

## Optimization of Physical Education Teaching Mode in Colleges based on Data Mining Clustering Algorithm

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### Abstract

*Deep neural networks (DNNs) and their learning algorithms have been widely used in large data analysis. With the practice of teaching network reform in higher education, many colleges began to use the network to change the traditional teaching methods, and made several achievements. In this paper, the authors first analyze the infinite depth neural network, and construct evaluation index system by using network data mining method. The result shows that 58.09% students think the evaluation from college physical education is formative assessment, 27.94% students think that the evaluation reflects the magnitude progress, and 30.15% students think that it reflects the students' self-evaluation. Physical teaching evaluation is an important part of physical education; however, the survey found that physical education students are lack of understanding of teaching evaluation. Therefore, colleges should make comprehensive evaluation of physical education, and formulate scientific and rational teaching evaluation concept.*

**Keywords:** *Neural network, teaching evaluation, large data, RTRL learning algorithm, sports education*

### 1. Introduction

From the beginning into the era of big data, big data analysis has emerged. From the data source to the value of the life cycle of big data in the information system through the data preparation, data storage and management, computing, data analysis and knowledge show 5 main links, including data analysis from the huge volume, velocity, variety rules and extract knowledge discovery in large numbers [1]. Only through the "data analysis" link, in order to obtain valuable information, in-depth, the 4V characteristics of big data, it is also the most important characteristics as the value, it can truly be reflected. Therefore large data analysis is very important in the field of big data, is from data to information, the decisive factor. 4V characteristics of big data to big data analysis have brought new challenges. The global digital data every 2 years to double the rate of growth, this year will reach 8ZB, the equivalent of 18 million of the Library of Congress. From one hand to the intelligent mobile phone video surveillance cameras and other sensing equipment, all the time generation of complex structured data and unstructured data, unstructured data and the growth rate is faster than the structured data [2]. IDC 2011 survey pointed out that the unstructured data generated in the next 10 years of data will account for 90%. In all human digital data, only a small part of numerical structural data obtained and analyzed deeply mining is the traditional data mining. Web page index, social data, semi-structured data in Google, Facebook and other large Internet companies have been some shallow analysis.

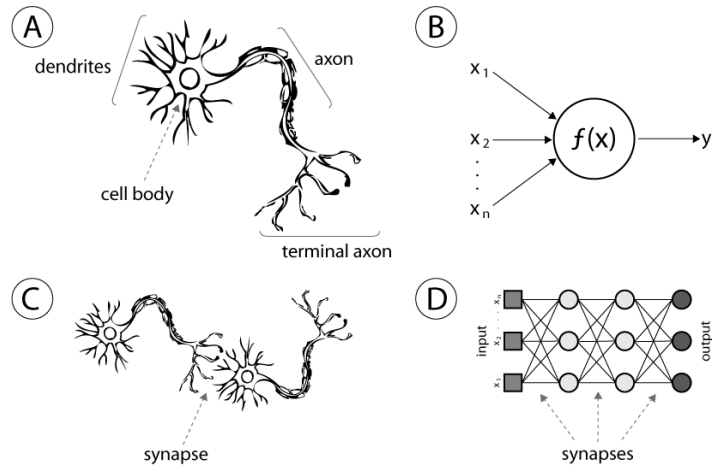
With the practice of the teaching reform of College Teaching in recent years, many colleges and universities have begun to use the Internet to change the traditional teaching methods, and have made some achievements. However, the application of the network

platform is not comprehensive and thus to a certain extent, reduce the efficiency of the use of network teaching platform. Advanced teaching concept of the platform is not just a technology platform, or a new embodiment of the concept of modern education [3-4]. In teaching, constructivism is the basis of teaching, and the concept of teaching and learning is rooted in the platform of each teaching platform, so as to combine theory and practice. Through this platform, the teachers and students role by the definition of a deeper level, teachers in the teaching is no longer a provider of knowledge, learning but the organizers, and the original simple lesson plan design into the design of teaching activities and resources. Teaching evaluation on Teachers' teaching and students' learning quality objective measure and value judgment process, teaching evaluation can not only for teachers teaching attitude, and make a value judgment, can the students learning attitude, learning ability and learning achievement changes to make a value judgment. Teaching evaluation is an indispensable link in the teaching process; it can provide feedback information, so as to timely adjust and improve teaching, to ensure the realization of teaching objectives. Evaluation of the teaching of physical education is an important part of the sports teaching in, is the value of physical education teaching activities and their effects on decision [5]. It has a direct role in all aspects of physical education teaching activities, from the overall control, regulate sports teaching activities, ensuring sports teaching activity to the desired goal. The present teaching work has the narrow, utilitarianism tendency, and the tendency is caused by the corresponding evaluation view [6]. The people who hold this kind of tendency think that the evaluation of the school teaching work is to rank the teachers and students. Failed to recognize teaching evaluation function is to feedback the learning process and results of the students, teachers in the teaching process and result feedback, and promote teachers to improve their teaching behavior, promote the progress of students, so as to improve the teaching quality of the school, the view of narrow teaching evaluation function, is not conducive to scientific evaluation, at the same time, guide the teaching evaluation of value view is one-sided, unscientific of. Influenced by the traditional values, teaching evaluation is based on the guiding ideology of the pursuit of the students' higher education, but not the difference between the measurement and the evaluation based on the teaching objectives [7-8]. Due to the wrong value guidance and evaluation, leading to the formation of scientific and rational value orientation, cannot be a scientific and rational evaluation.

## **2. Neural Network**

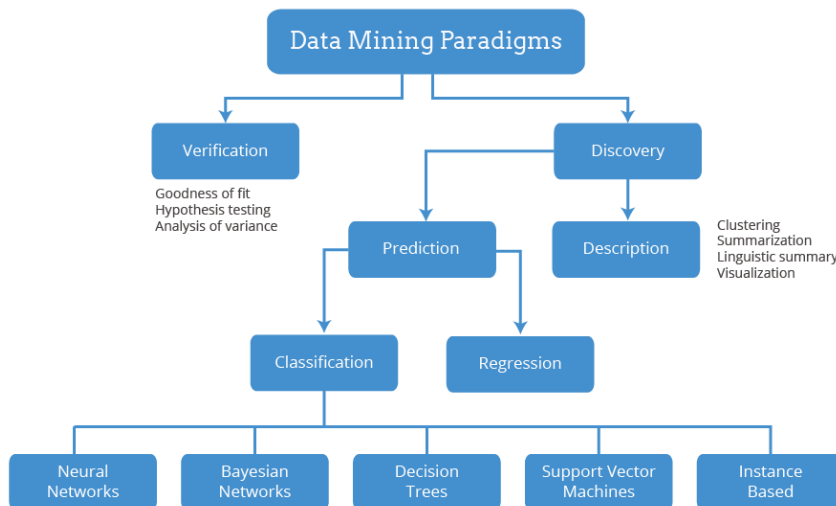
### **2.1. Depth Neural Network**

Connectionism school neural network belongs to the field of artificial intelligence, is an application similar to the brain synaptic structure information processing model. At present, the depth neural network used in big data analysis is mainly for feed forward neural networks (FNNs). The flow of data in such networks is unidirectional. By the first layer (input layer) into, hidden layer transfer and the mapping from the output layer outflow. Nature is in between the approximation of original data and features very strong nonlinear mapping relationship. According to the principle of uniform approximation of neural network, for an arbitrary nonlinear mapping, can a shallow layer network and a network to find it in any depth approximation accuracy, as long as the number of neurons in hidden layer shallow network enough or deep enough depth of the network. But usually, the shallow layer the depth of the network, network only requires far fewer parameters can be achieved with the same approximation effect. Since the current most widely used network encoding and convolutional neural network belong to the feed forward network.



**Figure 1. Neural Network Topology**

The depth neural network learning ability outstanding features make it particularly good at solving various recognition problems based on classification, such as speech recognition, image recognition and so on. The analysis of big data classification is one of the target, while another core the task is to predict the future changes of data, in other words, is to extract the timing characteristics of data. But because of the depth of the neural network topology is limited, its ability to extract the dynamic characteristics of time series data is limited, can pass Bus Driver as an example to illustrate the point. Bus Driver is a series of problems. It requires recognition the network can identify 2 events according to the specific sequence, no matter how many of the disturbance events. Assumptions are A, B, C and D four events, If the event A, the first event occurs B, the network output 1, otherwise it outputs 0. The difficulty of this task lies in the number of events A and after the first event B between disturbance events is uncertain, so the network must remember all the events have occurred.



**Figure 2. Data Mining Algorithm**

Data mining algorithm is based on data mining model to create a set of heuristics and computing, as shown in Figure 2. In order to create the model, the algorithm will first analyze the data you provide, and look for specific types of patterns and trends. K-Means

is one of the most classic and most widely used clustering method, today, there are many to throw a lot of improved model based on the proposed. K-means thought is very simple, for a clustering task (you need to specified clustered into several classes, of course, according to the nature of the thoughts should not need to specify the class number, a this is also a question of the clustering task is worth studying the subject), first randomly chosen centers K cluster and repeated calculation following the process until all the cluster center does not change (cluster does not change):

Step 1: for each object to calculate its similarity with each cluster center to belong to its most similar to the cluster.

Step 2: update the cluster center, the new cluster center by calculating the average of all objects belonging to the cluster.

The working process of the k-means algorithm that are as follows: first from N data objects of arbitrary choice of K objects as the initial cluster centers; and for the remaining other objects, according to them and the clustering center of similarity (distance), respectively, the they assigned to its most similar to the cluster center represents) clustering; then calculate each received a new cluster of the cluster centers (the clustering of all objects mean); and repeat this process until the standard measure function began to converge so far. In general, the mean square deviation is used as a standard measure function, and the K cluster has the following characteristics: the clustering itself is as compact as possible, and the separation between the clusters is as far as possible.

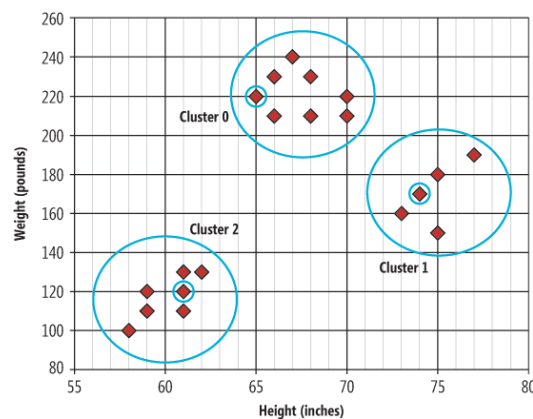


Figure 3. Clustering Analysis

## 2.2. Network Topology Structure

At present, the academic and industrial circles refers to the depth of the neural network, usually refers to a feed forward network with a certain depth, the characteristics of feed forward networks between neurons of the same layer without feedback connection, there is no time parameter attribute, so the depth of the neural network is good at dealing with static data. DNNs is a kind of recurrent neural network full interconnection, there are feedback connections between neurons. The feedback structure spread in the time dimension, with the continuous running time, the network can infinite. For each neuron in the infinite depth of the neural network, it is connected with three: the neurons with all the external input connection, connection and all other neurons, and the neurons and their feedback connections.

In general, the assumption that an infinite depth network has m external inputs, n neurons, and the network at the time t of the external input  $x_i$  as:

$$x(t) = (x_1(t), x_2(t), \dots, x_m(t))^T$$

The output of the neuron is  $y_i$ :

$$y(t) = (y_1(t), y_2(t), \dots, y_n(t))^T$$

Obviously, any neuron K at time  $t + 1$ , the total input SK (T + 1) is composed by X (t) and Y (t), Let w for network connection weights is a  $n \times (n + m)$  matrix. Without loss of generality, can make  $W = [W_u, W_i]$ , which  $W_u$  said between neurons in the connection weights,  $W_i$  means connection weights between the neurons and the external network, and as T+1 neural network to obtain the total input as:

$$y_k(t+1) = f_k(s_k(t+1))$$

### 3. Research Design

#### 3.1. Research Methods

Physical education teaching is fixed relative to the teaching content and teaching schedule contains the theory, practice, student ability culture three parts. Main purpose of special class teaching is no longer simply increase the competitive ability, should be based in order to improve the learning of theoretical knowledge, let the students master the ability to learn theoretical knowledge and technical guidance, to the professional quality of students training and teaching and training ability training is placed in an important position, in order to make students master the scientific research method of knowledge, training students' practical teaching ability.

- 1) **Literature method:** consulting on the evaluation of education, physical education teaching evaluation and teaching evaluation of books, journals and literature using library catalog retrieval system in China know online access to a large number of related literature, and summarizes the
- 2) **Interview method:** the content validity and construct validity of the questionnaire were improved by expert interview. The importance of the opinion of the survey object was determined by the expert interview, and the weight assignment was carried out "
- 3) **Questionnaire method:** design expert questionnaire, teacher questionnaire and student questionnaire, 5 questionnaires, 15 questionnaires, 150 questionnaires.
- 4) **Mathematical statistics method:** the use of Excel software for the results of the questionnaire survey mathematical statistics analysis, with the induction, deduction, analogy, reasoning and other logical analysis method for a variety of information and in-depth analysis and discussion
- 5) **Comparative research method:** the evaluation of physical education in ordinary colleges and universities in many aspects, multi factor, multi angle comparative study

**Table 1. Statistical Analysis of the Questionnaire**

category	expert	teacher	student
Total number	5	15	150
Total recovery	5	15	150
rate of recovery	100	100	100
Effective recovery	5	15	136
effective rate	100	100	90.67

#### 3.2. Physical Education Teaching

Special classes for students have two aspects of the requirements, on the one hand, the students in the technical and tactical level to continue to improve, on the other hand

requires students to have a higher level of professional theory. Statistics show that 73.3% experts and 60.3% teachers believe that theoretical lessons should be accounted for more than 30% of the total class hours. 40% experts and 66.7% teachers believe that practice and theory class proportion should be 6:4; 40% experts and 13.3% teachers think practice and theory class proportion shall be 7:3. 20% experts and 6.7% teachers think practice and theory class proportion shall be 5:5. Statistical results indicate that experts and teachers have attached great importance to theory courses, they agreed that theory course teaching content should be deep, but also has the breadth, let the students master the latest research results and theoretical knowledge, so that students have enough capacity to fit in at the school sports teaching, training and competition and in the management of school physical education. School sports science research and social sports guidance and other related sports work, but also can continue to absorb advanced teaching theory.

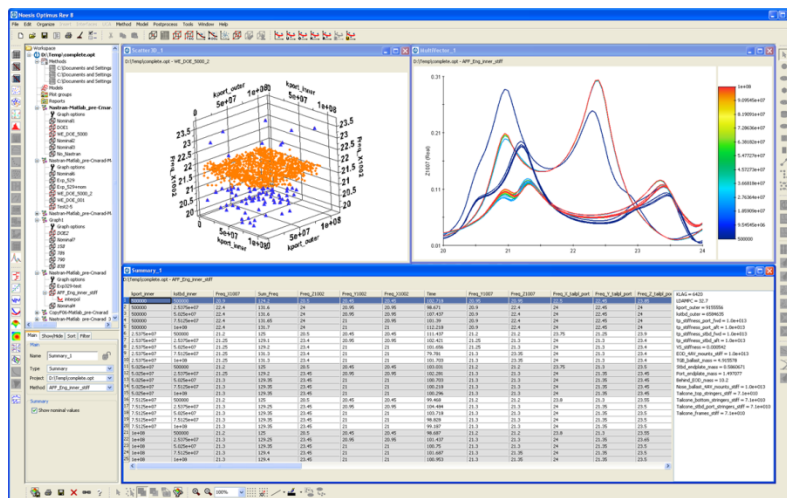


Figure 4. Data Mining Prediction

Table 2. Special Class and Theory Class

type	6:4	7:3	5:5	4:6
experts	40.0	40.0	20.0	0
Teachers	66.7	13.3	6.7	13.3

## 4. Empirical Analysis

### 4.1. System Principles

From the survey results and previous studies can be found in the current colleges and universities physical education teaching evaluation mainly has the following problems: first, evaluation of the parts the understanding is not uniform on the teaching of physical education majors, without unified understanding of evaluation content, will inevitably affect the content of each part in the evaluation of the weight, and then influence of teachers and students in the teaching contents of the effort, and ultimately affect the structure of knowledge and ability of sports talent. Secondly, in the evaluation process, means and methods used to assess the relative single, backward. In professional football course of physical education teaching evaluation, each department mainly adopts the theory test, technical evaluation standard examination, physical fitness test. The theoretical knowledge of students, usually test methods such as motor skills, physical fitness and learning evaluation. Usually in the Evaluation of student's comprehensive ability and emotional attitude, and did not use the corresponding means and methods of

evaluation of. Again, evaluation standard is different, is not conducive to horizontal comparison between schools. Finally, don't pay enough attention to the cultivation of students' comprehensive ability, emotion and attitude, ability, emotion and attitude factors for their future employment effects of larger, but in the evaluation process because affected by subjective factors affect larger, the evaluation of the difficulty is relatively large.

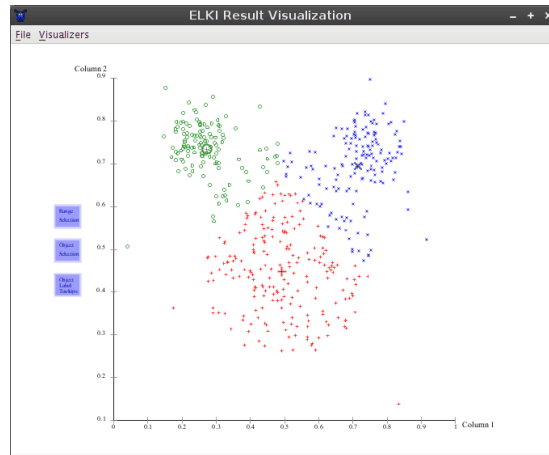


Figure 5. The Data Analysis Results

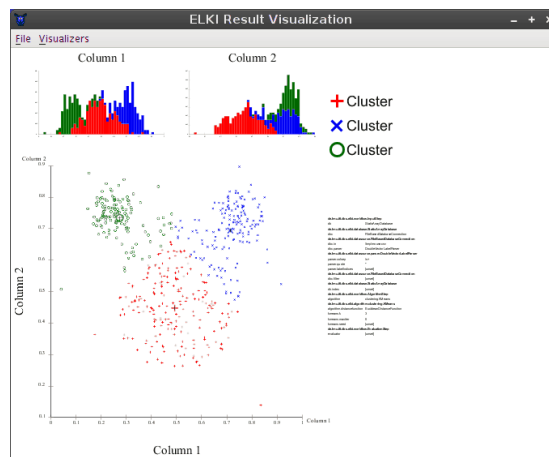


Figure 6. K-Means Clustering

Teaching evaluation is the principle of teaching evaluation should follow the basic requirements, it is people in teaching evaluation of the law, based on the understanding, not only reflects the objective law of the teaching evaluation and summary of the practical experience of people over a long period of time, the teaching evaluation has a guiding role. Evaluation index system is on the basis of the implementation of the evaluation, so the design of index system not only to reflect the essence of the special class of, but also pay attention to with guidance and certain in advance, the design of evaluation index system should follow the following principles:

- 1) **Pertinence principle:** the principle of human activities, a very important feature is its purpose, not the purpose of activity is blind, and implements the principle of purpose of teaching evaluation process, evaluation activities can not deviate from the teaching objectives, and any specific evaluation activities must have a specific purpose of evaluation. The proportion of basic knowledge of teaching evaluation in the dominant, but in the implementation of quality education today, in addition to

the assessment evaluation of the students master the knowledge of the situation, but also highlight the students' comprehensive analysis ability, students' ability of using knowledge, students' practical ability, innovation ability. If the teaching evaluation scheme is still only emphasizes the students basic knowledge master, it will make the teaching deviate from the goal of quality education. Therefore, only the teaching objectives and teaching evaluation objectives, to be more objective, impartial evaluation of teachers' teaching performance,

- 2) **Objectivity principle:** teaching evaluation is essentially a kind of value judgment and the value judgment must be based on facts, take an objective, impartial attitude, not subjective conjecture, not personal feelings, otherwise, will affect the correctness of the evaluation results, affect the realization of the purpose of evaluation. Therefore, to some extent, objectivity the principle is a basic guarantee to do the evaluation work. Can adhere to the evaluation criteria, the evaluation of the main evaluation of technical knowledge and experience, master of the situation and on the evaluation of knowledge and other factors. Some evaluation subjects in the implementation of the evaluation, the results and the subjective experience and random changes, some evaluation subject to evaluate higher than the actual the level of your aversion to the people, make less than the actual level of evaluation, so in the evaluation process, should always adhere to the evaluation criteria, the evaluation results should be treated objectively Land use and interpretation.
- 3) **Comprehensive principle:** the principle of comprehensive teaching evaluation, evaluation of the main requirements in observing and dealing with problems, to grasp all aspects of the contradiction from the whole, one can only see things, do not look at another aspect. Because the existing teaching activities is not isolated, it is affected by many factors first, pay attention to the comprehensive evaluation index, it is necessary to consider the surface of those visible factors, but also pay attention to those who see the potential factors not see. Because sometimes the potential factors on the purpose of the evaluation will have a greater impact, such as the psychological factors of the potential factors on the evaluation results plays a very important role. Secondly, to collect information, the evaluation should be as far as possible to collect information, such as the teachers' teaching quality evaluation, not just listen to the individual students! The leader's opinion, not only by a lesson about decided on, should be multi angle.
- 4) **Educational principle:** the principle of education is to promote the teaching evaluation should be assessed to carry forward the advantages and overcome the disadvantages. First, evaluation is thinking, people have feelings, in the evaluation process, they have their own ideas, have their own psychological activities, and the evaluation of teachers must fully respect the evaluation who does not like to go to trial as trial prisoners were evaluated. Otherwise, evaluation will generate resentment, refused to cooperate, make the evaluation of the loss of authenticity. Therefore, should respect and trust evaluation. Secondly, the evaluation results came out, there is a correct evaluation of the evaluation should be made on the evaluation. The achievements to be fully affirmed, careful analysis of evaluation of the problem, propose a solution to the problem, namely the correct handling of the evaluation results.

#### 4.2. Evaluation Index System

According to the survey results of the statistics, part of the index system is modified, the modified indicators into the indicator system weight table to expert advice, let the experts fill out the weight of each index. According to the research objective, combined with expert opinion, the distinction between the importance of the survey, the opinions of the experts' opinions weight is 0.6, the weight is 0.4. by using the analytic hierarchy process to deal with the weight of evaluation index system, it is in the judgment of the



people on the basis of the experience, planning method, using a combination of qualitative and quantitative calculation, the judgment standard, quantity, finally obtains the weight of evaluation index. It in the middle of the index of the same level compares two judgments, list the priority indicators into the indicator system and weight.

**Table 3. Learning Achievement Evaluation Index Judgment Matrix**

	Ideological and moral quality	Comprehensive ability	Affective expression
Ideological and moral quality	1	1/5	1/3
Comprehensive ability	5	1	3
Affective expression	3	1/3	1

Find out the sum of each column of the two comparison matrix:

$$\sum_{k=1}^3 \alpha k_1 = 1 + 5 + 3 = 9$$

$$\sum_{k=1}^3 \alpha k_2 = 1/5 + 1 + 1/3 = 23/15$$

$$\sum_{k=1}^3 \alpha k_3 = 1/3 + 3 + 1 = 13/3$$

By dividing each of the two elements of the matrix into the sum of their respective columns, the new standard two comparison matrix:

$$\alpha_{ij} = a_{ij} / \sum_{k=1}^n a_{ik}$$

$$\alpha_{11}=0.111$$

$$\alpha_{12}=0.130$$

$$\alpha_{13}=0.077$$

All values are calculated in turn, as shown in Table 4.

**Table 4. Index Weight Table**

variable	Ideological and moral quality	Comprehensive ability	Affective expression
Ideological and moral quality	0.111	0.130	0.077
Comprehensive ability	0.556	0.652	0.692
Affective expression	0.333	0.217	0.231

Weight of each index:

$$W1=0.318/2.899=0.110$$

$$W2=1.800/2.899=0.621$$

$$W3=0.781/2.899=0.269$$

The largest eigenvalue of the matrix of computation:

$$(AW)_1 = 1 \times 0.110 + 1/5 \times 0.621 + 1/3 \times 0.269 = 0.324$$

The RI value is used to eliminate the correction factor of the matrix which is caused by the influence of the matrix order, and the numerical value of the RI correction system is shown in Table 5.

**Table 5. Numerical Value of RI Correction System**

Order	1	2	3	4	5	6	7	8	9	10
RI value	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49

According to RI values, it can be concluded that the pairwise comparison matrices satisfy the consistency requirements, the derived feature vectors for effective, do the same calculation of another matrix, but also to meet the random consistency requirements, obtains the eigenvector effectively. Use Excel software according to the weight calculation method in order to calculate weights of each expert to each index, and then calculate the average weight.

### 4.3. Students Learning Evaluation

The evaluation of physical education is a basic part of the teaching process, which teaching activities and teaching effect of feedback regulation of the teaching process, the teaching activities to achieve the intended target. It has been gradually realized the function of PE teaching evaluation, and the evaluation of physical education seriously, the school sports teaching with the change of social progress and people's needs and continuous development, therefore, the school sports teaching evaluation must be based on the development needs to be constantly reform. According to the survey, 58.09% students reflect the current evaluation of students majoring in physical education is the evaluation of formative evaluation and summative evaluation of the combination, there are 27.94% students reflected the evaluation school improvement and affective performance, 23.53% students reflect the school students on each other, 30.15% students reflect the school evaluation includes students' self-evaluation; 22.06% students reflected their diagnostic evaluation of the students in the beginning of the semester.

Teaching evaluation is an important link in the teaching process, the survey found on teaching evaluation of physical education students lack of knowledge, 52.94% students think that the teaching evaluation is to urge the students to learn the method, 36.76% students think not, 10.29% students said is not clear. Through the questionnaire survey results show that the evaluation of College Physical Education on students' learning achievement the focus on motor skills, evaluation standard, evaluation of students' theoretical knowledge and progress was also very seriously, at the same time pay attention to timely evaluation of students in class and after class summary, not in the physical evaluation on a very important position, but still do not pay attention to the students' learning attitude and habits. Emotion, personality and affective performance evaluation, qualitative evaluation, lack of evaluation weights. The results show that the physical fitness and motor nerve type motor skill and the height of the people. Mark, if only from the motor skills a student evaluation, then good physical quality of students doesn't work hard, you can succeed, the physical quality of the poor student's efforts will not be successful. Therefore, easy to hurt the poor physical quality of students self-confidence so that they lose the enthusiasm of learning, and further away from the sports activities.

**Table 6. The Role of Teaching Evaluation**

variable	Urge to learn	Not urge to learn	unclear
Percentage (%)	52.94	36.76	10.29

**Table 7. Proportion of Assessment**

variable	Physical fitness	Motor skill	Technical standards	Theoretical knowledge	Class evaluation	Progress range
Percentage(%)	23.53	54.41	65.44	72.06	59.56	36.03

**Table 8. Evaluation of Physical Education Students**

variable	number	Percentage (%)
Teacher evaluation	93	100
Mutual evaluation	12	11.3
Self-evaluation	10	10.1

## 5. Conclusions

To change the traditional sports teaching evaluation for students to identify, sort and selection of deficiencies, it is necessary to establish a new comprehensive, scientific and objective evaluation system of teaching, in order to enhance the reliability and validity of the evaluation. The new concept of teaching evaluation is the evaluation of the basic point to the development of students, to promote the progress of the students learning as the goal, in order to improve the quality of physical education teaching and comprehensive evaluation, it looks now, looking back at the past, look to the future. So fundamentally established new sports teaching evaluation concept, teachers should change the past single evaluation criteria, weakening evaluation of feature selection, switching to the multi angle, methods of comprehensive quality evaluation, feedback and reinforcement, inspection, incentive to effect but also process, both to evaluate teachers' teaching is also evaluated students learn scientific and reasonable teaching evaluation concept.

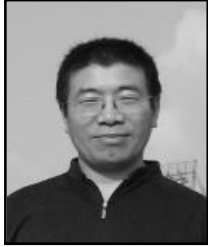
Learning evaluation should be a comprehensive evaluation on the learning of students, in the evaluation of student movement skills and physical fitness at the same time, students' learning attitude, affective performance evaluation cannot be ignored, in order to fully reflect the / student services for the development of philosophy of education, fully embodies the educational function of evaluation. The teaching evaluation should be based on the direction of the combination of the end evaluation and the formative assessment. The purpose and function of the two evaluations are different, and the final evaluation is the evaluation of the mastery of the teaching objectives. Distinguish the pros and cons of rating is the end of the main function of the evaluation and summative assessment should be identifying the problems and difficulties existing in the students learning to promote students' learning, but in the actual implementation process, evaluation of the center of gravity was many teachers on students' Assessment level, distortion of the end of the evaluation function, and cannot really play end evaluation function.

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