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Wearable Technology in Higher Education Reform

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Abstract: At present, China's higher education has entered a crucial stage of deepening reform in an all-round way. In this context, college physical education teaching is gradually moving towards the direction of combining diversification, flexibility and information. Through the functions of mobile Internet and cloud data collection, collation and analysis, the real-time data of students' learning activities can be effectively collected, and a good auxiliary reference system for the implementation and evaluation of physical education teaching can be established. Based on the existing research, this paper uses the wearable equipment to assist the teaching in the tennis elective course teaching activities, compares the traditional tennis elective course teaching methods, and tests the role and effect of wearable technology in tennis teaching. It provides valuable empirical support for the teaching of public sports tennis electives in the school.

1. Introduction

Since the reform and opening up, China's scientific and technological undertakings have made considerable progress, which has made great contributions to promoting modernization and realizing the historic leap from food and clothing to a well-off life in general [1-2]. In the new stage of the new century, in order to meet the challenges of knowledge-based economy and stand in the world's National Forest in the fierce international competition, to better promote the coordinated development of our socialist material, political and spiritual civilization, to build a well-off society in an all-round way and to push forward the great cause of building socialism with Chinese characteristics, we must vigorously advance science and technology. Step by step and innovation, step by step, give full play to the key role of scientific and technological innovation in the overall development of society and economy [3]. Scientific and technological innovation calls for the reform and innovation of higher education [4]. Since the reform and opening up, especially in recent years, China's higher education has developed rapidly and made important contributions to social and economic development. At present, under the background of increasingly fierce international competition with science and technology as the core, social and economic development puts forward higher requirements for higher education. Scientific and technological innovation calls for innovative talents, and requires higher education to provide strong talent support [5]. Scientific and technological innovation calls for colleges and universities(CAU) to exert their own advantages, promote the research and development of high-tech and advanced applied technology, increase the intensity of knowledge innovation, and directly serve the social and economic development [6].

Educational informationization refers to the process of fully and thoroughly using modern information technology to promote educational reform and development in the field of education (education management, education and teaching, and education and scientific research) [7-9]. In the Outline of National Medium and Long Term Educational Reform and Development Plan (2010-2020), educational informationization has been fully deployed [10-11].In the future, technology should be integrated into education and teaching, promote the all-round development of students, help to solve the difficult problems of education reform and development at all levels, promote educational equity, improve the quality of education and achieve the strategic goal of building a learning society. This is an important reflection of the revolutionary impact of technology on education and an important basis [12-14]. Wearable technology as a new technology, although it is emerging in the application of education, but its impact on higher education teaching reform can not be underestimated [15]. In 2013, Google Glasses [16-18] was used by medical students to explore cardiovascular exercises in different scenarios in order to promote their learning and achieve good results. Feasibility studies carried out by Arkansas medical science experts at universities record the teaching process through smart glasses, transmit it to classrooms via wireless and Bluetooth, and broadcast teaching videos live through streaming media. Other students who use smartphones, tablets or personal computers can also receive videos for learning. Thus, it opens up a unique way to solve the contradiction between quality and quantity, teaching and service, efficiency and equity in higher education.

Wearable devices have the characteristics of smaller space requirements and low power consumption, and can allow automatic capture of data [19-21], while interacting with the environment. Users can wear wearable devices with them, such as watches, glasses, helmet, backpack and so on. Wearable device is an electronic device that provides information to users and interacts with the environment from time to time [22]. The advantages of wearable computers are their convenience, instantaneity and integration. Wearable devices track individual behavior patterns, collect data, analyze and give personalized recommendations[23].There are many situations in which students do not know teachers and teachers do not know students. Because of the limited time and energy of teachers, it is impossible for every student to have access to them. To be hands-on and caring in the process of education will lead to teachers'ignorance of students' development, which will greatly hinder the achievement of teaching objectives [24]. And our wearable equipment can just solve this problem. In class or after class, students wear equipment, record their learning process and test results, teachers answer the difficult problems in learning in time, so as to truly teach students in accordance with their aptitude and study efficiently[25].

Enlightened by innovative education theory and media theory, this paper designs the experiment of wearable technology in tennis elective course teaching. This paper compares and explores the teaching theory, teaching organization, teaching effect and teaching evaluation of wearable technology in college tennis elective course teaching. By comparing and analyzing the teaching methods of traditional tennis elective courses, this paper examines whether wearable technology assistant teaching is helpful to the improvement of students'physical fitness; whether it is helpful to the formation of students' interest and habits in tennis; whether it has a positive effect on the students'mastery of basic tennis skills; whether it can accumulate the concept of "lifelong sports" for the maintenance of students' sports behavior or even for the formation of their concept of "lifelong sports" Polar action.

2. Proposed Methods

2.1. Wearable Technology

Wearable technology is an innovative technology proposed by the Media Laboratory of MIT in the 1960s. With this technology, multimedia, sensor and wireless communication technologies can be embedded in people's clothing, and gestures and eye movements can be supported.

2.1.1. Key Technologies

(1) Components

President Huang of Mobile Research Institute proposed that since wearable equipment, we can consider transforming the energy released by human body into electric power supply, which is also a research direction.

(2) User Experience

In the interactive mode, if the screen is small and the perception of touch is poor, we can consider making the interaction more humane through voice, eye movements and other ways. In terms of the number of functions, large and complete settings either consume a lot of power or most functions are idle; small and dedicated is a direction to solve one or two pain points of users in a more centralized way.

(3) Data and service integration

All wearable devices that do not provide software and data services are hooligans. Wearable equipment itself is not of great value. The key lies in the data it obtains and the services it provides.

(4) tactile technology

Analysts predict that by 2019, smart watches will account for more than 70% of the total deliveries of wearable devices, and smart watches can not be separated from touch technology. For example, Huawei's smart watch chooses Synapses Clear Pad capacitive touch controller, because the controller is mature, reliable, low power consumption, and has a highly sensitive human-computer interaction performance, touch with wet fingers, the effect is still good. Designers also require classic circular dials, and Synapses is the only provider that can provide a fully circular touch interface. Clear Pad capacitive tactile technology is a trustworthy solution in the industry and has been used in more than 1 billion consumer-oriented devices.

(5) Pressure touch

Through Force Touch device, users can perceive the intensity of light and heavy pressure, and call out different corresponding functions, which enrich the user's touch interaction level and experience. 3D Touch adds the function of re-clicking this dimension on the basis of the original Force Touch's light clicking and light clicking. The screen of the iPhone 6S is lighter, lighter and heavier, which is more sensitive than the pressure touch screen technology on Apple Watch. Pressure touch technology Clear Force can use finger or stylus to exert different forces, adjust the rolling speed and zoom ratio, achieve continuous and variable game control and different text or photo editing methods, thus enabling device manufacturers to differentiate smartphones.

(6) Battery Innovation

To make wearable devices as popular as smartphones and tablets, batteries have to be smaller, run longer, and be lighter and more flexible. Samsung SDI presented its new achievements at the Battery Expo in Seoul in 2015. Samsung demonstrated two new batteries.Another battery is Band, which can be mounted on the watch strap of a smart watch, making the battery power 50% more than the original device. Samsung bent the battery 50,000 times during the test to see if it is durable. Samsung not only cares about its shape, but also pays attention to its function. Band batteries will enter the market in 2017, which may change the market structure.

2.1.2. Design Characteristics of Wearable Equipment

(1) Modularization of architecture design. Each module includes sensor module, storage module, communication module, power supply module and so on.

(2) Multi-application oriented. Modules can be configurable to adapt to different application areas, such as: for medical health, disaster relief, combat fighters and so on.

(3) Low energy consumption and real-time. The system uses Beige wireless communication technology to save energy consumption and has good reliability to meet the design requirements.

(4) It has the function of information fusion. Sensors can collect physiological signals and environmental parameters of human body, and need complex information processing and fusion decision-making to improve the accuracy of discrimination.

(5) The material of clothing is suitable for harsh environment. The material used in smart clothing should have the characteristics of wear resistance, moisture resistance, fire protection and so on, so as to meet the requirements of field work.

2.1.3. Wearable System Hierarchy

Wearable system can be divided into four layers: application layer, service layer, driver layer and hardware layer.

(1) Hardware layer

The hardware layer is mainly composed of wireless sensor modules embedded in intelligent devices based on Beige protocol. These modules can realize the functions of acquisition, calculation, display, input, output, storage and so on. The design of these hardware modules first needs to meet the needs of intelligent design, which can collect physiological parameters, human posture, environmental parameters information and so on. And these modules should use flexible information fiber materials and clothing for a good combination. Secondly, in order to ensure that these functional modules can better judge the information and realize human-computer interaction, the processors need to process the collected signals with digital filtering, decision-making judgment, feature extraction and other information processing. Finally, the hardware design of the system needs to be comfortable, movable and convenient for human normal activities.

(2) Driver Layer

Its function is to provide the operation interface of the external device for the upper program, and to realize the device driver. The upper program can be implemented inside the device regardless of the operation, and only need to call the driver interface.

(3) Service Layer

As the core level of the system, the service layer realizes the preliminary acquisition of information through signal allocation, scheduling and decision-making.

Fusion and wisdom can ultimately achieve high-level fusion of information to meet the requirements of different applications.

(4) Application Layer

Organize and invoke business logic for the overall framework of the program. Several tasks can be implemented with an embedded operating system.

2.1.4. Information Processing of Wearable Equipment

Wearable equipment has a front-end system which is a part of embedded module and equipment. It mainly includes signal preprocessing, feature extraction, online decision-making and other modules. For example, in the design of pulse monitoring system, the pre-processing stage includes the functions of pulse signal acquisition, digital processing, filtering and so on. Then the effective signals are extracted and calculated.Wearable device backstage application platform has strong computing power, not only to achieve the calculation of complex conditions, but also to meet the relevant application requirements. In a word, background processing includes two aspects of information processing: first, feature extraction and information fusion for multiple sensors, and then information storage. Secondly, the real-time display of signal waveform, data feature extraction, data acquisition, data change polygraph, application-oriented information fusion decision support.

2.2. Characteristics of Higher Education Based on Information Technology

(1) Diversity of Teaching Environment

Under the background of modern education, the diversification of higher education teaching means includes not only computer and network technology, but also satellite radio and television technology and simulation technology. These new technologies not only broaden teachers'horizons, but also break the limitations of teaching space and time.Teachers and students can access the corresponding learning resources at any time, and they can know the world and swim in the network world without leaving home. Network teaching has become an important part of higher education, which can realize the exchange of classroom content and network resources.

Fusion and convergence, students can learn independently without the limitation of time and space. This teaching environment provides conditions for amateur education and distance education. Scholars can learn flexibly, in real time and on demand. Through modern educational technology and equipment, a bridge has been built between students, educational institutions and teachers. This is a new learning mode with students as the main body, especially the development of distance education and radio and television education. The teaching environment has shown a diversified development trend.

(2) The richness of teaching resources

Teaching resources provide necessary conditions for the development of teaching, including textbooks, audio and video, pictures, and other educational infrastructure, including teachers'resources and tools. Some scholars even summarize educational policies as teaching resources. Since the 1930s, more and more kinds of teaching media have been developed, and the concept of education has also changed. At present, the development of information technology has led to the diversification of information sources. The sharing and utilization of global educational resources has become a reality. The educational resources around the world have been utilized and the sharing of teaching activities has been realized. Students can share resources under the guidance of teachers. Teaching media is not only teaching resources, but also teachers and students. Teachers are not only the source of information for teaching activities, but also the media as a tool for information transmission, thus building a modern educational environment.

(3) The Efficiency of Teaching Media

The form and sound performance of teaching media can transmit teaching information in the form of image and sound at the same time, which makes abstract concepts of things concrete, teaching content simple and easy to understand, and use ears and eyes when accepting knowledge. It has both visual impact and sound feeling. Multimedia teaching makes the speed and breadth of information transmission more rapid and expanded. It can transmit images and sounds in real time and at the same time. The output of information matches the information received by students.It can be seen that the characteristics of teaching media meet the needs of modern educational technology, not only expanding the scope of students'perception, but also extending and deepening the teaching content, highlighting the essence of things, enhancing the appeal of teaching content, and improving students' interest in learning.

(4) Interaction in Classroom Teaching

Classroom is not only a place for teachers to impart knowledge, but also a paradise for exploring knowledge and igniting students'wisdom. The interaction of educational technology has changed the relationship between teachers and students. Teachers and students are partners in teaching activities.

3. Experiments

3.1. Research Subjects

This paper takes the application of wearable technology in tennis elective course teaching as the research object. 100 non-sports majors in 2018 were selected, and the proportion of male and female in the experimental group and the control group was the same.

3.2. Research Purposes

Through a 14-hour teaching experiment. The control group used traditional tennis teaching. Through direct observation of teachers, students'mastery of basic tennis skills was evaluated by experience, and teaching programs were controlled. In the experimental group, teachers and students analyzed the sport data acquired by wearable equipment, evaluated the students'mastery of basic tennis skills and controlled the teaching program. Through collecting and analyzing the data of pre-test and post-test, this paper examines whether wearable technology assists tennis elective course teaching to improve students'physical fitness and develop sports habits, and whether wearable technology can promote students to master basic tennis skills.

3.3. Experimentation Time

Time: The experiment was conducted from January 25, 2018 to December 25, 2018.

Location: University Tennis Hall.

Course Arrangement: Each Tuesday, a total of 28 weeks (48 hours).

4. Discussion

4.1. Comparison of Physical Fitness Differences after Test

After the experiment, the control group and the experimental group were tested again for specific physical fitness indicators. The results were as follows:

Table 1. Comparison of physical fitness before and after the experiment

project	Grouping	$\bar{x} \pm S$	T	P
800 meter long run	control group	186.2±10.1	1.401	>0.05
	Experience group	178±15.1		
Standing long jump	control group	2.16±.021	0.287	>0.05
	Experience group	2.25±0.41		
Push Back Run	control group	45.2±4.3	0.869	>0.05
	Experience group	41.2±5.3		
Throwing tennis	control group	4.5±0.6	-0.912	>0.05
	Experience group	5.31±0.5		

The above experimental results show that, on the basis of the basic consistency of objective conditions, after the experiment, the performance of the control group and the experimental group in turn running and tennis throwing has been improved, among which the performance of the students in the experimental group has been improved significantly.

4.2. Contrast of Tennis Basic Skills Mastery after Experiments

Table 2. Basic tennis technical test statistics of the control group before and after teaching experiments

project	Before and after the experiment	$\bar{x} \pm S$	T	P
Forehand serve	Before experiment	7.1±1.7	-21.312	P<0.01
	Post test	22.03±1.3		
Forehand hits high	Before experiment	3.8±1.562	-15.342	P<0.01
	Post test	23.45±3.4		
Forehand hanging net front ball	Before experiment	3.11±1.4	-12.534	P<0.01
	Post test	14.19±3.4		

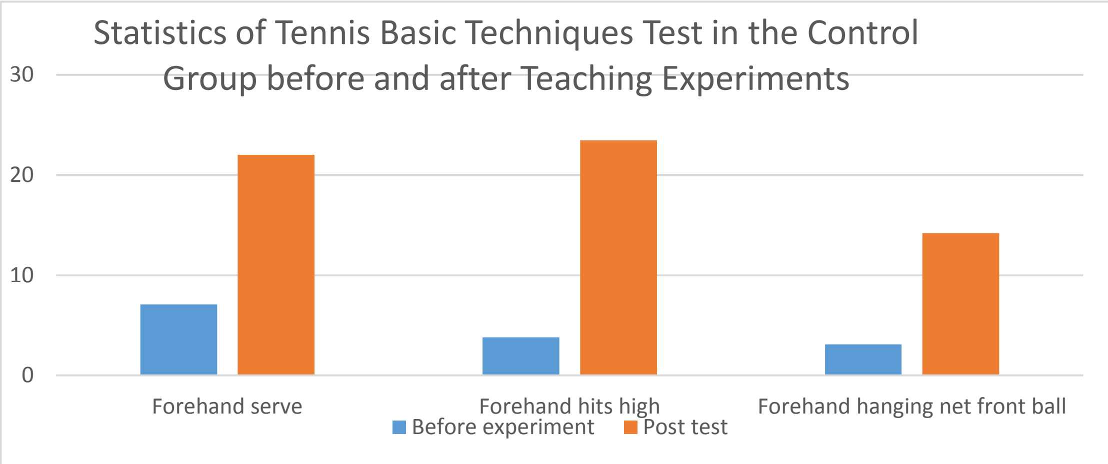

Figure 1. Basic tennis technical test statistics of control group before and after teaching experiments

As shown in Table 2, before and after the teaching experiment, we can see that the basic tennis skills test statistics of the control group show that the P values of the students in the control group before and after the three technical experiments are less than 0.01, showing a significant difference. From this analysis, we know that under the traditional tennis teaching method, the control group students have greatly improved their mastery of basic skills, and the traditional tennis teaching methods have a good effect on improving the basic tennis skills.

Table 3. Statistics of tennis basic techniques test in the experimental group before and after teaching experiments

project	Before and after the experiment	$\bar{x} \pm S$	T	P
Forehand serve	Before experiment	6.7±1.2	-17.32	P<0.01
	Post test	25.93±2.3		
Forehand hits high	Before experiment	3.9±1.162	-25.74	P<0.01
	Post test	25.45±2.7		
Forehand hanging net front ball	Before experiment	3.81±1.4	-10.53	P<0.01
	Post test	24.19±3.1		

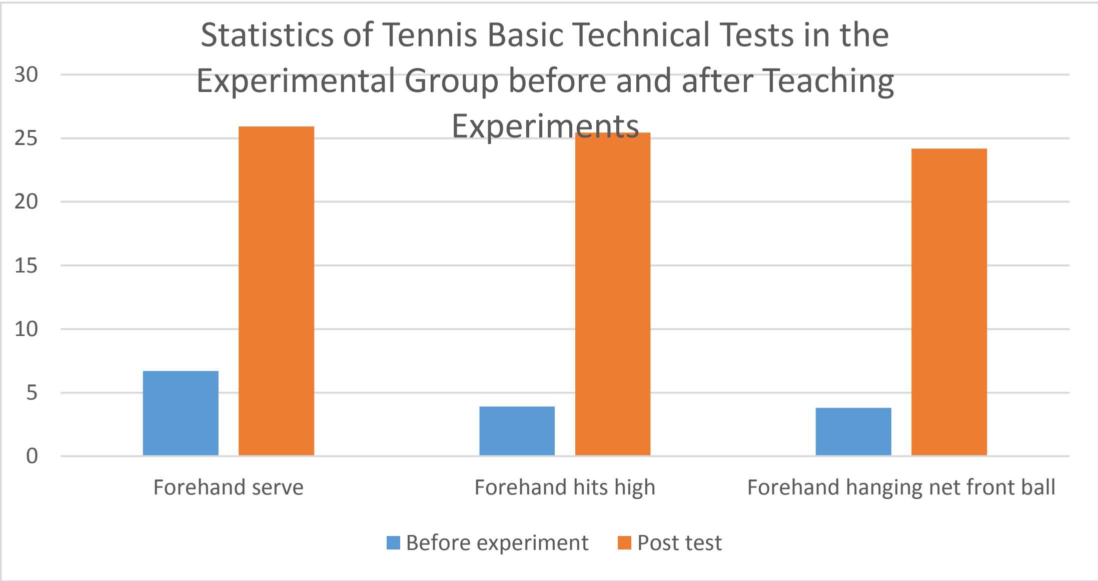

Figure 2. Basic tennis technical test statistics of the experimental group before and after teaching experiments

For example, table 3, before and after the teaching experiment, we can see the basic tennis technology test statistics of the experimental group. The control group students in the forehand serve high-range ball technology, forehand hit long-range ball technology, forehand hang net technology, before and after the experiment, the comparison analysis, the three techniques before and after the experiment, the score P value is less than 0.01, showing significant difference. From this analysis, we know that the experimental students have greatly improved their mastery of basic skills under the wearable technology-assisted tennis teaching mode, and the wearable technology-assisted tennis teaching has a significant effect on the improvement of basic tennis skills.

4.3. Contrastive Analysis of Students' Interest in Learning

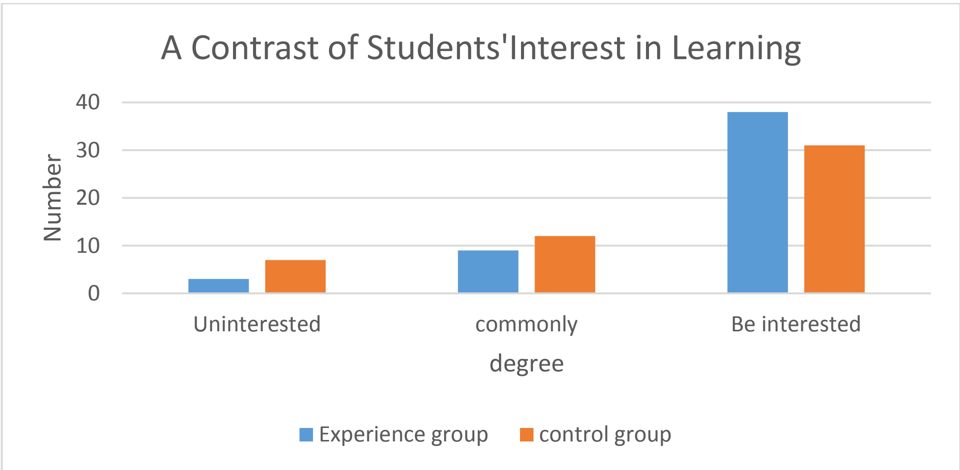

Figure 3. Comparison of learning interest between control group and experimental group after experiment

As shown in the comparison chart of learning interest between the control group and the experimental group after the experiment, after the experiment, the proportion of students interested in tennis in the experimental group is about 76%. There is no difference between tennis and other sports. The proportion of students who feel general is 18%. The proportion of students who are not interested in tennis is is about 6%. Relatively speaking, the proportion of students in the control group who are interested in tennis after the experiment is 62%. They feel one. About 24% of them are general, and about 14% are not interested in tennis after the experiment. The data show that wearable technology assisted tennis teaching can play a positive role in cultivating students' interest.

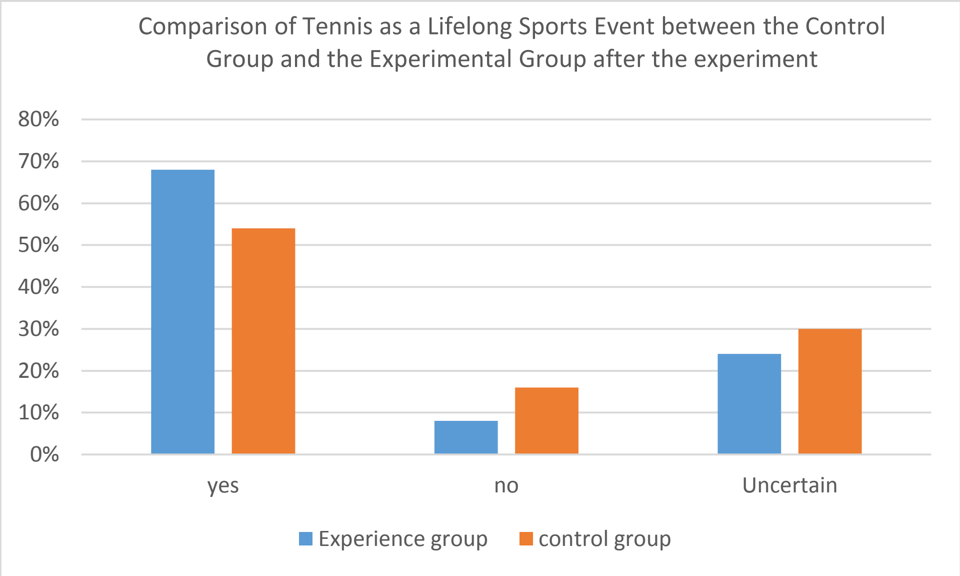

Figure 4. Comparison of tennis as a lifelong sports event between the control group and the experimental group after the experiment

Fig. 4. After the experiment, there are obvious differences between the two groups in whether tennis is is regarded as a "lifelong" sport. 68% of the students in the experimental group of wearable tennis teaching assisted by technology said they would stick to learning, keep exercising and continue to enhance their technical ability. Nearly 8% of the students said they would not regard tennis as their own lifelong sport, while 24% of the students said they would not take tennis as their own lifelong sport. While 54% of the students in the control group said that they would take tennis as their "lifelong" sports, 16% of the students would not take tennis as their "lifelong" sports, and 30% of the students said they were not sure.

5. Conclusion

(1) This paper analyses the characteristics of higher education based on information technology from four aspects: the diversity of educational environment, the richness of teaching resources, the efficiency of teaching media and the interaction of classroom teaching.

(2) Applying wearable technology in traditional tennis teaching classes, we can collect the data of students' usual training in class, then according to the training data of students, referring to the syllabus.

(3) The experimental results show that tennis elective course teaching with wearable technology

can effectively stimulate students' interest in learning and fully mobilize students' enthusiasm for learning.

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