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Successful Physical Education Teaching Model Relying on Deep Learning in College Volleyball Teaching

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Keyword: Deep Learning, Teaching Experiment, Volleyball Teaching, Controlled Experiment

Abstract: With the continuous innovation of information technology and science and the rapid rise of 5G network, information education is going deep into all levels and disciplines in the field of education. As a new science, deep learning is favored by many people, involved and applied in various fields, and also received extensive attention in the field of education. The research object of this study is the application of deep learning to assist college sports volleyball teaching. By using the methods of literature, inquiry, teaching experiment and other research methods, this paper conducted an 18 week experiment on 60 students in the optional course of college sports volleyball, and used the physical exercise attitude scale and questionnaire to understand the individual feelings of the students in the experimental class about the deep learning assisted teaching and learning. SPSS 22.0 was used to analyze the differences between the experimental class and the control class in physical quality, basic volleyball skills and exercise attitude. Students acknowledge and accept them. In the experimental class, 70% of the students were very satisfied with the deep learning action tracking technology assisted teaching method adopted by the teacher in the course of learning, and 10% of the students were satisfied.

1. Introduction

With the innovation of science and technology, China's education is also developing rapidly. The current teaching reform is a reform in the field of education and teaching to meet the needs of the information country. It not only improves students' professional theoretical knowledge, but also cultivates students' ability to apply what they have learned to scientific innovation in practice, laying a foundation for all-round development of application-oriented talents [1]. Physical education teaching reform is no exception. At present, the national fitness is also in hot progress, constantly cultivating more people to participate in fitness and guide the trend of fitness. In order to meet this social phenomenon and demand, college physical education curriculum is also in full

swing reform [2].

As an important part of higher education, physical education teaching is the basic way to achieve the goal of physical education. It is also an important way to impart relevant sports knowledge, technology and skills to students, cultivate their good ideological quality and will quality, and promote their all-round development [3]. In recent years, with the development and deepening of the education and teaching reform in colleges and universities, the level of talent training has achieved remarkable results compared with the previous ones, creating many methods that can be promoted. Volleyball, as one of the "three big balls", is a public course content in the vast majority of college physical education courses. It is very popular and loved by the majority of people, especially in the college sports elective courses of ordinary colleges and universities [4]. Chinese scholars believe that volleyball has the characteristics of both competition and entertainment. Regular participation in volleyball can not only improve the functional status of the central nervous system and internal organs of the human body, but also improve people's physical fitness and sports ability, improve the level of physical health in excitement and pleasure, so as to achieve the goal of physical fitness. In volleyball sports and matches, the mistakes and scores of attack and service, as well as the mutual cooperation between players, can effectively mediate their own emotions and psychological conditions, and cultivate students' good sports ethics and the good quality of unity and cooperation. Volleyball sports are characterized by a wide variety of techniques. The learning of each technical action must go through the process of generalization, differentiation, consolidation and improvement, and ultimately achieve action automation [5]. On the contrary, there are still some practical problems that need to be solved urgently. For example, the teaching method is old and single, the teaching method is not new, and the teaching content and teaching mode make the classroom boring. Under this environment, students are likely to feel tired of physical exercise, which further affects the enthusiasm of students to participate in physical exercise and their interest in physical learning [6]. How to enable students to fully grasp the teaching purpose of knowledge and skills within the class hours specified in the volleyball curriculum objectives, and to implement and follow the students' main position, and cultivate students' correct emotional attitude and lifelong physical exercise awareness are the key elements to improve the teaching quality. With the rapid development of information technology and the continuous deepening of the reform of physical education in colleges and universities in China, volleyball teaching has brought new development ideas. While respecting students' dominant position and learning interest, gradually enrich the teaching content, innovate teaching methods, and stimulate students' interest from their own perspective. Properly integrate the technology of in-depth learning into the auxiliary teaching of college sports volleyball, and provide new contents and methods for the development of college sports volleyball teaching [7].

Through the analysis function and advantages of deep learning on human movements, this research uses the platform to carry out auxiliary teaching for volleyball optional courses in a normal university, so as to explore the teaching effect of deep learning technology in college sports volleyball lessons. Through this research, students can effectively extend their learning time, broaden their knowledge horizons, and stimulate their interest in learning, Enhance the physical quality of students and their mastery of volleyball skills, as well as their independent learning ability and attitude towards physical exercise.

2. Overview of Related Concepts

2.1. Deep Learning Theory

The advantage of the artificial neural network with multiple hidden layers is that it has a very good feature learning ability. This neural network has a more profound display of feature data, and

the final network data is conducive to classification and visualization [8].

The deep structure neural network can effectively overcome the difficulty in training by using layer by layer unsupervised method. Since then, deep learning has been highly concerned by relevant scholars at home and abroad. The core idea of deep learning is to simulate the hierarchical abstract structure of mammalian cerebral cortex, and extract features from input data (pictures, videos, sounds, texts, etc.) level by level in an unsupervised way, and use the extracted features to complete the target task. Deep learning is a hot research direction in the current artificial intelligence, which is relative to Shallow Learning. Shallow learning is proposed based on the artificial neural network of the back propagation algorithm. With the back propagation algorithm, the artificial neural network model can obtain characteristic laws from a large number of training data sets using statistical methods to predict targets, There is only one hidden layer. Because there are few hidden layers of shallow artificial neural networks, it is difficult to adjust parameters for complex problems, and the training effect is poor. When the number of samples and computing units are limited, the representation ability is poor, and the generalization ability of the algorithm is poor, shallow learning is gradually fading out of people's sight [9]. Compared with shallow learning, deep learning models usually have five or more layers. On the other hand, with more hidden layers, more target features can be learned, and the learning of features is more profound, which can improve the accuracy of object recognition [10].

2.2. Activation Function

In convolutional neural network, if there is only linear convolution operation, the nonlinear ability of neural network model will be very poor. Therefore, the purpose of adding activation function is to add nonlinear factors to neural network, so that neural network can better solve more complex problems. Common activation functions include Sigmaid, Relu, Softmax, etc. The following uses the Sigmaid activation function as an example to illustrate its role [11].

Sigmaid activation function expression is shown in the formula.

$$\sigma(x)=\frac{1}{1+e^{-x}} \tag{1}$$

The output range of the sigmoid activation function is compressed to between 0 and 1. For a binary classification problem, the sigmoid activation function can be used as the output layer. However, the disadvantage is that the gradient will disappear in the process of reverse gradient solution, and finally the parameters of the network cannot be updated in time. Therefore, the selection of activation function requires strong nonlinear fitting ability as much as possible, so that the gradient will not disappear. For example, Relu activation function and Softmax activation function are designed to improve the nonlinear fitting ability of the network [12].

2.3. Target Detection Technology Based on Deep Learning

With the massive growth of image data, the amount of data is also growing. traditional target detection algorithms have become increasingly difficult to deal with massive data. With the rapid development of computer hardware equipment, the computing power of GPU image processor equipment has been greatly improved, which provides a strong guarantee for image processing research [13]. Deep learning target detection algorithms can be divided into two categories: one stage target detection algorithm and two stage target detection algorithm. One stage target detection algorithms (one shot object detectors) are deep learning target detection algorithms based on regression methods. These algorithms include SSD, RetinaNet, YOL0, YOLOv2, YOLOv3,

YOLOv4, etc. [14]. Compared with the two stage target detection algorithm, the one stage target detection algorithm is much faster, because there is no need to mark the candidate region, and the category probability and location information of the target object are directly regressed in one step [15].

YOLO series of algorithms are developed on the basis of YOLOv1 algorithm, and the core is to use direct regression. YOLOv1 target detection model uses regression method to solve the problem of target detection and recognition, and completes the prediction of target position frame and detection of category probability at one time. Although the use of network regression method reduces the detection accuracy to a certain extent, end-to-end target detection can greatly improve the speed of target detection, which can enable real-time detection and tracking of video [16].

The detection process of YOLOv1 is as follows:

(1) Scale the image to be detected to the size suitable for the network model.

(2) YOLO divides the image to be detected into 7×7. After division, the area size of each small grid is the original image, and each small grid is responsible for detecting the target object in its own area [17].

(3) Each small grid generates two bounding boxes, and each bounding box predicts five values, namely, x, y, w, h, and cs, where x and y are the center of the bounding boxes, w is the width, h is the height, and cs is the confidence. Confidence indicates the target probability value in each bounding boxes, and the expression is as follows

$$cs = \Pr(Object) * IoU_{pred}^{truth} \tag{2}$$

(4) Each small grid predicts 20 category conditional probabilities, representing the probability that the target object belongs to 20 different categories of objects.

(5) Each small grid predicts a value, and the final output of the model is a tensor of one dimension. The front dimension is the location information of the prediction frame, the middle dimension is the cs information predicted each time, and the final dimension is the category information of the predicted target.

(6) The non maximum suppression algorithm is used to eliminate redundant detection frames, and the most likely detection target is obtained. The main idea is to set a confidence threshold and IOU threshold. First, we need to traverse all candidate boxes of a class of objects in the entire image, remove all candidate boxes whose confidence threshold is less than the set confidence threshold, move the maximum confidence threshold of the remaining candidate boxes into the output list, and further calculate and filter out that all the IOUs in the remaining candidate boxes are greater than the IOU threshold in the output list, otherwise add them to the output list, Then the next type of object can be processed circularly, and the final detection result is in the output list.

2.4. Target Tracking Technology

Target tracking is an important link in the video analysis system of table tennis match based on depth learning, and its main role is to continuously track athletes, so as to facilitate the later calculation and analysis of athletes' motion data. In general, target tracking algorithms can be divided into two categories according to the working principle: generative model based and discriminant model based [18].

Discriminant model tracking algorithm is simply a binary classification problem, which transforms target tracking into the problem of searching the boundary between target and background decision. The sample area is divided into target area and non target area by classification. The accuracy and stability of target tracking are determined by the distinguishability

of target and non target apparent feature spaces. Discriminant model tracking algorithm can be divided into three research directions: discriminant model based on Boosting and SVM, discriminant model based on random learning, and discriminant model based on depth learning. The advantage of the algorithm based on Boosting tracking is that it can adaptively select features with strong learning ability to complete the tracking task, but this type of tracking algorithm does not take into account the correlation between target features, resulting in information redundancy. The SVM based tracking algorithm introduces the maximum classification interval constraint on the basis of a powerful classifier to clearly divide the target and non target. The tracking algorithms based on random learning mainly integrate the random features of the target and build the appearance model of the target. The advantages of this approach are high efficiency and fast tracking processing. However, the random selection of features will lead to unstable tracking performance. Such algorithms include linear random forest, naive Bayes algorithm, etc. The original intention of the tracking algorithm based on depth learning is to track the target according to the powerful feature modeling ability of depth learning, but there will be serious shortcomings when using the depth learning method to track the target. First, the target tracking uses too few positive sample data, only the data in the first frame of the video, so it is difficult to train a classifier with good performance; Second, the increase in the number of deep learning convolution layers leads to the complexity of the network structure, and the increase in the amount of algorithm computation leads to the decrease of real-time performance.

3. The Application of Successful PE Teaching Mode Relying on Deep Learning in College Volleyball Teaching

3.1. Questionnaire

According to the needs of this study, a targeted questionnaire was designed, and 60 students were distributed questionnaires for investigation. Before the experiment, we investigated the students' use of deep learning action tracking technology and volleyball learning, designed the Questionnaire on Students' Use of Deep Learning Action Tracking Technology and Volleyball Learning, investigated the students' attitude towards physical exercise, and compared and analyzed the students' attitude towards exercise before and after the experiment, The analysis result is whether the attitude towards students' physical exercise has been improved before and after the experiment by using deep learning action tracking technology to assist teaching; Finally, after the experiment, the feedback of volleyball auxiliary teaching in the experimental class using deep learning action tracking technology was investigated and analyzed.

3.2. Test Objects

According to the course selection of the (2019) level university sports volleyball project in a normal university, randomly select one class as the experimental class, use the deep learning action tracking technology to assist the teaching, and the other class as the control class, use the traditional teaching methods for teaching. According to the unified requirements, unified syllabus, unified teaching progress, and unified teaching content of the sports volleyball course in the normal university, A teaching experiment was carried out on 60 students for 18 weeks (36 class hours) to test whether the deep learning action tracking technology is effective in college sports volleyball class, and to prove the application of the deep learning action tracking technology in college sports volleyball class. A total of 60 students were selected from two classes of volleyball course in a normal university as the experimental subjects, of which one class was selected as the experimental class (12 men and 18 women) for this experiment, and the other class was selected as the control

group (12 men and 18 women) using traditional teaching methods. Before the experiment, collect and test the use of deep learning action tracking technology and volleyball learning, physical fitness, sports skills, and exercise attitude of the students in the two classes. After the experiment, conduct data statistics again for the two classes, and make a comparative analysis to get the final conclusion.

4. Numerical Analysis Results

4.1. Present Situation of Volleyball Teaching in Colleges and Universities

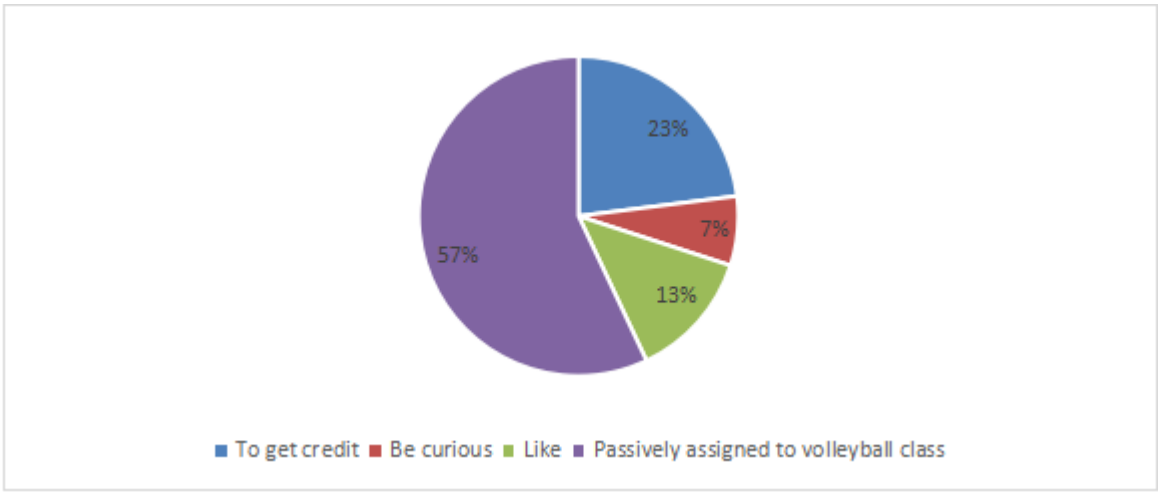

Figure 1. Students' volleyball learning

As shown in Figure 1, 57% of the students were assigned to volleyball classes and were forced to learn volleyball, ignoring the students' independent choice of learning, and 23% of the students were too purposeful to learn for credit. It can be seen from the above figure that students are not interested in learning volleyball.

4.2. Post Test Data Analysis

Table 1. Comparison and analysis of basic volleyball skills test results of experimental class and control class after the experiment

Index	Experimental group		Control group		N=24		N=30	
	Male	Female	Male	Female	Male		Female	
	$\overline{X} \pm S$	$\overline{X} \pm S$	$\overline{X} \pm S$	$\overline{X} \pm S$	T	P	T	P
Self-cushion	75.83±7.68	71.41±4.23	54.58±2.87	54.36±5.84	7.81	0.00*	9.58	0.00*
On the mat	76.67±4.52	73.33±7.14	60.33±3.31	51.21±7.89	8.65	0.00*	5.66	0.00*
Serve a ball	8.13±1.21	8.10±1.31	5.48±1.08	5.32±0.87	5.54	0.00*	6.87	0.00*

It can be seen from Table 1 that after the experiment, the boys and girls in the experimental class and the control class have obvious changes in the basic skills of self cushion, double cushion and serve ($P < 0.05$) but from the average, the average number of self cushion of the boys and girls in the experimental class and the control class after the experiment is 75.83 and 54.58, 71.41 and 54.36 respectively; The average number of pairs was 76.67 and 60.33, 73.33 and 51.21, respectively; the average number of service is 8.13 and 5.48, 8.10 and 5.32 respectively. Therefore, it can be concluded that the experimental class is superior to the control class in basic volleyball skills after the experiment, especially the students in the experimental class who use the deep learning action tracking technology to assist volleyball teaching have greatly improved in basic volleyball skills.

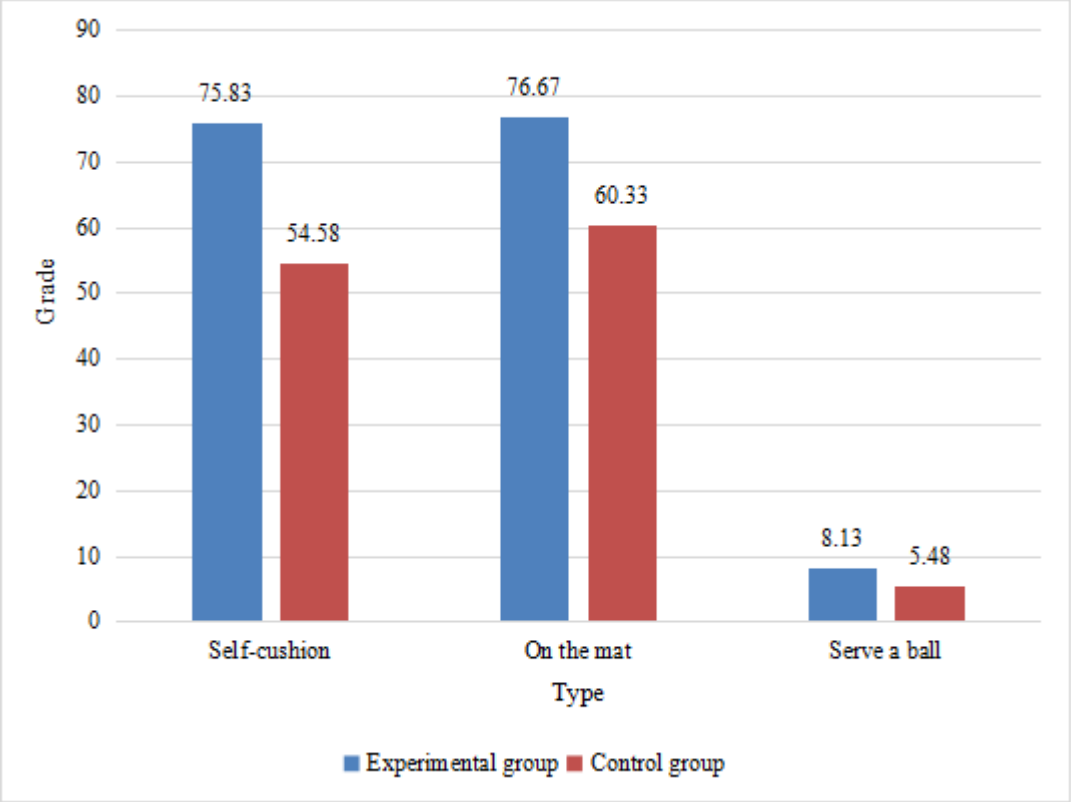

Figure 2. Comparison chart of basic volleyball technical results of boys in the experimental class and the control class after the experiment

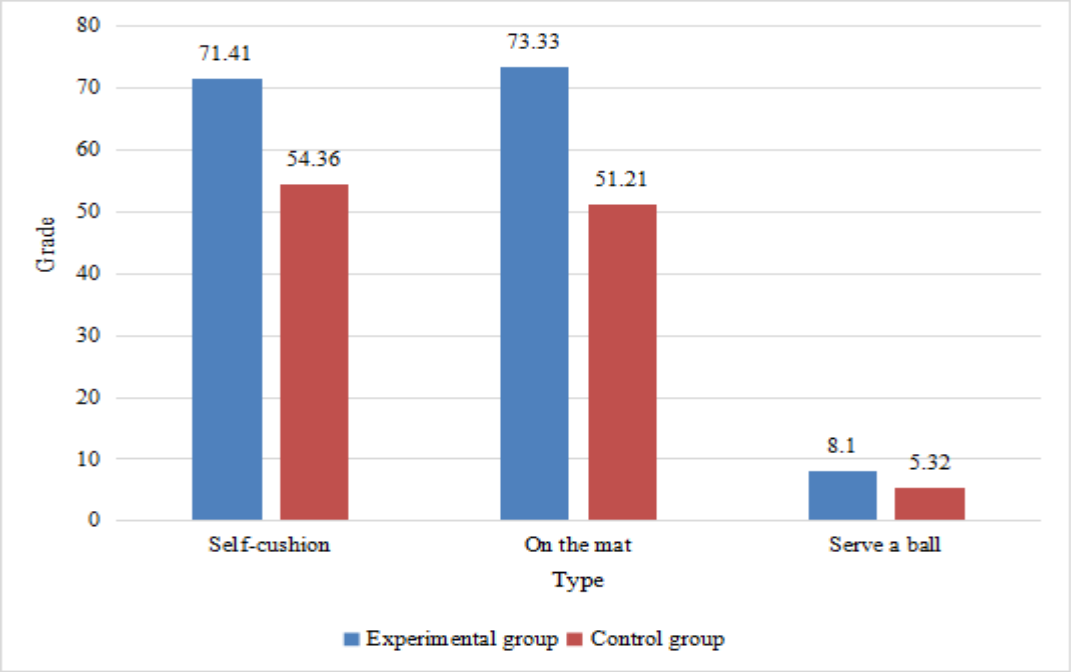

Figure 3. Comparison chart of basic volleyball technical results of female students in the experimental class and the control class after the experiment

The auxiliary teaching of deep learning motion tracking technology and traditional teaching have

obviously improved the basic volleyball skills, but the performance of the experimental class is obviously higher than that of the control class. The reason is that in the assisted teaching of deep learning action tracking technology, the time for "teaching" and "learning" can be effectively extended. Students can form a preliminary representation of the action in their minds by previewing before class, and understand the key points and difficulties of the action. By learning the specific action images transmitted by action tracking technology in depth, students can not only improve their practice time in the classroom, but also deepen their understanding of the action. The deep learning action tracking technology can help students learn at any time and anywhere in their spare time, excite the central cerebral cortex of students, and stimulate their interest in learning.

4.3. Student Feedback on Teaching Methods Based on Deep Learning

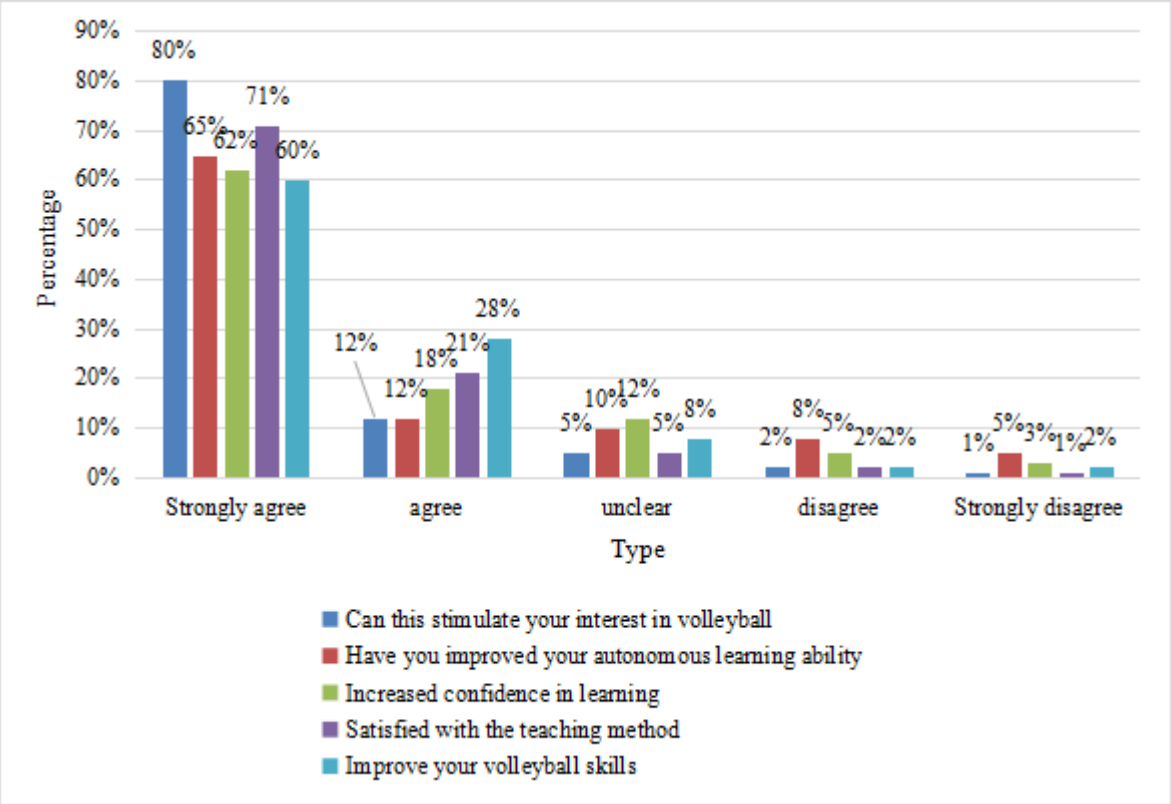

Figure 4. Student feedback on the teaching and learning

The feedback of students in the experimental class on the effect of using deep learning action tracking technology to assist teaching and learning was investigated in the form of a questionnaire. The results are shown in Figure 4. 86.6% of students in the experimental class knew more about the key and difficult points of technical actions through competition videos, action decomposition videos and text explanations. Students can watch videos and watch videos repeatedly at any time and anywhere, extending the time for students to learn volleyball and deepening their understanding of technical actions, Through watching the game video for many times, 60% believed that they had enhanced their awareness of defense and attack in the actual game, not only improved their movement skills but also mastered the basic theoretical knowledge of volleyball, which can effectively combine theory with practice. After investigation, 73.3% of the students think that it is a good choice to apply the deep learning motion tracking technology assisted teaching method to volleyball teaching. They said that the deep learning motion tracking technology assisted learning is

not only applied to volleyball classes, but also will be applied to other physical education classes in the future to improve their physical education learning level.

5. Conclusion

Through a semester of teaching experiment, the physical quality of the students in the experimental class and the control class as well as the basic skills of volleyball have changed to some extent. Among them, the basic skills of the students in the experimental class who use the deep learning action tracking technology to assist volleyball teaching are significantly higher than those in the control class. The experiment further proves that the use of deep learning action tracking technology to assist teaching can help students learn volleyball. In addition to learning during class, students can also learn and correct themselves by watching volleyball knowledge pushed by deep learning action tracking technology, decomposition video, competition video and physical fitness exercise methods in ordinary times, so as to better understand the basic volleyball technical actions and exercise methods while extending students' learning time in the classroom and breaking the limitations of students' learning places. The results of 18 weeks of teaching practice show that the experimental class has a higher learning attitude than the control class. Through deep learning action tracking technology to assist teaching, the teaching content is more abundant, the teaching methods are improved, the students' enthusiasm is stimulated, a better learning atmosphere is created, convenient communication methods are provided, the communication between students and teachers is strengthened, and the students' behavior cognition and attitude are improved, It enhances students' learning behavior intention and learning confidence, effectively deepens students' memory of learning content, enables students to deeply experience the happiness brought by sports, promotes students' physical and mental health development, and cultivates students' lifelong sports awareness.

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Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

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