Application of Computer Vision and Virtual Reality Technology in Online Teaching of Public Sports under the Background of the New Crown Epidemic

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Keywords: Online Teaching, Computer Vision, Virtual Reality Technology, New Crown Epidemic Background

Abstract: At the beginning of 2020, the new crown epidemic spread wildly, and most parts of the country were forced to press the pause button, which seriously affected the normal development of college sports work. In order to thoroughly implement the important instructions on the new crown pneumonia epidemic, the Ministry of Education issued the initiative of "suspending classes without stopping learning and teaching without stopping classes". Colleges and universities across the country responded one after another and started online physical education teaching and related work. This paper aims to discuss the application of computer vision and virtual reality technology in online teaching of public sports under the background of the new crown epidemic. In view of the current situation of online sports education, this paper analyzes the current virtual reality education ecology, and combines computer vision algorithms to propose a public sports online teaching method based on computer vision and virtual reality technology. The experimental results of this paper show that teaching in the form of online live broadcast, recorded broadcast, live broadcast + recorded broadcast can generally meet the students' exercise needs. However, there are still some physical education teachers with weak online teaching ability. There are about 364 students. About 63.64% of the students believe that their physical education teachers are not good at courseware production, and there is a dilemma of lack of teaching technology. The online public sports teaching mode can effectively meet the exercise needs of public sports students and improve their physical quality. There are 403 students, and about 70.45% of the students said that online public sports teaching can meet their exercise needs. Therefore, the full use of computer vision and virtual reality technology in online teaching can promote the application of digital teaching in schools and save educational resources for schools. It has created an innovative education model, improved the quality of school education, enhanced the experience of teachers and students, and attracted them to participate more.

1. Introduction

Relevant data show that the physical quality of young people is declining year by year, and it is urgent to promote the integration of physical education. The concept of "strengthening the body with physical fitness" has begun to attract widespread attention in the society, the status of physical education courses has been improved, and the exploration of the path for sports to enter the high school entrance examination and college entrance examination has aroused heated discussions again. College physical education, as the highest platform for physical education, plays an important role in demonstration and leading. However, there are still many problems and challenges in the development of college sports, which restrict the development of college sports: Insufficient sports facilities in schools make it difficult to meet the diverse needs of students and reduce students' interest in physical education classes. The teacher's teaching method is single, the teaching content is boring, and it cannot adapt to the new situation in the new era. Students are immersed in exam-oriented education and do not pay enough attention to physical education courses. Some students have weak awareness of physical exercise and lack of awareness of their own health, ignoring the importance of physical health. The traditional offline physical education model is single and cannot meet the diverse needs of physical education. It is urgent to join the modern teaching information technology such as "Internet +". The reform of physical education in colleges and universities should focus on the three commerce and education, and strengthen the promotion of physical education courses.

According to the research progress abroad, different researchers have also conducted corresponding collaborative research in online teaching: Lg A explored the experiences of undergraduates in diagnostic radiology with online teaching and learning during the COVID-19 lockdown [1]. Rodic M V described the actions taken to transform the chemical crystallography course at the University of Novi Sad, Serbia, from face-to-face to online teaching, and the new challenges encountered during these unprecedented times [2]. Xiao C took an online inorganic chemistry course as an example to illustrate how to provide an effective method for online teaching of chemistry. Combined with Dingding, WeChat, Learning@ZJU website and other applications, a network platform was built to successfully carry out the course [3]. Hermanns J described and discussed the development of an online course on the topic "Organic Chemistry" for non-specialized chemistry students [4]. However, these scholars' research on online teaching lacks a certain technical demonstration, and they find that there are better researches on online teaching based on computer vision. The literature on computer vision was consulted for this.

Some scholars also have some research in computer vision: Many computer vision and medical imaging problems face learning from large-scale datasets with millions of observations and features. Barbu A proposed a novel efficient learning scheme that enforces sparsity constraints by gradually removing variables based on criteria and schedules [5]. Khan N A proposed a computer vision-based method to identify malaria parasites from light microscopy images [6]. Tapu R introduced a novel computer vision-based perception system that is specialized for autonomous navigation of visually impaired people [7]. However, these scholars did not discuss the application of computer vision and virtual reality technology in the online teaching of public sports in the context of the new crown epidemic, but only discussed its significance unilaterally.

This paper aims to study the online teaching method of public sports under the technology of computer vision and virtual reality. The experimental results of this paper show that teaching in the form of online live broadcast, recorded broadcast, live broadcast + recorded broadcast can basically meet the students' exercise needs. However, there are still some physical education teachers with weak online teaching ability. About 63.64% of students believe that their physical education teachers are not good at making courseware, and their teaching level needs to be strengthened. The

online public sports teaching mode can effectively meet the exercise needs of public sports students and improve their physical quality. About 70.45% of students said that online public sports teaching can meet their exercise needs.

2. Online Teaching Based on Computer Vision and Virtual Reality Technology

2.1 Online Teaching

The online teaching mode uses the Internet as the medium of teaching, and presents the learning content to the learners in the form of video, live broadcast or multimedia dynamic performance. As shown in Figure 1, the entire teaching process is online. After the course is over, the video recordings of the course are saved on the platform, and people can flexibly choose to watch it repeatedly and draw up your own learning plan [8]. All learning content is no different from traditional teaching content. In order to provide the necessary guarantee for the teaching effect, teachers must improve their teaching ability when teaching online [9]. This paper discusses and considers the rationality and teaching effect of online courses.
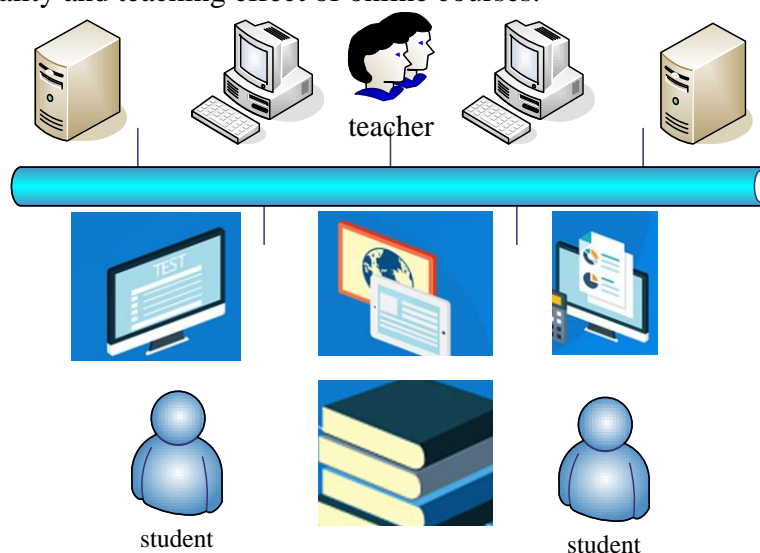
Figure 1. Online teaching

Various information technology companies, online training institutions, government education institutions, etc. came into being, and various online courses also appeared one by one. With the gradual improvement of such models, the types of courses are gradually refined, which can provide those who need them with accurate online teaching services, and the development of online courses will inevitably move towards a more brilliant future [10]. This paper aims to discuss the application of computer vision and virtual reality technology in the online teaching of public sports under the background of the new crown epidemic, and firstly analyzes the ecology of virtual reality education.

2.2 Virtual Reality Education Ecology

The virtual reality education ecology expresses the element relationship of the virtual reality ecosystem. Figure 2 is a figure of the elements of the virtual reality education ecosystem.
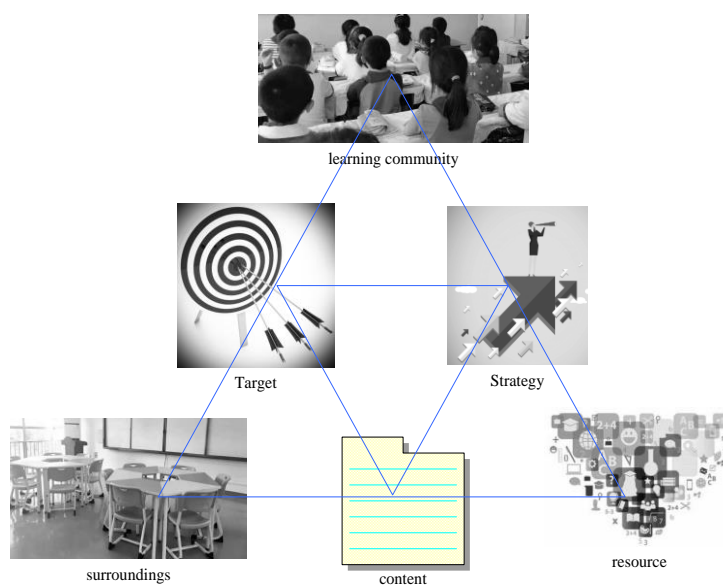
Figure 2. Elements of the Virtual Reality Education Ecosystem

(1) Learning community

The learning community is the main body of the virtual reality education ecosystem, which consists of learners, their collaborators, and assistants. For example, anglers in natural ecology are the "protagonists" of the system [11].

(2) Target

Goals are an effective enabler for the functioning of the ecosystem, such as the target of fishing in natural ecology - fish [12].

(3) Strategy

Strategies include learners' learning strategies, teaching strategies and resource presentation methods, etc. Appropriate learning strategies can effectively ensure the learning effect [13].

(4) Environment

The environment is the "soil" for learners to carry out learning activities, such as air, sunlight and water on which human beings depend. It is a continuous and unified mixed environment composed of physical environment (hardware) and virtual environment (software) [14].

Physical environment: it includes equipment required for study. Tables and chairs, projectors, computers, wearable devices, handles, etc., are hardware tools for completing teaching activities [15].

Virtual environment: it refers to the software environment that learners need for learning, and is also a learning resource environment [16].

(5) Content

Content is what learners learn. The learning content in the virtual education ecosystem is rich, interesting and interactive, which is convenient for learners to acquire, such as fish, shrimp, aquatic plants, etc. in ecosystem lakes [17].

(6) Resources

Resource is the most important supporting element of the ecosystem and runs through every link of the ecosystem [18].

2.3 Computer Vision Algorithms

Vision is an important way for people to obtain external information. Computer vision refers to

the collection and processing of external visual information through image sensors and computers, so that machines have the ability to "think" similar to humans. Digital signals such as images, videos, and multi-dimensional signals are collected by imaging equipment such as cameras, which are input as signals, and then processed by a computer to achieve the purpose of detection, identification, and tracking, and finally obtain a judgment and interpretation that meets the requirements [19].

(1) Harris corner detection and matching algorithm

In computer vision, the corner point is a very important point of interest, which is the point where the boundary changes in the image are more obvious. It is usually applied to problems such as object recognition, image matching, visual tracking, 3D reconstruction, etc., and analyzes specific specific points. Harris corners are commonly used corners based on grayscale images, which are sensitive to noise, precise positioning, rotation invariant, and high discrimination [20].

Harris corner detection

The principle of Harris corner detection is to use a detection window to move the window in the image, and the window to be detected will not change in the smooth area of the image and the direction of the edge of the image.

Window translation $[r, w]$ produces a grayscale change $O[r, w]$:

$$O[r, w] = \sum_{a,b} t(a, b)[N(a + r, b + w) - N(a, b)]^2 \quad (1)$$

Among them, $t(a, b)$ is the window function, $N(a + r, b + w)$ is the image grayscale after translation, and $N(a, b)$ is the image grayscale.

So:

$$N(a + r, b + w) = N(a + r) + N_a r + N_b w + U(r^2 + w^2) \quad (2)$$

It can be obtained:

$$O[r, w] = [r, w] \begin{bmatrix} N_a^2 & N_a N_b \\ N_a N_b & N_b^2 \end{bmatrix} \begin{bmatrix} r \\ w \end{bmatrix} (3)$$

For a locally tiny amount of movement $[r, w]$, $O[r, w]$ is approximated as:

$$O[r, w] \cong [r, w] Q \begin{bmatrix} r \\ w \end{bmatrix} (4)$$

Among them, Q is a 2*2 matrix:

$$Q = \sum_{a,b} t(a, b) \begin{bmatrix} N_a^2 & N_a N_b \\ N_a N_b & N_b^2 \end{bmatrix} (5)$$

Response value function S:

$$S = \varphi_1 \varphi_2 - h(\varphi_1 + \varphi_2)^2 \quad (6)$$

Among them, h is generally between 0.04 and 0.06, and φ_1 and φ_2 are the eigenvalues of Q. S is rotationally invariant to the image.

Usually, in order to improve the stability of the results and reduce the influence of the parameter h on the results, S is defined as:

$$S = \frac{Det(Q)}{Tr(Q) + \tau} \quad (7)$$

Among them, $Det(Q)$ is the determinant of Q, $Tr(Q)$ is the trace of Q, and τ is an arbitrarily small number.

The specific steps of Harris corner detection are as follows:

Input: RGB image

Step 1: Convert the image into a grayscale image, which is smoothed to obtain an image. The convolution kernel is:

$$h = \begin{bmatrix} 1 & 4 & 6 & 4 & 1 \\ 4 & 16 & 24 & 16 & 4 \\ 6 & 24 & 36 & 24 & 6 \\ 4 & 16 & 24 & 16 & 4 \\ 1 & 4 & 6 & 4 & 1 \end{bmatrix}(8)$$

Step 2: Find the gradients N_a and N_b of the image on the a-axis and b-axis through convolution. The convolution kernel is:

$$h_a = [-0.5, 0, 0.5](9)$$
$$h_a = h_a^`(10)$$

Step 3: Find N_a^2, N_b^2, $N_a N_b$ in the formula, among them:

$$N_a^2 = N_a \times N_a(11)$$
$$N_b^2 = N_b \times N_b(12)$$
$$N_a N_b = N_a \times N_b(13)$$

Step 4: Find the response response matrix S. According to the formula there are:

$$Det(Q) = N_a^2 \times N_b^2 - (N_a \times N_b)^2(14)$$
$$Tr(Q) = N_a^2 + N_b^2(15)$$
$$S = \frac{Det(Q)}{(Tr(Q)+2.2204e-16)}(16)$$

Among them, τ takes the constant $2.2204e - 16$.

Step 5: When thresholding, select a threshold V and scan the S matrix.

Step 6: Suppress the local maximum value, scan the S matrix according to the suppression window size 3, and judge whether the unit value is consistent with the maximum value in the 3×3 area. If there is, take it as a corner and record it, otherwise it will be discarded.

(2) Harris corner matching

The vector description of Harris corners is the transformation of diagonal corners from point features to vector features. The point feature only contains the coordinate information and grayscale information of the point, and the comparability is not strong, so the point feature is converted into a vector feature by using the information of the neighborhood.

Coarse matching only roughly matches the corners on the two images, it does not guarantee the correctness of all matching corner pairs. It may contain some false matches, so another exact match is required. RANSAC random sampling consistency algorithm is used for exact matching.

RANSAC is an iterative algorithm with strong robustness and is often used for parameter estimation.

The main steps of RANSAC for accurate corner matching are:

The number of iterations P of RANSAC is determined by the number of coarse matching corner pairs C, then:

$$P = \frac{log(1-i)}{log(1-(1-\tau)^c)}(17)$$

Randomly select 4 diagonal points from the four diagonal points (the 4 corner points cannot be on a straight line), and then find the conversion mode L.

The remaining matching points are then counted, and the number of inlier pairs is recorded. Assuming that the point (a, b) in the image to be matched is roughly consistent with $(a^`, b^`)$ in the reference image, (a, b) is calculated from L to $(a^{``}, b^{``})$, if $(a^{``}, b^{``})$ and $(a^`, b^`)$ are consistent, or the distance between the two is less than a certain critical value, then the pair is regarded as an inner point, otherwise it is an outer point.

Repeat the above operations to check whether the obtained number of interior point pairs meets the requirements, if so, stop the loop and record L, if not, continue.

The key to the RANSAC algorithm is the calculation of the transformation model L, which is also known as the homography matrix. Similar to the fundamental matrix, L is a third-order matrix,

representing the coordinate transformation relationship between the two images. Denote (a, b) and $(a^{``}, b^{``})$ as a pair of matching corners, and the relationship between them can be expressed as:

$$L = \begin{bmatrix} l_0 & l_3 & l_6 \\ l_1 & l_4 & l_7 \\ l_2 & l_5 & l_8 \end{bmatrix} \quad (18)$$

$$\begin{bmatrix} a^` \\ b^` \\ 1 \end{bmatrix} = L \begin{bmatrix} a \\ b \\ 1 \end{bmatrix} \quad (19)$$

In theory, at least 4 diagonal points need to be selected and 8 independent thread formulas are established to solve L. After L is known, the calculations of $a^`$ and $b^`$ are as follows:

$$\begin{cases} a^` = \frac{l_0 a + l_3 b + l_6}{l_2 a + l_5 b + l_8} \\ b^` = \frac{l_1 a + l_4 b + l_7}{l_2 a + l_5 b + l_8} \end{cases} \quad (20)$$

3. Deconstruction of the Current Situation of Online Public Physical Education

3.1 Online Public Physical Education Resources

This paper aims to discuss the application of computer vision and virtual reality technology in online teaching of public sports under the background of the new crown epidemic. Online public physical education resources are various conditions that can be used to effectively carry out physical education activities, mainly including physical education course materials, physical education teaching materials, physical education environment, audio, video, PPT, etc. And computer vision and virtual reality technology can better assist online teaching.

(1) Online public physical education teaching medium

The essential difference between online public physical education and traditional public physical education is the different teaching media. Online public physical education is taught through electronic devices (mobile phones, computers, etc.), and teachers and students are in different spaces. This teaching method enabled by virtual reality technology enables participants to directly apply visual, auditory and tactile sensations and allows them to observe and operate interactively. In the process of online public physical education, the selection of the teaching platform and the implementation form of teaching are all factors that affect the quality of the classroom. Class media is the basic guarantee for teaching. To ensure the normal development of online public physical education, the use of learning platforms is an essential part. Therefore, a survey was conducted on the online public sports learning media of students, and the survey results are shown in Figure 3.

As can be seen from the figure, the selection of online public sports teaching media in ordinary colleges and universities in Province A mainly includes computer vision and virtual reality places such as Rain Classroom, Dingding, WeChat, Tencent Conference, Tencent Classroom, Chaoxing, China University MOOC, and QQ. Among them, Rain Classroom, Tencent Classroom, DingTalk, Tencent Meeting, and QQ are the more commonly used online virtual reality sports teaching media. There are 422 students who study online public sports through Rain Classroom, accounting for 26.00%; 242 students who study online public sports through DingTalk, accounting for 14.91%. 139 students studied online public sports through WeChat, accounting for 8.56%; 227 students studied online public sports through Tencent Conference, accounting for 13.99%. 87 students studied online public sports through Chaoxing, accounting for 5.36%; 22 students studied online public sports through Chinese University MOOC, accounting for 1.35%. There are 191 students who study online public sports through QQ, accounting for 11.77%; 29 students who study online public sports through other students, accounting for 1.79%.
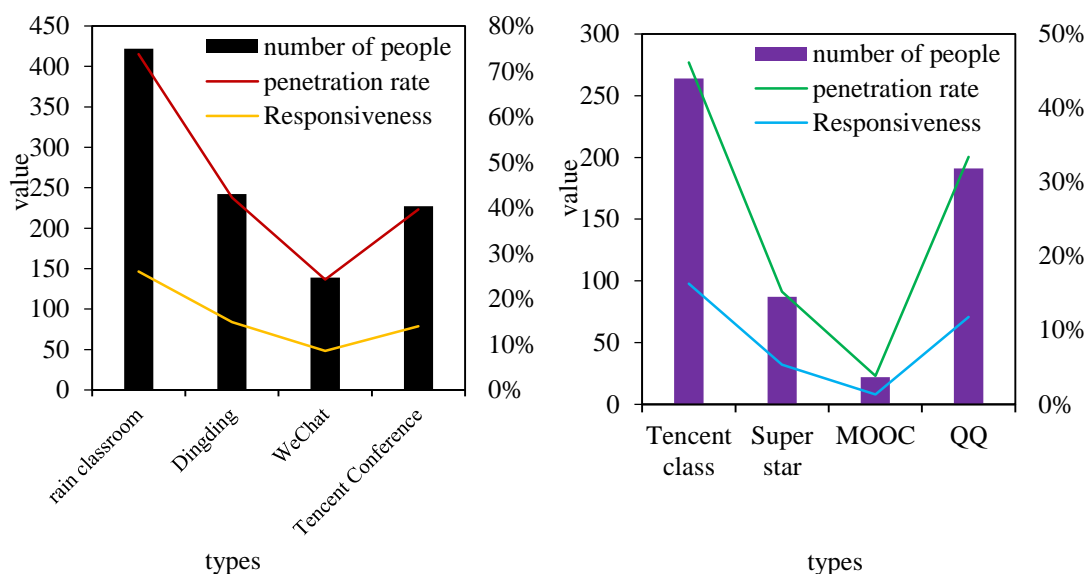
Figure 3. The specific application of online public sports teaching media

(2) Online public sports teaching venues

The particularity of physical education courses lies in physical participation and spatial changes, so the venue space of the class also has certain special requirements, so that it can have a virtuality beyond reality. According to different sports, the requirements for venue space are different. For sports, a discipline with strict venue requirements, the sudden arrival of the new crown pneumonia epidemic has made public physical education teachers have a certain test in the choice of teaching content. The particularity of online sports learning lies in home learning, which requires the generation of a three-dimensional realistic virtual environment. For example, basketball, football, volleyball and other projects cannot be practiced at the school's special venue. Physical education teachers are restricted when they demonstrate movements online, and the venues for students to practice are also restricted. Therefore, the situation of students' online public sports learning venues is investigated, as shown in Table 1.

Table 1. Venue selection for online public sports learning

	number of people	percentage
indoor	485	85.52%
basketball court	3	0.38%
corridor	8	1.25%
other	75	12.81%

It can be seen from the table that online public sports learning venues include indoor, basketball court, corridor and other four types. Among them, 485 students choose to study online public sports indoors, accounting for 85.52%. There are 3 students who choose to study online public sports on the basketball court, accounting for 0.38%, and 8 students who choose to study online public sports in the corridor, accounting for 1.25%. There were 75 students who chose to study online public sports in other places (mainly outdoor venues in the community and courtyards at home), accounting for 12.81%. Therefore, it can be seen that during the online public sports learning period, the learning venues are mainly concentrated indoors, and only a very small number of students can go to the basketball court and corridor for learning. However, different places do not affect the application of computer vision and virtual reality technology in online teaching.

(3) Online public physical education teaching equipment

In the process of physical education, learning different movement skills requires different

exercise equipment. For example, in the practice of playing football on the inside of the instep, it is necessary to use a football, so equipment is an integral part of the physical education process. During the COVID-19 epidemic at home, the space limits the choice of sports equipment. In the process of online public physical education, the use of equipment will also lead to different virtual reality technologies. Therefore, the situation of students' online public sports learning equipment is investigated, as shown in Table 2.

Table 2. Use of online physical education equipment

	number of people	percentage
often	181	31.11%
Occasionally	251	43.61%
general	79	13.87%
very little	61	10.42%
None	6	1.38%

It can be seen from the table that the use of online public physical education equipment can be divided into five types: frequent use, occasional use, general use, rare use and no use. Among them, 181 students, accounting for 31.11%, believed that online public physical education often used equipment. 251 students, accounting for 43.61%, believed that online public physical education occasionally used equipment; 79 students believed that online public physical education generally used equipment, accounting for 13.87%. 61 students, accounting for 10.42%, think that online physical education teaching rarely uses equipment. There were 6 students who believed that online public physical education did not use equipment, accounting for 1.38%. Therefore, it can be seen that online public physical education is mainly carried out using equipment. Although most students do not have professional equipment at home for online physical learning and exercise, it was found through later interviews that this would not affect students' exercise. Students and teachers will use local materials, using mineral water bottles at home, filled with water (sand) to act as low-weight dumbbells, oil buckets or drinking buckets as heavy-weight dumbbells and other methods to create exercise conditions. Therefore, the online teaching methods based on computer vision and virtual reality technology are flexible and changeable, and the virtual reality sense can be satisfied by replacing equipment and other methods.

3.2 Online Public Education Teaching Mode

During the period of "suspending classes without stopping school, without stopping school without practice" during the COVID-19 epidemic, teachers used mobile network platforms to teach. The online public physical education teaching mode refers to the activity forms adopted by public physical education teachers and students in order to complete teaching tasks and achieve teaching goals. It is a teaching method adopted by public physical education teachers to guide students to complete physical movement skills and obtain physical and mental quality development. It mainly includes three teaching modes: live broadcast, recorded broadcast and live broadcast + recorded broadcast. These modes are all realized based on computer vision and virtual reality technology. Table 3 shows the survey of students on the teaching mode of online public physical education.

Table 3. Online public physical education teaching mode

	number of people	percentage
live streaming	159	28.13%
Occasionally Record and broadcast	31	5.09%
Live + Recording	379	66.78%

It can be seen from the table that 159 people choose to study public physical education through

teachers' live classes, accounting for 28.13%; 31 people choose to study public sports through teachers' recorded and broadcast classes, accounting for 5.09%. There are 379 people who choose to learn public sports through teachers' live broadcast + recorded courses, accounting for 66.78%. Therefore, the online public physical education teaching mode is mainly based on live broadcast + recording, that is, in the form of text figures + video, using teaching methods such as teaching methods, demonstration methods, and situational experience methods to teach the teaching content. During the epidemic, the form of live broadcast + recorded broadcast is more suitable. Teachers prepare the content that needs to be explained and demonstrated in this lesson or this stage before class, and can play the teaching content directly during class, which improves the quality of teaching and enriches the resources of school digital education. Teachers need to prepare carefully when recording a class, which is more organized than explaining and demonstrating in class, and improves the efficiency of the class. After class, people use WeChat, DingTalk and other backgrounds to conduct follow-up inspection and evaluation. The form of live broadcast + recorded broadcast can allow students to feel the motor skills they have learned more intuitively, improve their enthusiasm for learning, help students learn the teaching content, and create an innovative educational model. However, in the later in-depth interviews with students, it was found that most students prefer to take live classes instead of recorded classes. Students hope to communicate with teachers in real time during the learning process. At the same time, during the investigation, it was found that the general high-level online public physical education is in good condition, and no situation was found in the investigation schools. The online teaching method not only enriches the teaching resources of virtual reality technology in schools, but also saves the cost of education for schools.

3.3 Contents of Online Public Physical Education Teaching

The content of physical education is the core element of physical education, and it is the system of physical education knowledge and skills selected to achieve the physical education objectives set in the early stage. Through investigation and research, it was found that the online public physical education activities during the period of "suspended classes and non-stop practice" in various colleges and universities are mainly based on quality training with a small scope of activities and a small range of activities. Through interviews and exchanges, it was found that the content of online public physical education at this stage is relatively simple, and computer vision and virtual reality technologies have not been fully used, which is different from the content of the courses imagined by the students. Figure 4 shows the course selection of students during the online public sports learning stage.

It can be seen from the figure that the content selection of online public physical education includes physical fitness exercises, traditional martial arts and yoga. Among them, there are 545 students who choose physical fitness practice as the content of online public physical education, accounting for 65.82%. There were 251 students who chose martial arts as the online public physical education content, accounting for 30.31%; 32 students chose yoga as the online public physical education content, accounting for 3.87%. Therefore, the content of online public physical education mainly focuses on physical fitness exercises, followed by traditional martial arts, and yoga is the least. Physical fitness exercises include planks, burpees, push-ups, high leg raises, trotting, etc., which can allow students to perform necessary running and jumping exercises. As shown in Figure 5, through investigation and communication, it is found that the main reasons for choosing physical fitness exercises as the main teaching content are: First, it occupies a small space. Due to the epidemic, everyone needs to be isolated at home and cannot practice in an open field or professional training ground. The second is that materials can be obtained locally. Compared with

the foot basket row, which has special equipment requirements, it is very easy to exercise physical fitness. People can use flour bags at home, mineral water bottles filled with water, etc. to be turned into sports equipment for exercise. The third is to meet the training intensity needs of students, meet the training load required by the course, so as to achieve the purpose of training, and play a role in strengthening the body for students who cannot go out to exercise. If virtual reality technology is fully used in online physical education, these problems can be alleviated to a certain extent.
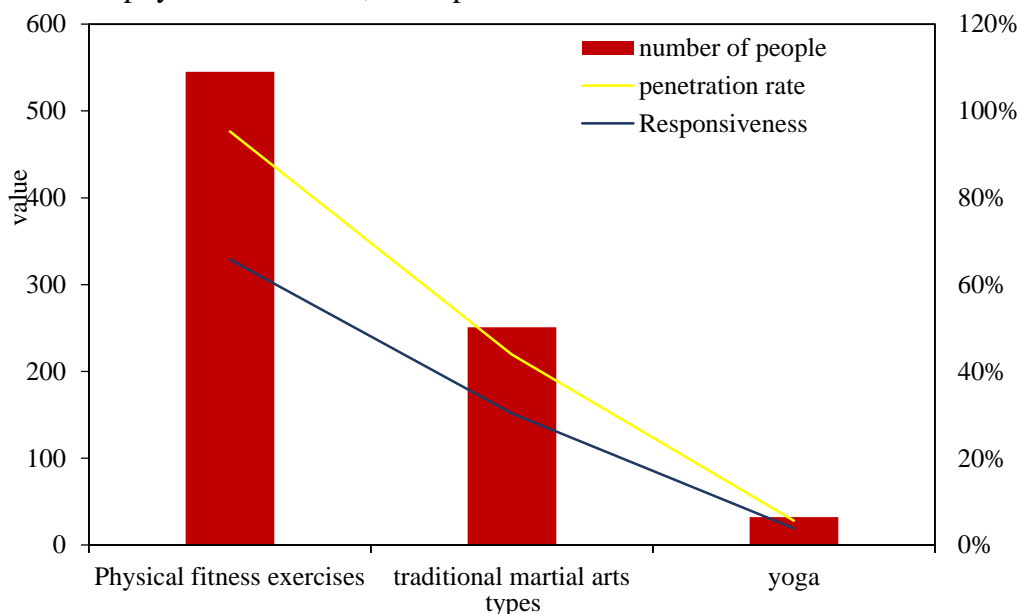

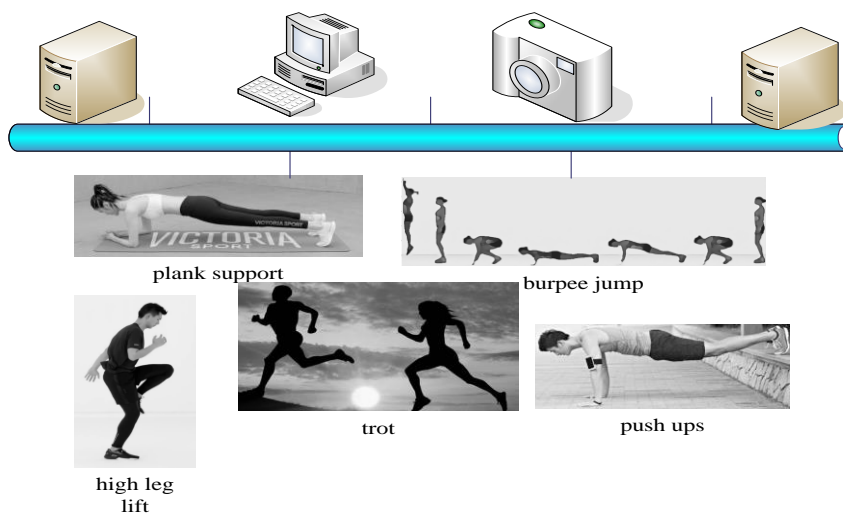*Figure 4. Selection of online public physical education content*

Figure 5. Online teaching of sports

3.4 Online Public Physical Education Teaching Link

The whole teaching work of physical education teachers can be divided into five parts: lesson preparation, class, homework assignment and feedback, extracurricular tutoring, assessment and evaluation of academic performance.

(1) Online public physical education teachers prepare lessons

Lesson preparation means that physical education teachers should correctly choose the best

teaching method and order in the process of implementing the teaching purpose according to the curriculum standards and the characteristics of the course, combined with their own teaching habits and styles. Mainly divided into two forms of individual lesson preparation and group lesson preparation.

The energy of each PE teacher is limited and the details of PE teaching considered are limited. In traditional physical education, one physical education teacher leads one class, but this kind of artificial matching often leads to the phenomenon of unbalanced resource distribution. The advantage of online physical education is that teachers can teach multiple classes at the same time based on virtual reality technology, which is of great significance for saving teaching resources and improving educational equity. During online physical education, due to the limited space for home practice, the available physical education content is also limited. According to the survey, most physical education teachers will choose the combination of live broadcast and recording and broadcasting. When preparing for lessons, the content of recording and broadcasting needs to be prepared. The specific class process of most college physical education teachers is explained by teachers—playing warm-up video—explanation—playing exercise video (physical fitness exercises mainly based on running and jumping)—explanation—playing relaxation exercises (mainly yoga and Tai Chi)—arranging homework after class. Record the sports-related content in class in advance. In some colleges and universities, teachers from the same teaching and research section complete this session together, and young teachers are responsible for demonstrations. The new media has good IT teachers who are responsible for editing, which can greatly improve the teaching effect.

(2) Online public physical education teachers teach

Classroom is the core content of the whole teaching activity. The standard of a good class is to let the students pay full attention in the class, and to teach students according to their aptitude in the teaching process. A teacher's class attitude directly affects the quality of teaching and students' interest in learning. Therefore, a survey was conducted on online public physical education teachers' class attitude, and the survey results are shown in Figure 6.
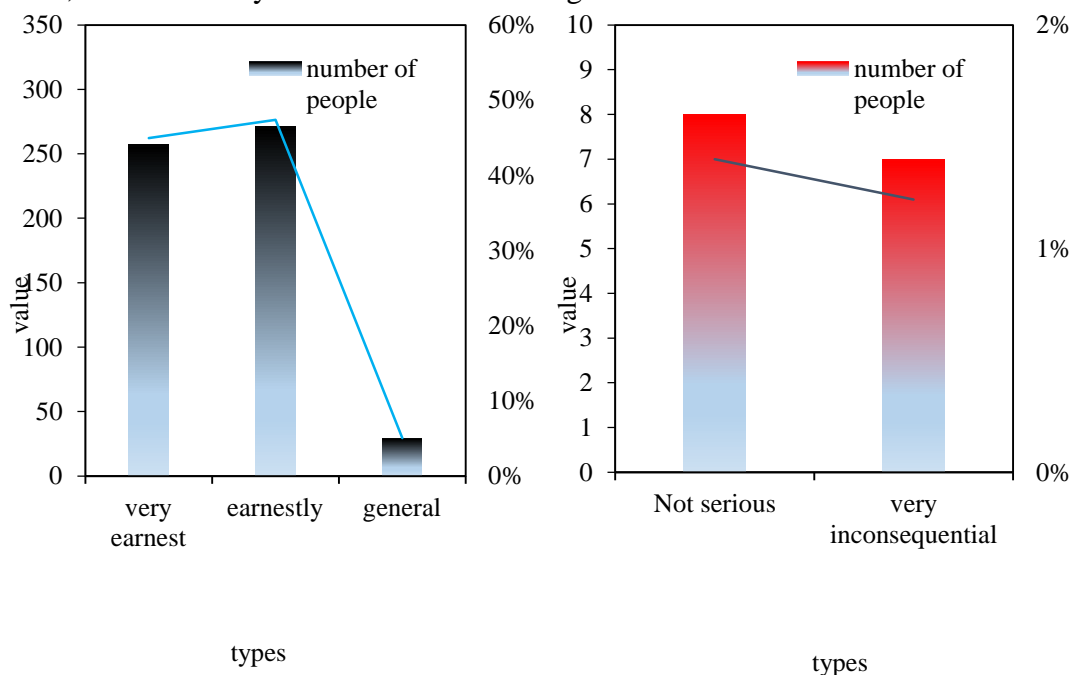

Figure 6. Attitude of online public physical education teachers in class

It can be seen from the figure that the attitude of online public physical education can be divided

into five situations: very serious, serious, average, not serious and very not serious. Among them, 257 students, accounting for 44.93%, believed that the teaching attitude of online public physical education teachers was very serious. There are 271 students who think that the online public physical education teachers have a serious teaching attitude, accounting for 47.38%; 29 students who think that the online public physical education teachers' teaching attitude is average, accounting for 5.07%. 8 students, accounting for 1.40%, believed that the online public physical education teachers were not serious about their teaching attitude; 7 students, accounting for 1.22%, believed that the online public physical education teachers' teaching attitude was not serious. Therefore, it can be seen that the teaching attitude of online public physical education teachers is serious, and there is less lack of seriousness.

(3) After-school feedback on online public physical education

After-class feedback is a combination of the content taught, various types of exercises completed by students after class. Due to the particularity of physical education subjects, physical exercises are mostly based on practical exercises. By checking the practice after class, teachers can find out the defects of students in the learning process in time, and at the same time put forward suggestions for improvement and next learning. The online teaching method based on virtual reality technology can well test the practice after class by recording video. Therefore, a survey was conducted on the uploading of online public physical education teachers' requests for students' after-school practice, and the survey results are shown in Table 4.

Table 4. Online public physical education after-school practice teachers' requirements to upload

	number of people	percentage
Yes	521	91.8%
no	22	3.85%
not clear	29	5.07%

It can be seen from the table that online public physical education teachers require students to upload their after-school practice arrangements, which can be divided into three cases: yes, no and unclear. There are 521 students who choose online public physical education teachers to upload after-school exercises, accounting for 91.08%. There are 22 students who choose online public physical education teachers who do not require to upload after-school exercises, accounting for 3.85%. There were 29 students who chose online public physical education and did not know that teachers asked to upload after-school exercises, accounting for 5.07%. Therefore, it can be seen that most teachers in online public physical education require students to upload after-school exercises, and there are also a small number of teachers who do not require to upload after-class exercises, and some students do not listen to the class carefully, resulting in unclear teachers' assignment of after-class exercises.

As can be seen from Figure 7, whether online public physical education can meet students' exercise needs can be divided into five situations: very satisfied, basically satisfied, average, not satisfied, and very not satisfied. There are 177 students, accounting for 30.94% of the students, that online public physical education is very satisfying for their exercise needs, and 227 students, accounting for 39.69% of the students, said that online public physical education basically meets their exercise needs. There are 132 students, accounting for 23.08% of the students, that online public physical education generally meets their exercise needs, and 29 students, accounting for 5.07% of the students, said that online public physical education does not meet their exercise needs. There are 7 students, accounting for 1.22% of the students, that online public physical education is very unsatisfactory for their exercise needs. Therefore, it can be seen that online public physical education can meet the exercise needs of most students, but a small number of students cannot. It may be because these students often exercise, so that online public physical education cannot meet
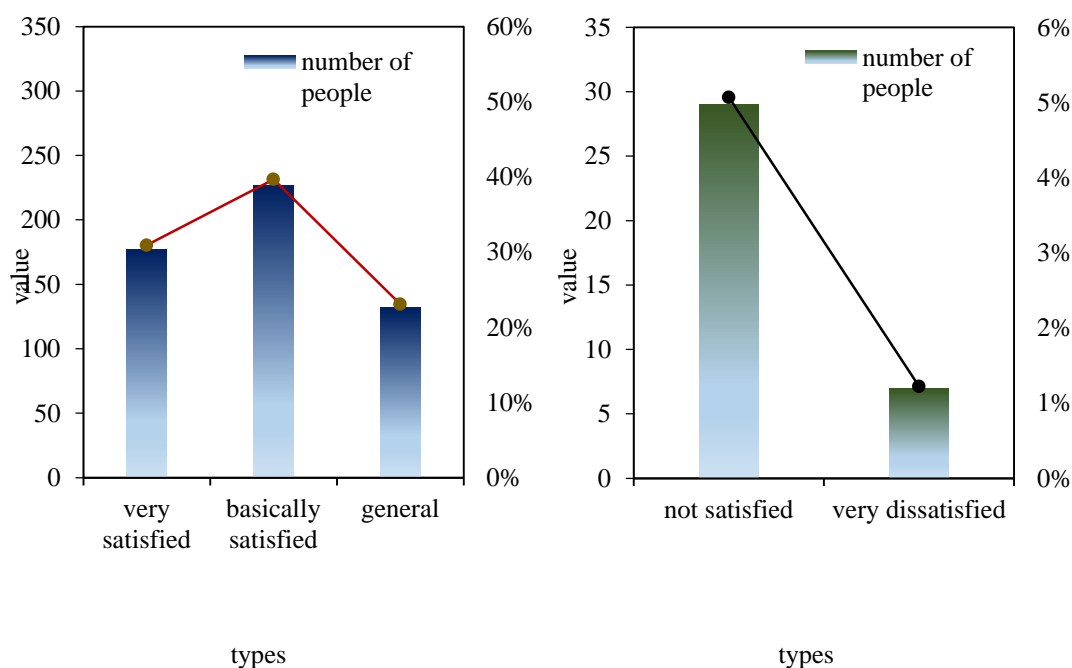
their exercise needs.

Figure 7. Satisfaction of students' exercise needs in online public physical education

(4) Evaluation of online public physical education teaching performance

Academic achievement is a test of students' learning achievements. There are mainly two ways: one is the usual test, such as after class or after learning a certain basic technical action completely. The second is the examination, which can test the students' learning situation more comprehensively and systematically. The examination of academic performance will help physical education teachers to discover the advantages and disadvantages of teaching and further improve teaching methods; enable students to understand their own learning situation and physical ability, adjust their learning status, and strengthen exercise. Parents and schools can also learn about learning and teaching, and better promote the development of physical education. Therefore, an investigation was conducted on the academic performance inspection of online public physical education teaching. The survey results are shown in Figure 8.

It can be seen from the figure that the online public physical education academic performance inspection forms can be divided into online live broadcast, offline video transmission, no assessment and other three situations. There are 439 students who choose online public physical education to conduct score check in the form of offline transmission and video transmission, accounting for 76.75%. There are 9 students who choose online public physical education to check their grades without assessment, accounting for 1.57%; 7 students who choose online public physical education to check their grades by other methods, accounting for 1.22%. Therefore, it can be seen that the offline transmission of video is the most important method of performance inspection in online public physical education, followed by online live broadcast, and there are fewer forms of non-assessment and other homework inspections. The homework inspection method of offline video transmission is convenient and fast, without delaying time, but it lacks the fairness of the examination. The form of online live broadcast is just the opposite. When taking the test, everyone will open their own video, the teacher can invigilate the test, and the students can supervise each other, but the students in the entire class need to do it at the same time. Physical exams are often the assessment of physical skills and movements. If each student takes it

individually, it will take a long time and require a lot of work. If all students take it at the same time, teachers cannot observe carefully, and the fairness of the exam will also be lost. Some students who do not take the exam are very likely to be elective subjects and do not need to take the exam. Teachers can grade the students according to their usual class conditions.
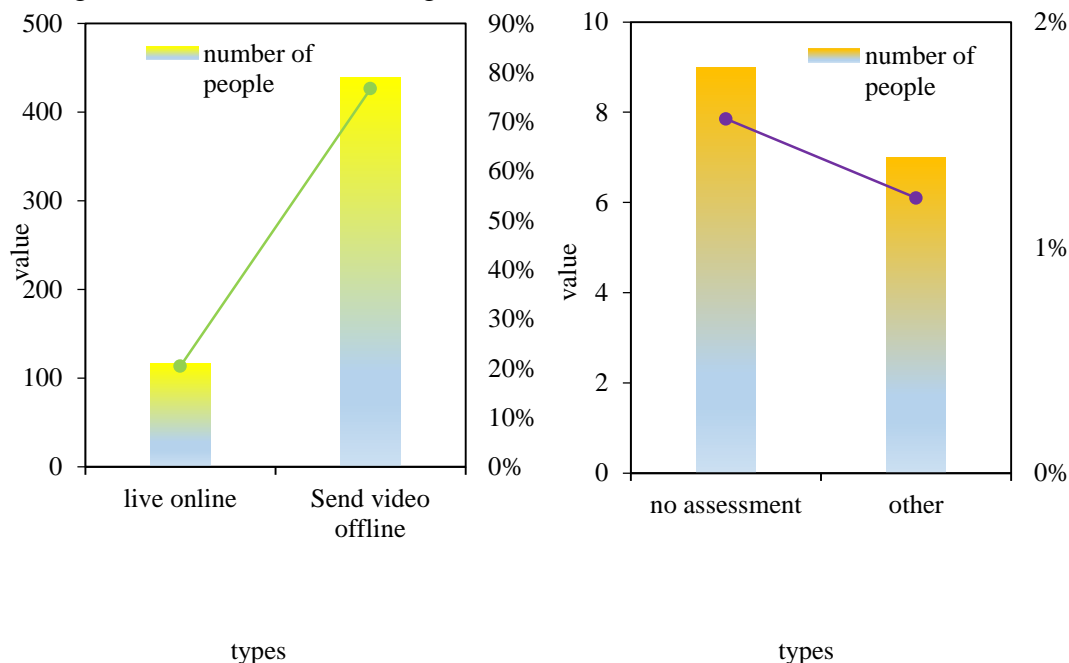

Figure 8. Online physical education academic performance inspection form

(5) Evaluation of Online Public Physical Education Teaching

Physical education evaluation is to evaluate and evaluate the process and results of "teaching" and "learning" on the basis of the purpose and principle of physical education. Teaching evaluation is an important method to achieve the purpose of education, which includes the evaluation of teaching content and the evaluation of teaching results. Teaching evaluation has two functions. Teachers' evaluation of students' athletic ability reflects the specific situation of students in the learning process, and the results of in-class evaluation can reflect students' mastery in time. Teachers can adjust the teaching plan at any time and teach students according to their aptitude, which is conducive to the realization of teaching goals, and also plays a role in spurring students to complete the teaching tasks in the classroom seriously. Students' evaluation of teachers' physical education teaching, from the perspective of students themselves, evaluate the teaching content, teaching mode, and the novel and interesting degree of the class. Based on the full use of computer vision and virtual reality technology, it is conducive to the improvement of the quality of teachers' classrooms and the learning of students. According to the different evaluation functions, there are three types of physical education evaluation: diagnostic, formative and summative. Therefore, a survey was conducted on students' attitudes towards online public sports teaching evaluation, and the results of the survey are shown in Figure 9.
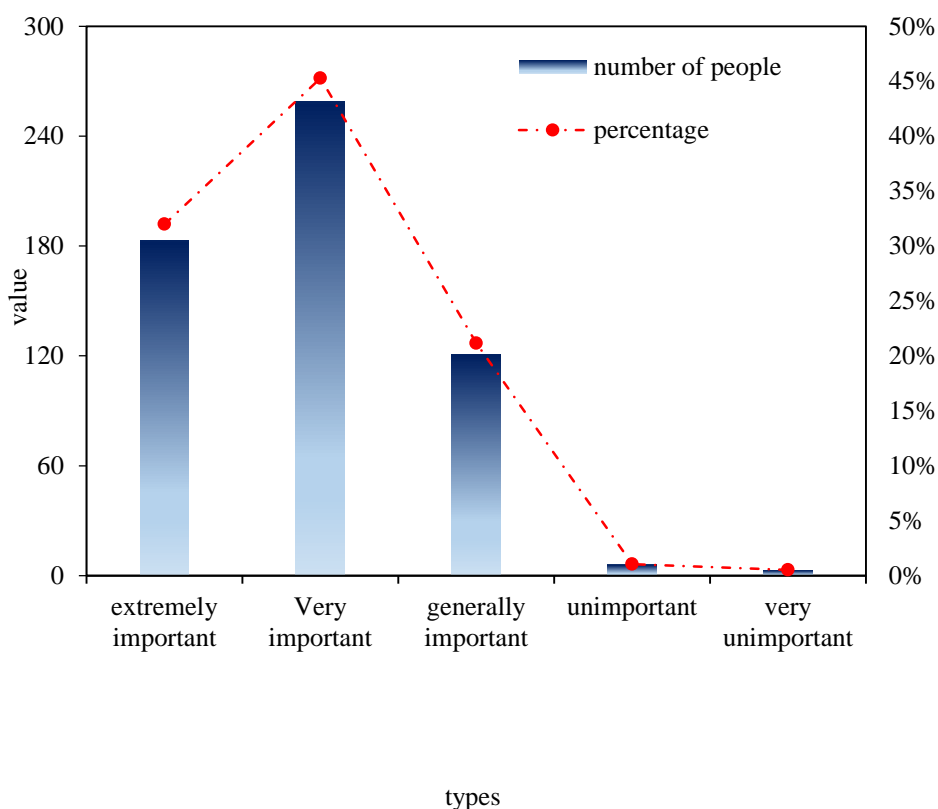
Figure 9. Students' evaluation of the importance of online public physical education teaching

It can be seen from the figure that students think that the importance of online public sports teaching evaluation can be divided into five forms: very important, very important, generally important, unimportant and very unimportant. Among them, 183 students think that online public physical education evaluation is very important, accounting for 31.99%; 259 students think that online public physical education teaching evaluation is very important, accounting for 45.28%. There are 121 students who think online public physical education evaluation is generally important, accounting for 21.15%; 6 students who think online public physical education evaluation is not important, accounting for 1.05%. There are 3 students who think that online public physical education evaluation is very unimportant, accounting for 0.53%. It can be seen from this that a large number of students think that online public physical education evaluation is very important, and only a small number of students think it is not important. Therefore, teachers must pay attention to evaluation when organizing online public physical education, because these evaluations are of great value to students' learning and development. Teachers can enrich teaching methods based on virtual reality technology to attract students and motivate students to participate more.

4. Conclusions

The outbreak of the new crown pneumonia epidemic has made online public physical education popularized and applied. Online public physical education is a new education method based on computer vision and virtual reality, a change in teaching environment and teaching mode. Online public physical education is the specific promotion and implementation of the teaching concept in the new era, the new demand for improving the quality of nationals and talents in the new era, the satisfaction of students' learning needs in a special period, and the specific performance of the progress of the times on the recycling of teaching resources. Physical education teachers teach

through online live broadcast, recorded broadcast, live broadcast + recorded broadcast, etc., which can meet the exercise needs of students to the greatest extent. However, some physical education teachers have weak online teaching ability. There are 364 students, accounting for 63.64% of the students. They think that their physical education teachers are not good at making courseware, and there is a dilemma of lack of teaching technology. The online public physical education model can effectively meet the exercise needs of public physical education students and improve their physical fitness. There are 403 students, accounting for 70.45% of the students who said that online public physical education can meet their exercise needs. However, there are still low levels of network informatization and imperfect teaching platforms in colleges and universities, resulting in unsmooth course teaching. There were 305 students, accounting for 53.32% of the students, who said that the network was unstable during the class, and there was a dilemma of insufficient teaching facilities. The full use of computer vision and virtual reality technology in online teaching can promote the application of digital teaching in schools and save educational resources for schools. It has created an innovative education model, improved the quality of school education, enhanced the experience of teachers and students, and attracted them to participate more.

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