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Research Article

A Study on the Effect of the Club Model on the Effectiveness of College Volleyball Teaching Based on a Random Matrix Model

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This paper constructs a random matrix-based teaching evaluation model for college volleyball clubs and deeply investigates the impact of a random matrix-based teaching evaluation model for college volleyball clubs on the effectiveness of college volleyball teaching. Based on random matrix theory (RMT), we analyze the data characteristics according to the single ring law. By introducing matrix Stein pairs, combined with the Laplace transform method, some concentration inequalities of random matrices are proved, and these inequalities play a very important role in the study of eigenvalues of random matrices. The random matrix model was used to analyze the changes brought by the club-based curriculum teaching to students' physical quality, and a random matrix-based assessment model of college volleyball club teaching was proposed. The model fit test and independence test were conducted using IBM SPSS Statistics 20 software, and an online survey in the form of Questionnaire Star platform was used to map the correlation between college volleyball education and club-based teaching reform with X college physical education students as the research subjects, to provide more scientific theoretical guidance for the influence of club-based teaching mode of physical education courses on the physical quality of college students.

1. Introduction

The continuous and healthy growth of the people is always an important historical symbol of the prosperity and prosperity of a country. In recent years, with the continuous development, the economy, politics, education, and military have been gradually strengthened, and the comprehensive national power has been gradually enhanced because of the contribution of talents in various fields [1]. Because of this, the country has increasingly high requirements for talents, who not only have profound professional knowledge but also need to have a strong and healthy body. Colleges and universities are the bases for cultivating reserve talents and are the source of guaranteeing that talents in various fields of the country are constantly put into national construction. In recent years, as the requirements of talents for social development have become higher and higher, colleges and universities have carried out educational reforms accordingly [2]. In the background of the new cultural education concepts, breakthroughs and innovations are constantly made, and physical education, as an important part of college education, has an irreplaceable role in the process of students' physical and mental development and sound personality. School is an important platform for students to acquire knowledge and improve their abilities, it is also a turning point for them to contribute to society and the country, and school sports play the role of "escort." The quality and health education of students fully reflect the irreplaceable role of physical education, the physical and mental health of students needs the process of physical education to achieve, and it is an indispensable process for students to develop good physical behavior in their lives and to shape the foundation for lifelong physical education [3]. The reform of physical education in higher education, with health first as the guiding ideology, integrates the concepts of "sunshine sports" and "lifelong sports," and innovates the implementation of sports clubs.

Stochastic matrix theory, in general, is the theory of randomized matrix processes; that is, this theory is the product of the combination of matrix theory and stochastic processes. At the same time, random matrix theory is also an important basic mathematical research discipline in the diversified discipline of stochastic statistics and data analysis engineering [4]. Random matrix theory focuses on the statistical properties of the eigenvalues (or singular values) of random matrices. It plays an important role as an important research area of probability theory in machine learning, operations research and cybernetics, and computational mathematics. The main reason for the eventual success of random vector matrices is due to the universality of the design theory of random vector matrices: the values of each eigenpoint in them are correlated with the values obtained as a probability-averaged horizontal distribution spacing not relying exclusively on the average distribution of probabilities. This algebraic property is widely considered to be the basic research basis for the algebraic theory of random variable matrices. It shows that various theoretical spatial correlations of random function matrices with their eigenvalues are also fully compatible with Boolean's law. The country's requirements for talents are getting higher and higher, not only have deep professional knowledge, but also need to have a strong physique.

Traditional college volleyball courses do not highlight the fitness of volleyball or are teacher-centered, teachers to students there are the phenomenon of indoctrination teaching, and students follow the teacher's way of thinking and lack independent thinking and independent thinking environment [5]. Club teaching, on the other hand, is student-oriented, giving students ample space for performance and practice environment, cultivating students' awareness of willingness to learn, awareness of independent exercise, ability to actively participate in the exercise, enhancing the awareness of sports from "required exercise" to "independent exercise," and transforming. This study is based on a random matrix to construct a college volleyball team. This study is based on a random matrix to explore the effect of club teaching on the effectiveness of volleyball teaching in colleges and universities, hoping to find a teaching model that is more suitable for students' sports needs and integrated with the current society. By updating and reformulating the teaching content, teaching process, teaching methods, teaching evaluation, and teaching programs, the needs of students who choose volleyball classes will be met [6]. The implementation of the club teaching model for volleyball courses allows all the needs of students to be met, and this model will have an enhanced physical fitness and good health status for students, thus improving the athletic ability of college students and forming a lifelong sports mindset.

Physical education allows students to learn about sports through physical activity, both to enhance their physical fitness and to develop a lifelong awareness of physical education for a rapidly developing modern economy. With good physical fitness, students' options for choosing a career become more and can play a positive role in promoting the prosperous development of the socialist market economy, allowing students to better serve society. In the process of volleyball teaching, individual differences are more likely to be highlighted due to the different learning abilities of students, so how to change the teaching mode and respect the individual development of students is a problem now faced by vocational and technical colleges, and the sports club teaching mode focuses on the physical quality of each student, aiming to make students develop a good lifelong sports ideology, in line with the physiological and psychological characteristics of students at this stage.

2. Related Works

Foreign universities began to explore the construction of on-campus sports clubs at the early stage of club formation, and after continuous exploration and practice, the teaching and operation mechanism of sports clubs reached maturity. Some countries and regions such as Europe, America, and Japan, of them, build on-campus and off-campus sports clubs with single sports items so that student's participation in sports clubs becomes a new communication platform [7]. They all aim to improve students' motivation and thus develop a lifelong sports mindset. McIntosh et al. pointed out that the student choice system is a system in which the school proposes several types of sports as the content of physical education learning, and students choose the type of sport they want to learn and then perform the learning activities [8]. In the study of Ge et al., it is suggested that the development of sports in German colleges and universities started after the early 20th century, and after more than 200 years of development, various sports clubs in Germany have reached 91,000, with more than 27.6 million members, accounting for more than 1/3 of the total population of Germany (more than 82 million) [9]. In Germany, engaging in sports has been fully integrated into people's lives, and people treat physical exercise as a serious matter and play sports for a certain period within a specific period. McGrath et al. pointed out that the teaching of sports clubs in colleges and universities has an important influence on students' interest, awareness, perception, and emotion of sports, which is conducive to the establishment of a lifelong view of physical exercise [10]. Xie et al., in his study of the development of the implementation of the sports club teaching model in colleges and universities, analyzed the organizational composition, construction ideas, advantages and disadvantages, and existing problems of sports club teaching, respectively, and pointed out the differences between sports club teaching and traditional sports teaching, and that compared with the limitations of traditional sports teaching, sports club teaching is carried out in diversified forms, which is more in line with the development needs of today's society [11].

Stochastic matrix theory is a numerical analysis method in terms of matrices, mostly used to study complex systems, and is a discipline with important applications in many fields such as physics, engineering, and finance. The theory enables spectral energy analysis and eigenstate learning of complex systems, while obtaining the degree of randomness of data in complex systems, enabling the study of system structure and

properties from the macroscopic domain [12]. Unlike the traditional matrix theory, a random matrix is a matrix whose internal elements are random variables, so the random matrix theory can be said to be a theory combining matrix theory and probabilistic theory. Foreign research on matrix inverse eigenvalue problems started earlier, and Ntzoufras et al. first proposed matrix addition and multiplication problems for inverse eigenvalue problems [13]. However, the improvement of the effect brought by the intrinsic dimension is not always significant; for example, the difference between the intrinsic dimension and the dimension of the matrix itself is not significant in the case that all the eigenvalues of the matrix are essentially the same. In addition, Rana and Mittal applied the diagonalization method instead of the trace operation to obtain the dimension-independent concentration inequality for the maximum singular value of the random matrix hierarchy, while the selection of auxiliary matrices and auxiliary functions is a challenge of the method [14]. The concentration inequality for the interval between the eigenvalues of the random matrix was given by Thakkar and Shah [15]. In the experiments and research of this paper, the extraction of kurtosis values is used to clean the data that may have anomalies. The kurtosis state is a peak state used to define the probability distribution of a given real number and its random variables under normal conditions.

Universities around the world actively explore and practice the sports club teaching model to enhance students' interest in physical exercise and strengthen their physical quality. Although sports clubs have been accepted by many colleges and universities and actively used to promote the reform of physical education teaching in colleges and universities, this teaching model still faces many difficulties in concrete implementation, insufficient attention, and difficulties ineffective integration with the existing curriculum system, which restrict the role of the new teaching model of sports clubs in physical education teaching in colleges and universities [16]. The ultimate object of education is people, and the in-depth research and empirical analysis of sports club teaching mode from the perspective of students are of great practical significance to promote the innovation of sports club teaching mode in higher education institutions and achieve the goal of national fitness and sports power.

3. Analysis of the Effectiveness of Club Teaching on College Volleyball Teaching Based on a Random Matrix Model

3.1. Construction of a Club Teaching Model Based on a Random Matrix. Unlike the traditional matrix theory, a random matrix is a matrix whose internal elements are random variables, so the random matrix theory can be said to be a theory combining matrix theory and probability theory. A random matrix is a matrix in which the elements are random variables [17]. When the amount of data is large enough, the empirical spectral distribution of random matrices exhibits many excellent statistical properties, such as the single-loop law (ring law) and the Marchenko–Pastur law (M-P law), which are all significant discoveries of random matrix theory. It is worth mentioning that although random matrix theory theoretically requires a data volume close to infinity, good properties can be observed for matrices of moderate size in practice, so in practical engineering applications, a few tens to hundreds of dimensions are generally chosen to show good convergence. The linear characteristic root statistic is used in the research content of this paper, and it is briefly introduced next.

Random matrix theory has two basic concepts: empirical spectrum distribution (ESD) and limiting spectral distribution (LSD). The limiting spectral distribution function LSD is the limit distribution of the empirical spectral distribution function ESD. The empirical spectral distribution function ESD of a random matrix has randomness, while its limiting spectrum distribution function LSD has certain regularity.

$$A = \left\{a_{i,j}\right\}^{C^m + C^m},$$
$$F^A(x) = \sum_{i=1}^{N} I\left(\lambda_i^A \geq x\right), \tag{1}$$

where $F^A(x)$ is the probability of the characteristic root $\lambda_i^A \geq x$. The demonstrative function is $I(g), i = 1, 2, \ldots, N$, and the characteristic root of matrix A is into λ_i^A.

The linear eigenstatistic represents the distribution of the eigenvalues of a random matrix. The linear eigenroot statistic describes the trace of the random matrix. It is believed in probability theory that the trace can represent the statistical properties of the matrix to a certain extent. Since each element of the matrix is random, the eigenvalues of the matrix are also random, so the individual eigenvalues cannot reflect the statistical properties of the matrix.

$$X_n(\varphi) = \frac{1}{n^2} \sum_{i=1} \phi(\lambda_i). \tag{2}$$

X_n is the linear eigenroot statistic of the matrix X, where $\lambda_i (i = 1, 2, \ldots, n)$ is the eigenvalue of X, where the function φ is not unique, and it can be any function such as mean, variance, and covariance, as long as it can indicate the matrix characteristics. Selecting a different φ function will result in a different linear eigenroot statistic, but it will not affect the matrix analysis results.

Many studies have progressed by using methods already established in random matrix theory, but at the same time, some difficult problems have arisen that cannot be solved without new tools [18]. Therefore, we need to find simpler techniques to obtain more detailed quantitative information about random matrices. With the advent of concentrated inequalities in random matrices, previously complex problems can be solved using simpler methods. We consider a finite sequence of random Hermitian matrices of dimension $d\{X_k\}$. Using the basic properties of matrices to bound the probabilities,

$$p = \lambda_{\max}\left(\sum_{i=1}^{k} X_k\right) \geq t. \tag{3}$$

In equation (3), $\lambda_{\max}$ denotes the maximum eigenvalue of the matrix of the Hermite matrix. This equation is more

general than it seems because we can use the same idea to explore related problems. For example, one can study the minimum eigenvalue of a random matrix sum, the maximum singular value of a random rectangular matrix sum, and other problems.

Multi-domain feature extraction including time domain, frequency domain, and time-frequency domain is performed on the sampled data framed by the time window. Different time domain index values have different sensitivity and stability to the fault, while frequency domain indexes can reflect the fault characteristics, and the combined use of time and frequency domain indexes is suitable for online detection. The frequency domain features such as mean frequency, center frequency, and root mean square frequency are also extracted, the number is S_2, and the time-frequency domain feature indicators are S_3. According to the above description, multi-domain features are extracted for each group of sample data, and a total of S features are extracted; then, $S = S_1 + S_2 + S_3$, the feature matrix Z is constructed, and to unify the feature magnitude, Z is normalized. For the number of features, S needs to be involved in the next operation, most of the articles in similar research directions do not have explicit requirements on the number of features extracted, and their number is required to be as many as possible to meet the matrix requirements. In the traditional physical education teaching mode, the students' attitude toward volleyball is relatively lazy. During the class, they only complete the tasks assigned by the teacher and do not care about the quality of the completion.

According to the random matrix spectral analysis theory, there is a quantitative relationship between the sample covariance matrix and the overall sampling covariance matrix spectral structure, and when the sample dimension tends to infinity proportionally to the sample size, the empirical spectral distribution $R_Y(n)$ will converge to a definite distribution under appropriate conditions. According to the theoretical description of the random matrix theory spectral analysis, after the above construction and processing of the monitoring data, the algorithm flow design of the random matrix model is shown in Figure 1.

The ratio of the maximum eigenvalue to the minimum eigenvalue $D = \lambda_{\max}/\lambda_{\min}$ is taken as the test index, and a suitable threshold is selected to judge the operation state of the model. According to the M-P law in the theory of spectral analysis, the asymptotic values b and an of $\lambda_{\max}$ and $\lambda_{\min}$ are obtained, and then we have

$$f(x) = \begin{cases} D > d, A, \\ D \le d, H. \end{cases} \tag{4}$$

The Iris Flowers Dataset (IFS) is used to predict flower species based on iris measurements and is often used for machine learning classification algorithm validation. It is a multi-class classification problem with an equal number of observations in each class. The dataset has a total of 150 groups, including 3 species of iris, with 50 sets of data for each iris, and each set of data includes 4 features, sepal length, sepal width, petal length, and petal width, and 1 classification result. In this paper, we use two kinds of iris data, 4 features of each flower as input variables, and the algorithm kind of detection results as output variables. The two iris flowers are classified as species H and species A. Accuracy (Acc), recall (Re), and evaluation (F-score, Fs) are used as validity measures and calculated in conjunction with the rolling bearing anomaly detection algorithm. It was found that most of the explanatory variables that finally entered the model were significant at the 0.1 or 0.05 level; that is, the explanatory variables generally had an important impact on the equation. The calculated results of the likelihood ratio show that the model has a better explanation effect ($p < 0.01$).

The number of two iris datasets is 100 groups according to the matrix construction and randomization to obtain the matrix Y, the ratio of ranks used $c = 0.8$, and then according to the eigenvalue index algorithm, and the calculation of the index value and threshold, the expected judgment results will be as follows: species H iris is judged as species H, and the number is recorded as H_1; species H iris is judged as species A, and the number is recorded as H_2; species A iris is judged as species A, and the number is recorded as A_1; the species A iris is judged to be species A, and the number is recorded as A_2. Equation (4) was used to detect these two iris species, and the results are shown in Figure 2.

3.2. Analysis of the Effectiveness of Club Teaching on College Volleyball Teaching. In the traditional physical education teaching mode, students treat volleyball with a lazy attitude; during the class, they just finish the tasks given by the teacher and do not care about the quality of completion, no absence, and someone to play with is the purpose of the class; teachers also do not care about students' learning, they only give teaching tasks and finish the demonstration, and the rest of the time is for students to learn by themselves. This teaching model allows teachers to accomplish teaching performance, but ignores student learning; students just blindly learn the sport at the end of the semester to cope with exams, rather than they want to go to the sport. In the teaching process, students do not have a fixed partner or a group to study with, each class is a new group, and the teacher uses teaching methods such as lecture and demonstration; the evaluation criteria are based on the performance at the end of the semester, and the teacher grades the students according to the scoring criteria constructed from the teaching objectives, not caring about the learning process [19]. In the context of "exam-oriented education," students only pay attention to their grades in all their studies, including their physical education grades; the traditional physical education teaching model emphasizes the proficiency in physical education skills and ignores students' efforts in the learning process, and students' grades are mainly evaluated by how well they know the skills. This form of teaching judgment is not conducive to students' learning and undermines students' interest and self-confidence in learning.

The purpose of the class is to not be absent and someone to play; because traditional teaching fails to motivate students interested in exploring and increasing the volleyball curriculum, students are perfunctory for the purpose of

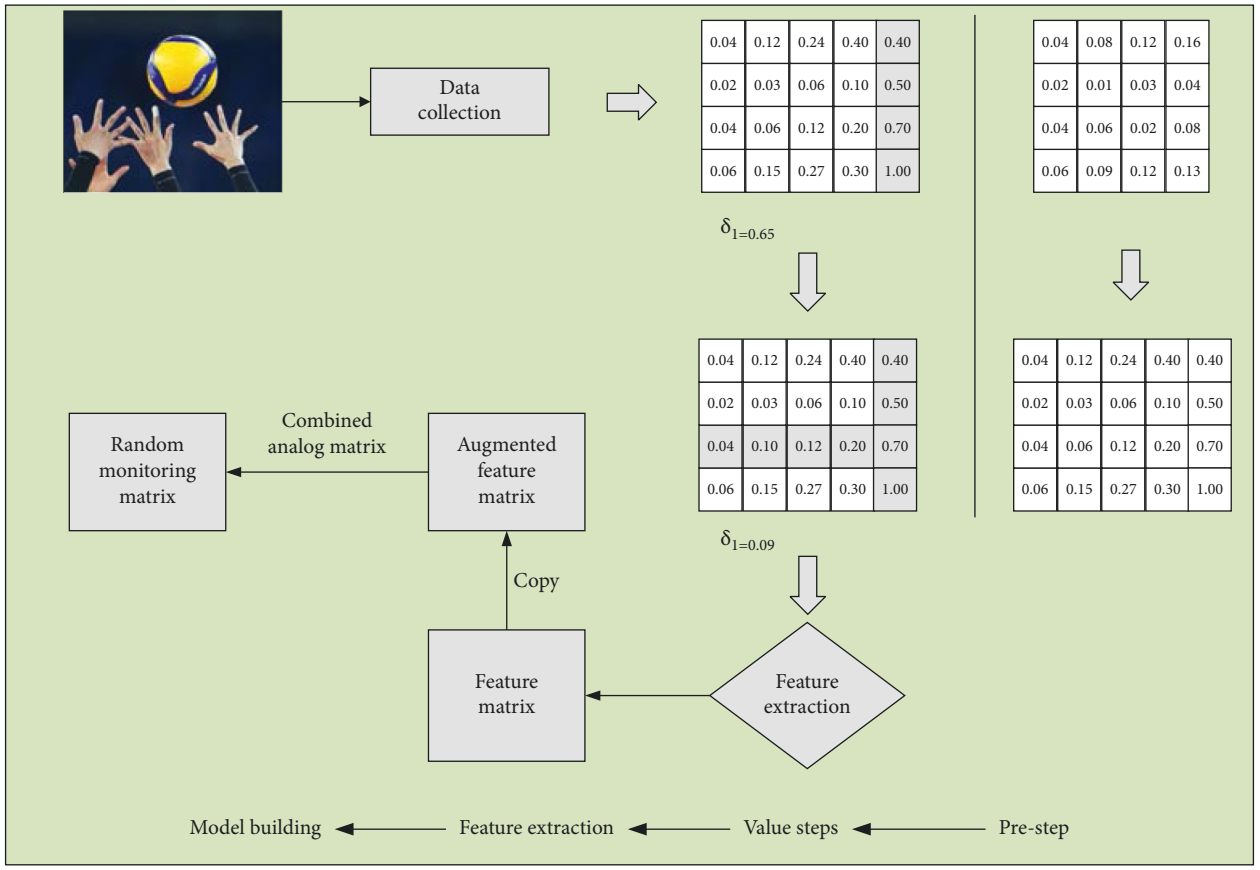

Figure 1: Random matrix model algorithm flow.

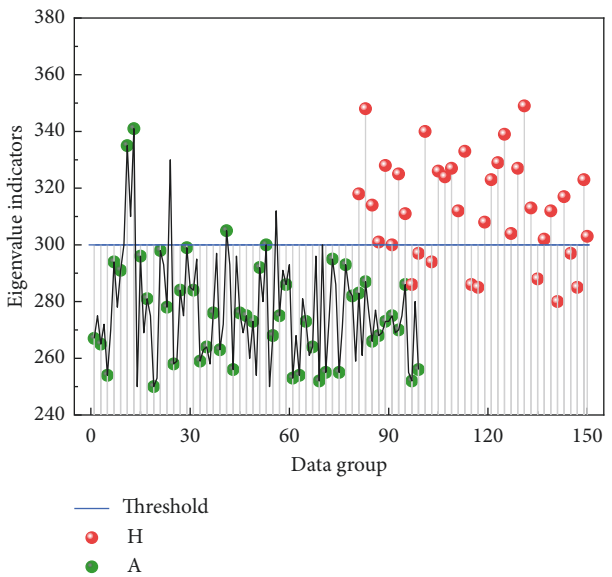

Figure 2: Random matrix algorithm detection results.

completing credits and assignments. Volleyball club teaching mode is a new teaching organization mode of college volleyball course, which is born under the guiding ideology of "quality education reform" and "health first." It not only enables students to master volleyball skills but also cultivates students' interest and habit of exercising and lays a good foundation for students' lifelong sports. In this teaching model, students are the main body, teachers are the guide, and teachers guide students to learn better [20]. The teaching goal is no longer to learn technical movements but to improve students' interest in learning, promote students' physical and mental health, and cultivate students' lifelong physical education as the main goal. A random matrix was used to establish an assessment model between physical fitness and the gender of students participating in club-based teaching, physical fitness score in the initial period, the type of course chosen, the activity level of participating in the course, and whether the teacher directly instructs them. Through this model, the degree of physical fitness improvement of college students after the implementation of club-based teaching is accurately predicted, which provides scientific and theoretical guidance for precise intervention in the design of club-based teaching to effectively improve students' physical fitness. The structure of the evaluation model of college volleyball club teaching based on the random matrix is shown in Figure 3.

University life has more discretionary time compared with high school life, and sufficient after-school time can satisfy college students to do many things they like, which is especially important for the development of good personal habits and is also an important bridging stage from school to society. According to the survey, contemporary college

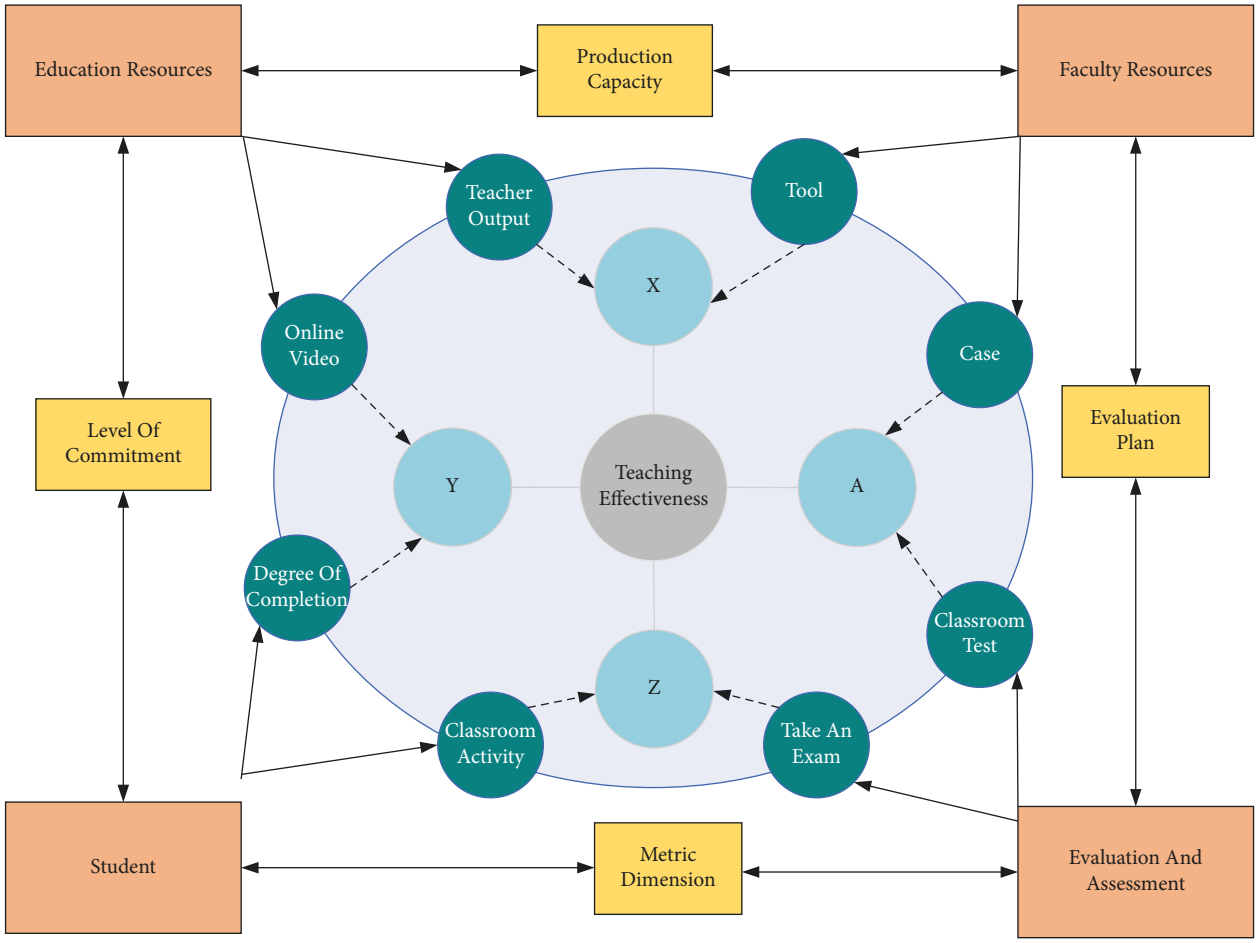

Figure 3: A random matrix-based teaching evaluation model for college volleyball clubs.

students can't make full use of their spare time and have no reasonable plan for their own life. Figure 4 shows the statistical results of the current situation of college students' after-school life.

In Figure 4, both male and female students in colleges and universities use the after-school time for their entertainment, have little awareness of active physical exercise, and spend little time on physical exercise, which indicates that students do not know enough about sports and do not have favorite sports, and some traditional sports are not enough to stimulate students' interest in sports [21]. This requires us to understand students in physical education, strengthen students' interest in sports, focus on students' personality development needs, mobilize students' enthusiasm to participate in physical exercise on their own, enhance the awareness of physical exercise, let students master one or two sports skills, be able to carry out the long-term exercise, and form lifelong exercise habits.

Most studies mainly discuss the role of college sports club teaching modes and analyze the problems, and few empirical studies are conducted based on the perspective of student subjects. Based on the primary data collected from the microsurgery, this study selects multiple logit selection models to study the preferences of sports club teaching modes of college physical education students and

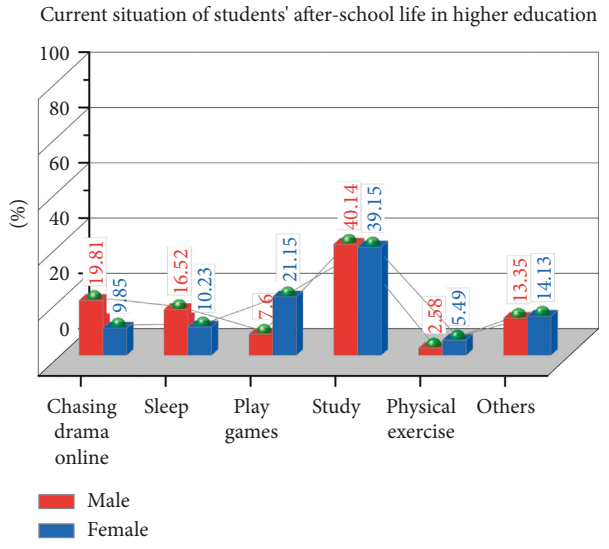

Figure 4: Current situation of students' after-school life in higher education.

comprehensively focuses on the correlations and influences between different sports club teaching modes and students' individual and professional characteristics and other factors [22]. The iris flower dataset has a total of 150 groups,

including 3 species of iris, and each iris has 50 groups of data. Each group of data includes 4 features of sepal length, sepal width, petal length, and petal width and 1 classification result. The purpose of the study is to reflect the important role played by sports club teaching mode in college physical education through students' feedback, to provide a reference for more scientific and reasonable teaching mode reform and innovation in the future.

The research team mainly used the online survey form of the Questionnaire Star platform to collect data on the preferences of sports club models of physical education students in X universities by distributing 500 questionnaires in December 2021 and finally got 459 valid questionnaires with an efficiency rate of 91.80%. From the specific design of the sports club model, we need to consider the characteristics and applicability of different sports club models. The preferences and needs of students of physical education majors in college X should be considered from their characteristics. The selected variables and the constructed index system are shown in Table 1.

4. Analysis of Results

4.1. Random Matrix Model Performance Test. To satisfy the asymptotic convergence when analyzing the spectral distribution of high-dimensional random matrices, it is theoretically required to use random matrices with dimensions close to infinity, but an infinite amount of data is not available in practical applications. Asymptotic convergence can be observed in moderate size random matrices of tens to hundreds of dimensions, which makes it possible to apply random matrix theory to practical engineering problems. When using random matrices for processing and analysis, anomalies in the data can have a relatively large impact on the analysis of the results and produce erroneous results. Such anomalies adversely affect our analysis results and can produce relatively large errors in our classification accuracy, so it is necessary to clean and remove such anomalous data [23]. In the experiments and studies in this paper, kurtosis values are extracted to clean the data that may have anomalies. A kurtosis state, which is used to qualify the probability distribution of a given real number and its random variables, is a peak state under normal conditions. A higher kurtosis which implies an increase in the precision of the variance is mainly because an extreme mean of the variance at low precision frequencies has been greater or almost exceeded the mean of the kurtosis. The kurtosis is calculated as follows:

$$\gamma_2 = \frac{k_2}{k_4} = \frac{\sigma_4}{\mu_4} - 1, \tag{5}$$

where μ_4 is the fourth-order central moment, σ is a standard deviation, and minus 1 is to make the kurtosis of the normal distribution to 0. When a kurtosis threshold is set, it can be used for automatic filtering of abnormal data. The advantage of doing this is that compared to manually finding out the kurtosis and then filtering it automatically, it can avoid the increase of workload when the amount of data is relatively large, compared to setting two thresholds above and below the magnitude to remove it, it can avoid the trouble of determining the threshold value due to the scale shift of the magnitude threshold, and it only needs to set one indicator to remove the abnormal data so that it can be further analyzed to obtain a more accurate kurtosis threshold setting.

Suppose, when the system is running normally, the sample covariance matrix of the random matrix formed by collecting data from the stable operation of the system is S_0 and S_0 is called the reference sample covariance matrix. After a fault or disturbance occurs during the system operation, the covariance matrix of the random matrix is formed by collecting the data after the disturbance is S_1. Then, the self-concurrent polynomial of the random matrix is defined as $p(s_o, s_o^1)$.

$$p(s_o, s_1) = s_1 + s_0. \tag{6}$$

Use the model data without event occurrence and the model data without interference to generate the sample covariance matrix, select the model voltage after the load is increased to generate the sample covariance matrix, and construct the self concurrent polynomial according to the equation. The corresponding eigenvalue probability density function results are shown in Figure 5.

When no perturbation occurs in the model, the eigenvalues are distributed around 0 in the statistical histogram of the probability density function of eigenvalues of the model's self-associating polynomial $p(s_o, s_o^1)$. When the model has events, the histogram of the probability density function of the eigenvalues of the model self-associating polynomial $p(s_o, s_o^1)$ has large, isolated eigenvalues, called outliers, in addition to the eigenvalues around 0. The comparison shows that the outliers are generated by the presence of perturbations, and the outliers reflect the magnitude of the model affected by the perturbations.

The factor structures were derived by three methods: principal component method, sparse principal component method, and modified sparse principal component method [5, 24]. The variable commonness indicates the dependence of the original variables on the common factor, and the greater the variable commonness indicates, the greater the dependence on the common factor. Compared with the principal component method, most of the variables are more dependent on the common factor obtained by the sparse principal component method, which indicates that the sparse principal component method loses less information than the principal component method; compared with the sparse principal component method, the improved sparse principal component method has three variables with higher commonality than the sparse principal component method, two variables with much lower commonality, and the other variables with the differences that are not significant, as shown in Figure 6.

As an important platform for students to acquire knowledge and improve their own abilities, schools are also a turning point to contribute to the society and the country, and school sports play the role of "escort." The algorithm of factor extraction and the choice of factor rotation method

Table 1: Breakdown of research indicators of students' sports club model preferences.

Explanatory variables	Symbol	Value method			
		1	2	3	4
Gender	$X1$	Male	Female		
Grade	$X2$	Fresh man	Sophomore	Junior year	
Profession	$X3$	Basketball	Volleyball	Football	Tennis
Club size	$X4$	$X4 \leq 5$	$5 < X4 \leq 10$	$10 < X4 \leq 15$	$X4 > 15$
Number of workouts per week	$X5$	$X5 = 0$	$0 < X5 \leq 5$	$5 < X5 \leq 10$	$X5 > 10$
Physical health	$X6$	Poor	Generally	Better	Very good

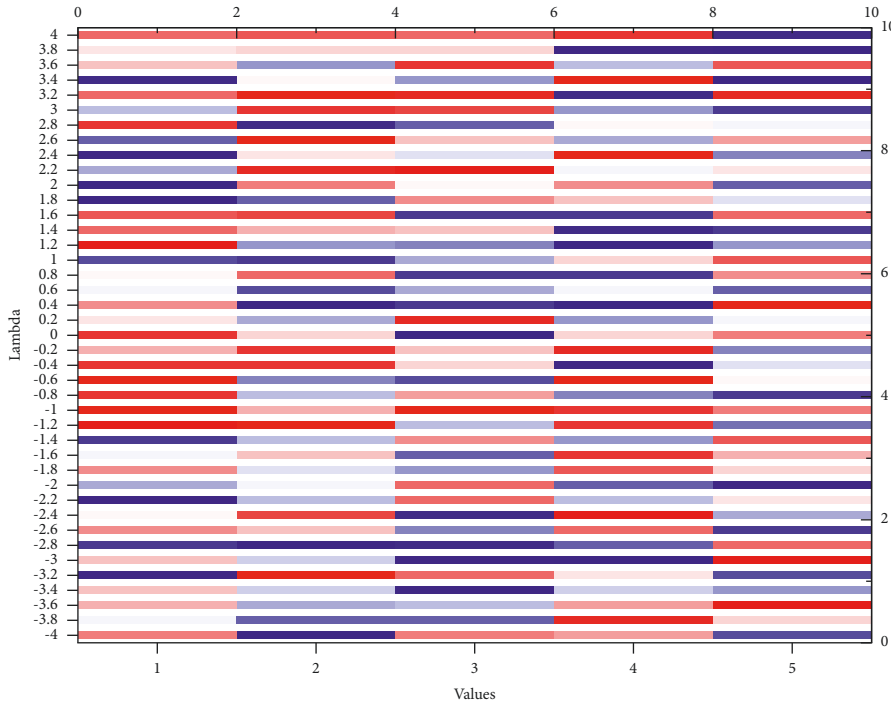

Figure 5: $p(s_o, s_o^1)$ eigenvalue probability density function statistics results.

are not decisive strategies, and most satisfactory factor analyses yield essentially the same factor structure. There is still no single method to obtain perfect common factors, so the following recommendations are available for the use of factor analysis. First, perform different factor extraction methods and compare the factor structures of several methods to see if they are the same. Second, for large datasets, you can divide them into two parts, perform factor analysis on each part separately, and then perform factor analysis on the whole data to compare whether the factor structures obtained in the three cases are the same. All the above methods are used to check whether the results are stable or not.

4.2. Results of the Analysis of Teaching Effectiveness of College Volleyball Clubs. In this study, model fit tests and independence tests were conducted using IBM SPSS Statistics 20 software. Most of the explanatory variables that eventually entered the model were found to be significant at 0.1 or 0.05 level; i.e., the explanatory variables generally had a significant effect on the equation. The results of the calculation of the likelihood ratio indicated that the explanatory role of the model was good ($p < 0.01$), the calculation of the McFadden value indicated that the alternatives met the independence assumption, and the alternatives in this study met the requirements related to the calculation using a multinomial logit selection model. Based on the results of the model test, the great likelihood method was used to estimate the parameters of the factors influencing students' sports club mode preferences in higher education institutions. The variables with zero parameter estimation results were excluded using the Wald test. This fully shows that the students have affirmed the sports club activities of each school. However, there are still some students who think that the school's sports club activities are not comprehensive enough and show dissatisfaction. This requires colleges and universities to reasonably improve all aspects when implementing the sports club teaching model to ensure that students participate as scheduled.

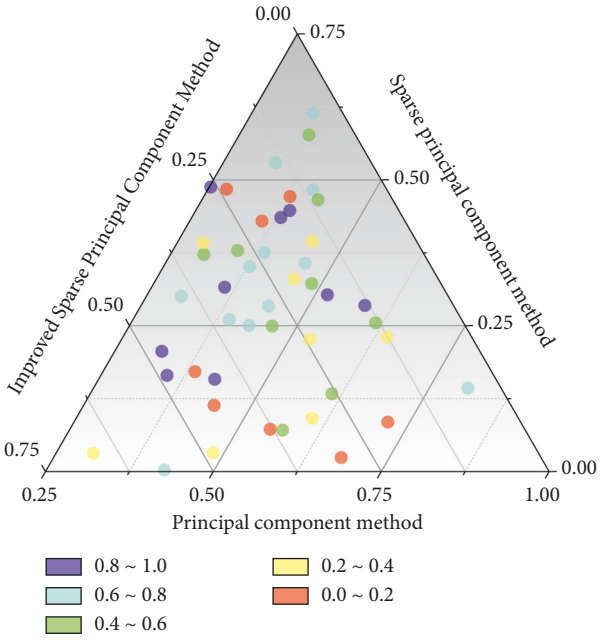

Figure 6: Comparison of results of the commonness of the variables of the methods.

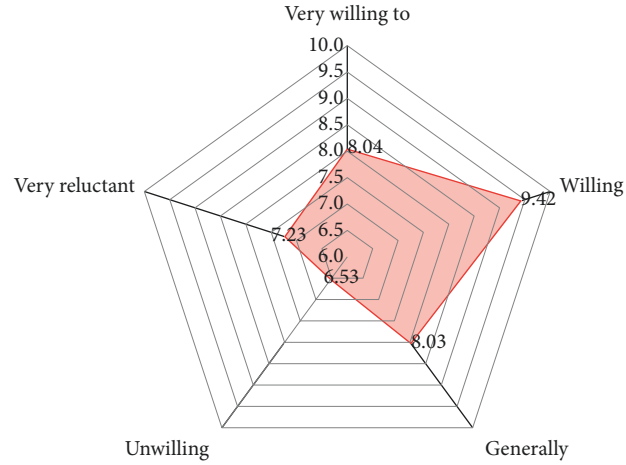

Figure 7: Students' willingness to carry out club teaching.

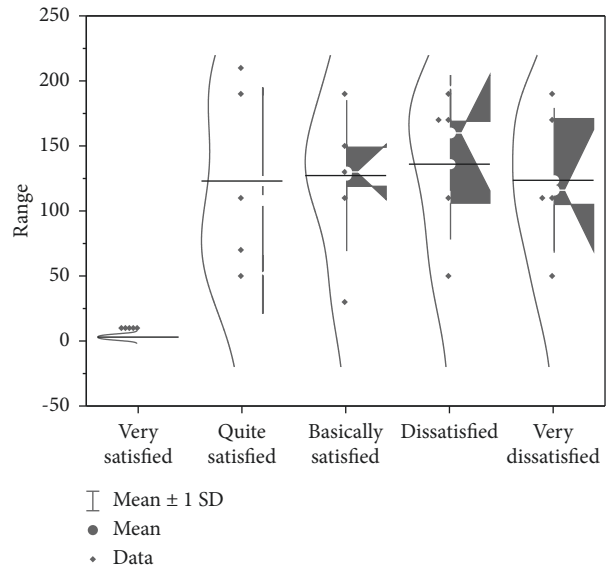

Figure 8: Students' satisfaction with conducting sports clubs.

Students' participation in sports club teaching activities has a certain psychological drive and is also one of their psychological behaviors. The attitude of students' participation in sports clubs determines a series of mental inputs such as students' ideology, physical actions, and integration into the teaching environment [12]. Before carrying out sports club teaching, understanding students' attitudes toward participation is an essential part of it. As shown in Figure 7, the survey of students shows that students have positive attitudes toward participating in sports clubs, with 24.8% very willing to participate, 49.3% willing, 15.2% average, and only 10.7% unwilling and very unwilling. The data show that students are very willing to participate in sports clubs, which has positive significance for the development of sports clubs and plays an irreplaceable role in promoting the construction of a civilized and harmonious campus and enriching the cultural life of the campus. It is because the club teaching, without imposing the choice of items, gives students a large enough environment to choose classes and mobilizes students' enthusiasm to participate.

Schools carry out sports clubs, and students have a different sense of experience in different implementation environments, as well as hold different levels of recognition and satisfaction with carrying out sports club activities. As shown in Figure 8, in the survey of whether students are satisfied with the form of sports club teaching, it can be known that 76.1% of the number of students surveyed expressed satisfaction, more than half, and a few students expressed dissatisfaction, accounting for only 23.9%, which fully indicates that the implementation of various activities of sports clubs in each school has been affirmed by students, but there are still some students who think the implementation of various activities of sports clubs in schools. However, there are still some students who think that the activities of sports clubs are not comprehensive enough and show dissatisfaction, which requires universities to reasonably improve all aspects of the situation when implementing the teaching mode of sports clubs to ensure students' participation as expected.

The random matrix theory does not rely on the model of the thing itself when analyzing problems, but collects relevant data to construct a matrix according to the needs of research, uses the matrix as an analysis unit, and combines current data and historical data to form a matrix to achieve real-time analysis. The change in students' physical fitness, the development of interpersonal relationships, the improvement of their skills, and the development of their sports habits in participating in the teaching activities of the volleyball club are important benchmarks for evaluating the goodness of the various teaching activities carried out by the volleyball club [25]. The survey of students shows that students have made great progress in their physical fitness, interpersonal relationships, proficiency in motor skills, and

Table 2: Student participation volleyball club status indicator settings.

	Physical changes	Interpersonal relationship	Motor skills	Sports love situation
Big boost	*A*1	*B*1	*C*1	*D*1
Not obvious	*A*2	*B*2	*C*2	*D*2
No change	*A*3	*B*3	*C*3	*D*3

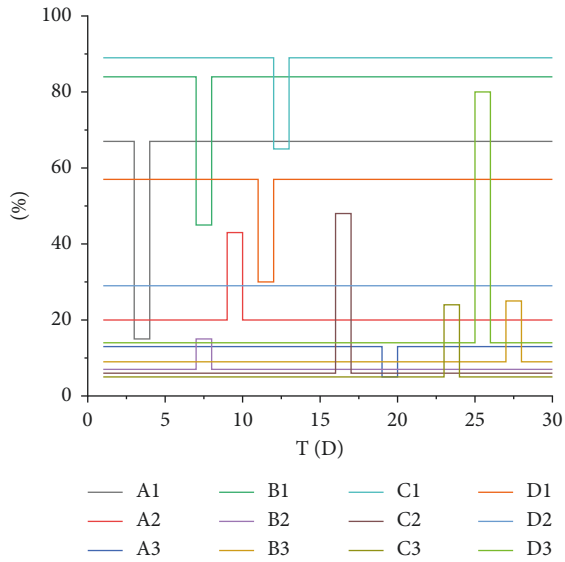

Figure 9: Current status of athletic effects of student participation in volleyball clubs.

improvement of passing and snapping skills during their participation, with a qualitative improvement in all aspects. For convenience, the variable indicators are set as shown in Table 2, and the results are shown in Figure 9, which shows the current situation of students' participation in volleyball. Among them, 95% of the students said that after participating in club volleyball, their physical quality has improved greatly in all aspects; 84% of the students said that after participating in club volleyball courses, they met more students, made new friends, and promoted their social skills at the same time; 89% of the students said that participating in volleyball has accelerated the mastery of the skills they learned and improved their proficiency in the skills they learned; 57% of the students said that after participating in volleyball club, they are willing to devote themselves to volleyball learning and training because their own sports skills have been strengthened and they have a deeper love for volleyball. When an event occurs in the model, in addition to the eigenvalues near 0 in the statistical histogram of the model's self-adjoint polynomial eigenvalue probability density function, there are also large and isolated eigenvalues, which are called outliers.

Teachers' perceptions of club teaching are that the club teaching model can make good use of the movement demonstration method and competition method, which make volleyball teaching activities direct, specific, and accurate, and can convey to students the movement skills related to volleyball teaching. Students can learn the movements taught by the teacher on their own and thus improve their understanding of the movements. In addition, club teaching can effectively emphasize the continuous movements, the structure of the movements, and the important and difficult movements in volleyball teaching to improve the student's overall proficiency in volleyball. Teachers can show students the overall movement skills in volleyball according to the relaxed teaching style of the club, and then decompose and demonstrate the passing movements, arm striking points, and ball facing stance according to students' understanding. The club teaching mode can also help students to learn volleyball skills. On the other hand, the club teaching mode can also motivate students to actively explore volleyball movements, which relies on the competitive teaching style of the club teaching mode.

5. Discussion

With the changing times, today's students have a higher demand for the current physical education in colleges and universities. Their choice shows that the club teaching mode is more popular among students, and teachers also believe that such a teaching mode can enhance physical fitness, develop an interest in sports, and increase interpersonal communication while learning skills [26]. The implementation of the club teaching model in physical education courses is the best learning mode for students, and they experience the enjoyment of club teaching in the classroom, but at present, students in colleges and universities do not have good sports thinking and think that physical education courses are the kind of sheep-herding teaching without any meaning, and we need to increase the publicity of sports thinking so that students have a proper sports thinking, in the club teaching mode, to establish a correct sports ideology of the club teaching mode, laying a solid foundation for lifelong sports. In the implementation of club teaching, the teacher, as the leader of the curriculum, must remember not to be formalistic, let alone put the cart before the horse and neglect the original purpose of teaching by pursuing too the form of club teaching. Therefore, to implement the club teaching model in physical education courses it is necessary to establish the teaching guideline, objectives, contents, methods, and evaluation of the club teaching model in physical education courses. These are several important factors of the teaching model, and only by putting these elements throughout the Pai sports club teaching model can the superiority of the club teaching model of the physical education curriculum be brought into play.

6. Conclusion

In this paper, a random matrix-based model for evaluating college volleyball club instruction is constructed to explore

the impact of club instruction on the effectiveness of college volleyball instruction. Sparse principal component analysis and improved sparse principal component analysis are proposed for parameter estimation to directly obtain factor loading matrices that satisfy the simplicity principle. In this paper, an online survey in the form of the Questionnaire Star platform was used to study X college physical education students. A research method based on the random matrix model is used to initially propose a training model that realistically maps the interrelationship between the indicators of college students' physical fitness assessment and their final assessment scores, which provides a more scientific theoretical guidance for building an interactive and open physical education curriculum, allowing students to learn knowledge through experience, master techniques through practice, and improve their abilities through competition. Due to the limited time and capacity, the experiments in this paper were only identified for physical education majors, and the practicality of club teaching for nonphysical education majors needs to be further tested. This paper only takes the students majoring in physical education in X university as the research object. Although the results obtained are consistent with the results of the active test and are in line with expectations, more volleyball professionals are still needed to conduct the test to make the experimental results more convincing. In the next step, the model can be applied to college teaching on a small scale to improve persuasiveness.

Data Availability

The data used to support the findings of this study are included within the article.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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