text{IND}(B) = \{X | (X \subseteq U \wedge \forall_x \forall_y \forall_b (b(x) = b(y)))\}$ is the division of indistinguishable relation B to U , and it is also the set of B basic sets of universe U .

$$\begin{aligned} B^*(X) &= \{x | (x \in U \wedge [x]_B \subseteq X)\}, \\ B_*(X) &= \{x | (x \in U \wedge [x]_B \cap X \neq \emptyset)\}. \end{aligned} \quad (7)$$

There is a lot of data in the evaluation of teaching effectiveness that needs to be mined. The teaching effectiveness evaluation data mining system can be used as a general data mining tool to eliminate a lot of repetitive work in teaching effectiveness evaluation and is technically feasible. Setting up a data backup strategy on the database platform is required to ensure data security. When data is accidentally

deleted during a daily incremental backup operation, for example, the system administrator or database administrator can restore to the database before it is deleted, export relevant data records, and restore to the current database. The functions of the teaching effectiveness evaluation data mining system should include attribute definition, feature extraction [27, 28], decision tree and rule generation, and data prediction, according to the design goal. Prior to data mining, define the issues that must be resolved. Data mining is only suitable for users' needs if the question is precisely defined. The most important aspect of the question definition is to choose the mining attributes. If there is class C in the dataset, the relative frequency of class c samples in node t is $p(c|t)$, and the information entropy of node t is

$$\text{Entropy}(t) = - \sum_{c=1}^c p(c|t) \log_2 p(c|t). \quad (8)$$

If the node t_0 contains n data, k subnodes are generated after splitting, and the information gain is defined as

$$\text{Info Gain} = \text{Entropy}(t_0) - \sum_{k=1}^K \frac{nk}{n} \text{Entropy}(t_k). \quad (9)$$

In order to avoid the overfitting problem, the information gain rate is usually used instead of the information gain as the criterion for evaluating the quality of the split:

$$\begin{aligned} \text{Info Gain Ratio} &= \frac{\text{Info Gain}}{\text{Split Info}} \\ &= \frac{\text{Entropy}(t_0) - \text{Entropy}(t_k)}{- \sum_{k=1}^k nk/n \log_2 (nk/n)}. \end{aligned} \quad (10)$$

Flipping the classroom makes the teacher change from the knowledge giver in the traditional classroom to the promoter and guide of learning. This shows that teachers are no longer the center of knowledge transmission but the main promoters of students' autonomous learning. When students are in doubt and need help, PE teachers will give the greatest help and support. The data sources and evaluation methods of PE teaching effectiveness evaluation generally consist of the following parts: testing students' scores, questionnaires, on-the-spot lectures, students' online scoring evaluation, educational supervision data, and so on. Most of the time, students' online scoring evaluation is realized. Simultaneously, students can submit online questions about issues encountered during the evaluation process, and teachers will respond. The establishment of an index system is essential for improving evaluation objectivity and accuracy. The index system is a collection of all factors to consider when evaluating specific teaching activities, teaching objectives, and management objectives, and it is a specific provision for the quality and quantity requirements of teachers' teaching activities. School educational supervision, in addition to student scoring, is an important part of evaluating effectiveness. One of the assessment indicators is educational administration supervision. At present, the evaluation of educational administration supervision is stored in the educational administration supervision

TABLE 1: Dimensions of teaching effectiveness evaluation.

First-level dimension	Secondary dimension	Tertiary dimension
Teacher	Teaching role (B1)	Developer of teaching resources (C1)
		Organiser of classroom teaching and guide of students' learning (C2)
	Education and teaching philosophy (B2)	Facilitator of students' personalised learning (C3)
		Able to adapt to new teaching methods and evaluation methods (C4)
Subject knowledge quality (B3)	Pay attention to cultivating students' high-order thinking ability and creativity (C5)	
	Familiar with subject knowledge and thought (C6)	
	Understanding the nature of subject knowledge (C7)	
Information technology literacy (B4)	Proficiency in modern information technology (C8)	
	Ability to make microcourses (C9)	
Student	Student role (B5)	Autonomous learners of preclass teaching resources (C10)
		Collaborators in classroom learning (C11)
	Comprehensive capacity (B6)	Participants in classroom communication and interaction (C12)
		Master the basic knowledge of the subject (C13)
	IT capability (B7)	Independent learning ability (C14)
		Master information technology knowledge (C15)
	Skilled use of information technology equipment (C16)	

business system of the academic affairs office, which is the data input by the school educational administration office through the system during each educational administration supervision and is divided into five levels: very satisfied, satisfied, basically satisfied, average, and dissatisfied. Therefore, it is necessary to import these data. The dimensions of teaching effectiveness evaluation are shown in Table 1.

Ordinary users are not permitted to modify the data in order to maintain the integrity of the original data. As a result, when entering the module, authentication is required, and only the administrator with the correct user name and password can edit data. Send the imported parameters to obtain supervision data according to the supervision data service configuration. The supervision data is obtained from

the server and imported into the database in batches, which makes supervision data query and statistical summary easier. The system automatically records the import log of each data record during the data import process, and the operator can check the data situation while supervising data import. The weight values of dimensions are determined using an analytical hierarchy process at all levels, but the weight values of dimensions cannot directly evaluate the effect of flipped classroom teaching, so we set the scores of evaluation dimensions of scheme level in achieving the goal based on actual needs. An evaluation scheme consists of several evaluation indexes, each of which has a different weight, and the weights of all evaluation indexes add up to 100. Each index is completed using the percentile system when evaluating teachers. In this model, we use pedagogy theories and educational measurement to assess the effectiveness of teaching using test scores and questionnaires from students.

4. Result Analysis and Discussion

The effectiveness of flipped classroom teaching is measured by a set of measures or schemes implemented in the process of maximising the impact of flipped classroom teaching activities, meeting expected teaching objectives, and completing expected teaching tasks. Effectiveness can also be used as a metric for reexamining. The researchers' accurate understanding of interactive teaching mode is deepened by reexamining interactive learning from the perspective of "effectiveness," which highlights students' thematic position. The key point is to establish the evaluation dimension content of flipped classroom teaching, determine which contents of flipped classroom teaching should be evaluated and which should not, and provide specific quantitative or qualitative requirements, or both, to better guide the implementation of flipped classroom. The effectiveness evaluation system for PE flipped classroom teaching was designed and analysed in the previous chapter, and this section will analyse the system using practical examples. This case involves a university freshman teacher and student. For freshmen, the course is PE. The goal of this case study is to use a quantitative evaluation dimension table to reflect on the implementation of PE flipped classroom teaching activities. The evaluation table of classroom activities is shown in Table 2.

Data collection is the premise and foundation of data analysis and mining. Data preprocessing plays a vital role in the success of data mining. The work in the data preparation stage mainly includes data collection and preprocessing, which occupies a large part in the whole data mining process, and it takes a lot of time to prepare data. At the same time, it is also a major difficulty in the practical application of data mining. Data preprocessing is a series of processing work, such as necessary cleaning, integration, transformation, and dispersion, on the original data to be studied before knowledge discovery so as to meet the minimum norms and standards required by mining algorithms for knowledge acquisition research. Because data information is scattered in different data materials and its storage methods may be different, it brings great difficulties to data collection. At the

TABLE 2: Evaluation table of classroom activity effect.

Type	Very devoted (%)	General input (%)	Passive input (%)	Unable to invest (%)
Team discussion	10.36	62.14	23.49	4.01
Brainstorm	3.65	54.72	38.37	3.23
Teacher led discussion	21.35	53.27	19.87	5.51
Group presentation	9.98	31.46	39.89	18.67

same time, some data are lost due to the negligence of management departments in daily management, which will bring difficulties to system testing. In this paper, the SQL Server Analysis Services component is used to provide a platform for data analysis and data preprocessing so as to classify or preprocess the data in the database. Data preprocessing includes rejecting certain data according to certain rules. This data preprocessing tool provides a convenient data processing platform for some data mining application systems and improves the efficiency of data mining. This paper compares different methods to verify the performance of this method. The recall results of different methods are shown in Figure 3. The accuracy is shown in Figure 4.

Due to the limited data sources of this case, the amount of data actually used for mining is not sufficient, and most of them are temporarily edited data, so the model finally generated by this system has a certain deviation. In this paper, the data layer of the system adopts Microsoft database platform, which provides the management of system data. Besides data management, some system configuration settings are also implemented. As mentioned above, first enter the system and select the "data mining" module of the system to define the attributes of data mining. Select related data tables and their related attributes to generate data mining tables, and then filter the data of the tables to generate training sets. When using theory to deal with the decision table, it is required that each value in the decision table be expressed by discrete values. If the value range of some conditional attributes or decision attributes is continuous, it must be discretized before processing. We will compare the PE scores of students who use traditional teaching methods with those who use flipped classroom teaching. The results are shown in Figure 5.

Testing students' scores, questionnaire surveys, on-the-spot lectures, students' grading evaluations, and educational supervision data are all common methods of teaching evaluation. A variety of quantitative and nonquantitative data is obtained as a result of this. Comprehensive evaluation is required to comprehensively analyse and study these data, make value judgments, and arrive at evaluation conclusions. The comprehensive evaluation method is used in this paper to calculate relevant indicators in order to complete the comprehensive evaluation of evaluation indicators, which is to complete the comprehensive evaluation of teachers' teaching quality using data from student evaluation and

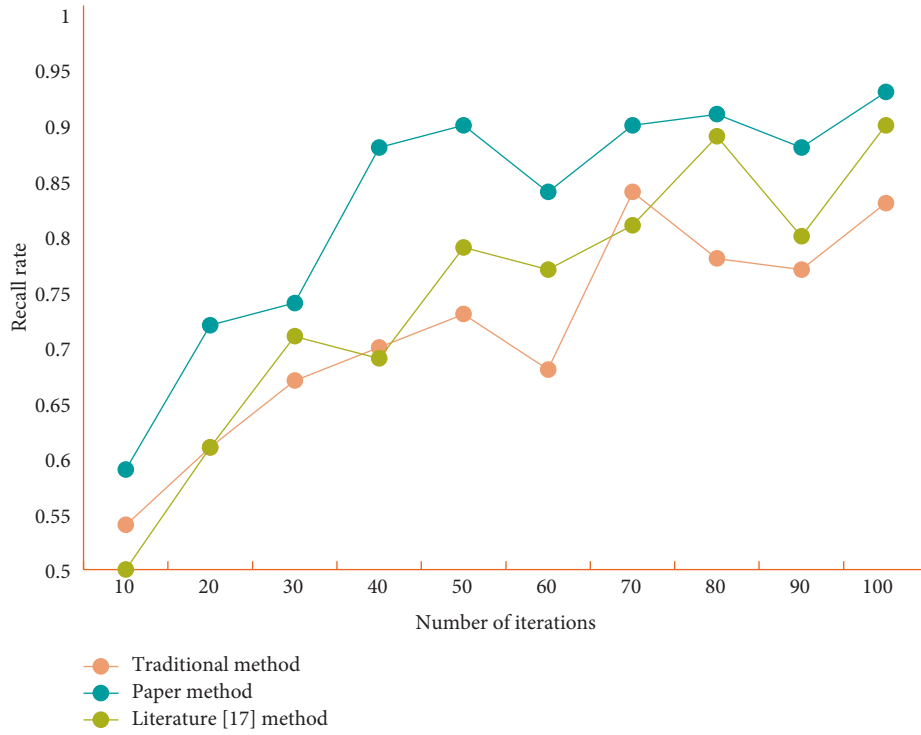


FIGURE 3: Comparison of recall results.

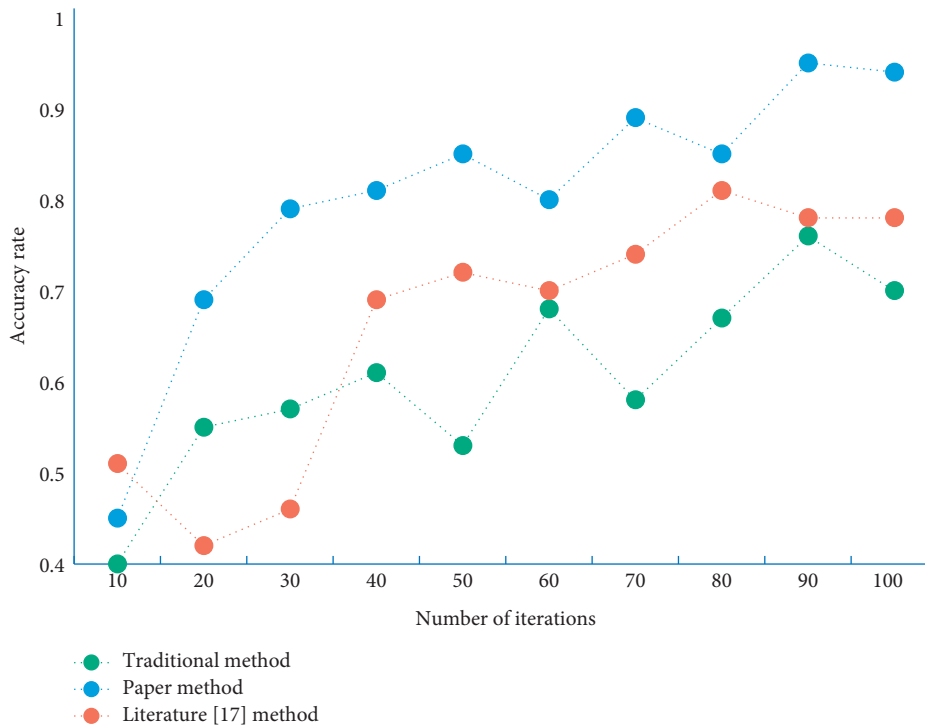


FIGURE 4: Comparison of accuracy results.

teaching supervision. Data redundancy still exists in the information system after attribute reduction because attribute reduction is only a part of data reduction. Not every attribute is necessary for every object. The goal of value reduction is to eliminate redundant attributes and simplify

the information system even further. The achievement evaluation is used to calculate the comprehensive scores through each weight, and the achievement inquiry is used to inquire about the comprehensive evaluation scores of teachers, which are displayed in the form of tables, with the

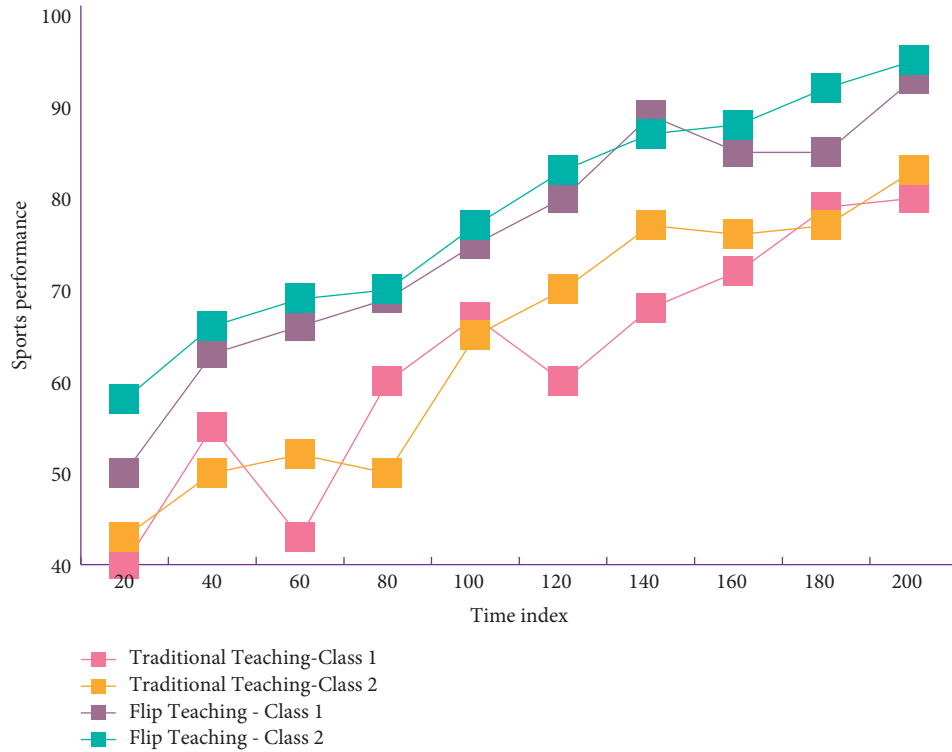


FIGURE 5: Comparison of students' PE scores.

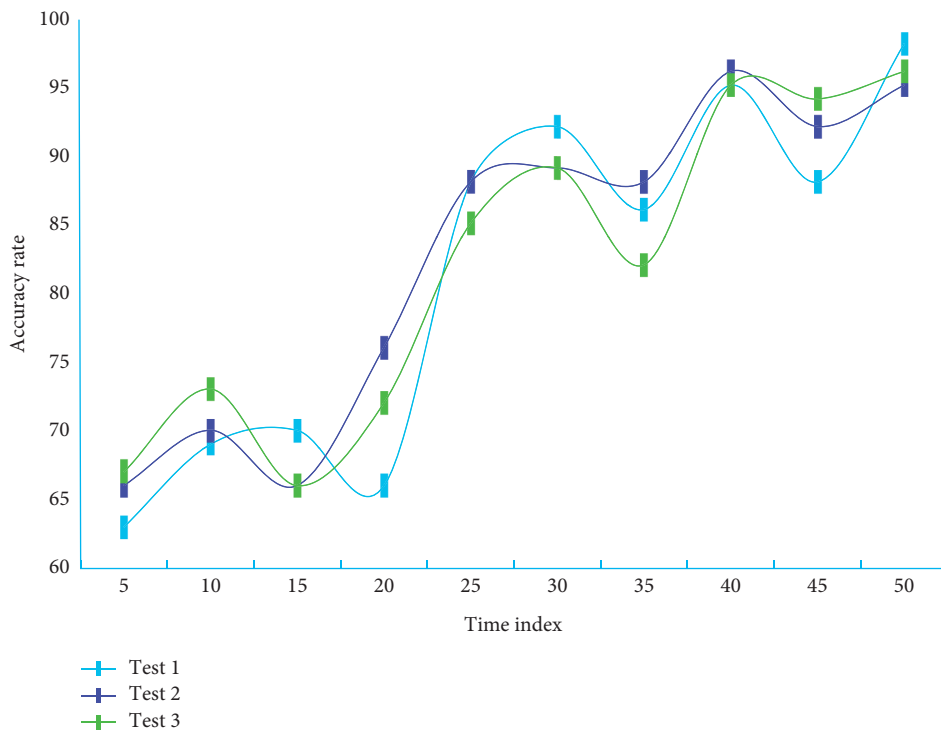


FIGURE 6: Accuracy test.

table information including teachers' names, course names, and evaluation scores. Select and summarize some attribute characteristics related to learning effect from the platform's data set, which primarily includes the number of courses entered, the number of assignments handed in and the

results of each assignment, the number of online reading resources, the number of study notes, and the scores of stage quizzes and elective courses. Many experiments were carried out in order to verify the system's reliability. The result is shown in Figure 6.

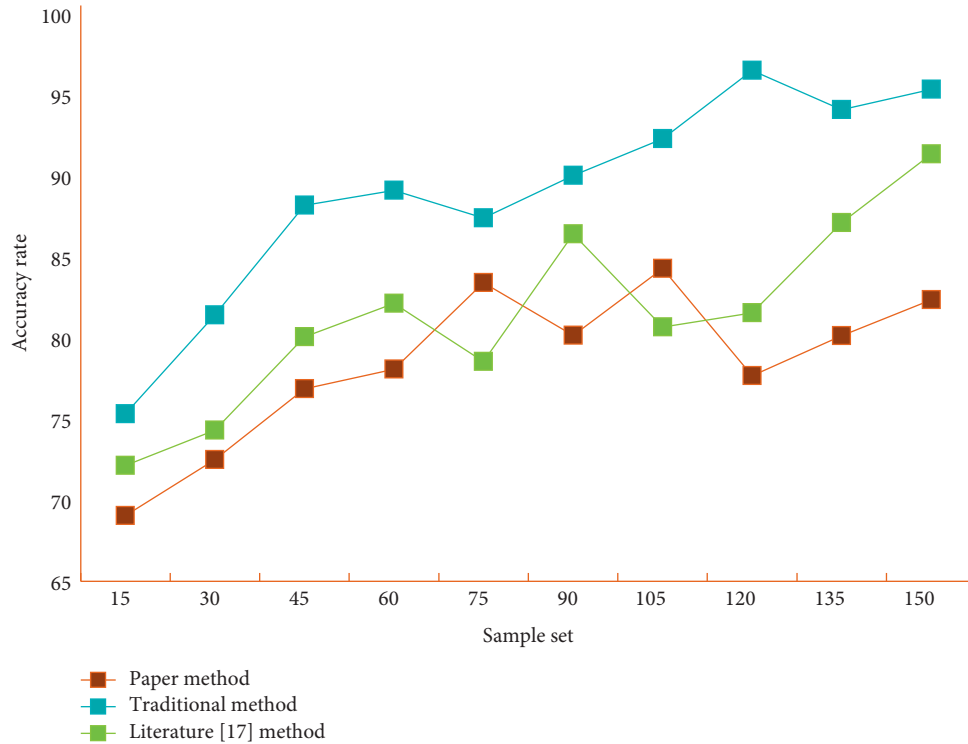


FIGURE 7: Evaluation results of different methods.

It can be seen that the accuracy of this system is relatively stable and has been at a high level. When calculating teaching evaluation indexes, students' evaluation and teaching supervision data have corresponding weight coefficients, and calculation weight management includes evaluation weight inquiry and evaluation weight maintenance. The evaluation weight query is used to query the calculation weights of student evaluation and teaching supervision data, each weight is always 100, and the evaluation weight maintenance is used to maintain the names and coefficients of each weight. Through the implementation of flipped classroom teaching and evaluation dimension quantitative table, we evaluate the flipped classroom activities jointly carried out by teachers and students. According to the comparison of flipped classroom implementation process and evaluation dimension quantitative table one by one, this PE course basically meets the content of evaluation dimension. In particular, the teaching content, the use of media, and the interaction between teachers and students and students in the classroom are fully reflected. According to this model, the teaching department should conduct targeted discussions or interviews on the teaching with different degrees, analyse the main factors that affect the teaching effect, summarize the teachers' suggestions and opinions on improving the teaching quality, find out the main reasons that affect teachers' teaching work, actively take corresponding measures to improve the work enthusiasm of teachers with different degree levels, strengthen teachers' teaching management, and improve teachers' teaching quality and teaching effect. In order to verify the feasibility and superiority of this system, we use different

methods to evaluate the effectiveness of PE flipped classroom. The comparison results are shown in Figure 7.

In the flipped classroom mode, the roles of teachers and students have been flipped, and the relationship between teachers and students has also been flipped. The main advantage of flip-flop classroom is that students fully present the problems they encounter in learning in class and solve them after interaction with teachers and peers in class, which is also the main feature that distinguishes flip-flop classroom from traditional classroom. Experiments in this paper prove that this method is practical and feasible. And the evaluation accuracy of this method is as high as 95.37%, which is about 13% higher than that of traditional methods. At the same time, the experiment shows that flipping the classroom plays an active role in stimulating students' interest, improving test scores, and improving teachers' job satisfaction. Using PE flipped classroom teaching is effective.

5. Conclusions

In the new era of rapid development of information technology, flipped classroom has been paid more and more attention. Flip-over classroom gives students more freedom to learn, which not only reconstructs the harmonious relationship between teachers and students but also promotes the effective utilisation and development of teaching resources. However, there are still some colleges and universities that do not deeply realize the role of flipping the classroom in the process of PE teaching, so they lack scientificity in the process of application. At the same time, there is no effective arrangement and design, which directly

leads to the low overall level of flipped classroom teaching mode, which needs attention and major improvement. Based on the perspective of knowledge construction, this paper evaluates the effectiveness of PE flipped classroom teaching. Experiments show that the evaluation accuracy of this method is as high as 95.37%, which is about 13% higher than that of traditional methods. It has certain practicability and feasibility. Practice has proved that flipping the classroom can stimulate students' interest, improve test scores, and improve teachers' job satisfaction. This system can not only analyse the data of teaching and quality evaluation but also extract the main attribute characteristics that affect the learning effect so that teachers can know the students' learning situation in time during the teaching process and then adjust the teaching methods or do personalised counseling to improve the quality of PE teaching. In the specific implementation process, relevant personnel should scientifically design and systematically arrange the flipping classroom teaching mode. In particular, it is necessary to combine the actual situation of PE teaching in colleges and universities, strengthen the innovation of application concept of flipped classroom teaching mode, and promote the integration of application methods of flipped classroom teaching mode, so that the application of flipped classroom teaching mode in PE teaching in colleges and universities can achieve better results. Although this paper has achieved some research results, there are still some shortcomings and areas for improvement in the research process, which will be continuously improved in the follow-up work.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors do not have any possible conflicts of interest.

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