

Application of Multimedia Technology in PE Teaching in Colleges and Universities

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ABSTRACT

With the rapid development of information technology, multimedia technology has gradually penetrated various fields, including physical education in colleges and universities. Traditional physical education teaching methods lack interaction, and it is difficult to ensure the durability and depth of the effect of teaching. In college physical education teaching, multimedia technology can be displayed through various forms of media, and it helps to stimulate students' interest and enthusiasm in learning. Therefore, we need to find a new teaching method to improve current physical education in colleges and universities. This paper expounds the applications of multimedia technology in college physical education from three dimensions: video teaching, audio teaching, and virtual reality technology. The effect of applying multimedia technology in physical education teaching is analyzed through case studies. This paper will provide a useful reference for the innovation and development of physical education teaching in colleges and universities.

KEYWORDS:

Multimedia technology, Physical education in colleges and universities, Practical application

In today's society, with the deepening of educational reform, physical education teaching in colleges and universities is gradually developing and improving. However, there are still some problems and challenges in physical education teaching in colleges and universities (Li, 2023). Firstly, from the perspective of teaching philosophy, although most colleges and universities realize the importance of physical education to students' physical and mental development, in practice, they often pay too much attention to competitiveness and skills, ignoring the educational function of physical education (Siedentop & Van der Mars, 2022). This leads some students to accept knowledge and skills passively in physical education teaching, lacking initiative and creativity.

Secondly, regarding teaching content and methods, the content of physical education in colleges and universities is relatively unvaried, lacking diversity and innovation. Many courses are still stuck in traditional basic projects such as track and field and ball games, lacking content closely related to modern society and life (Dai, 2020). At the same time, the teaching methods are also more traditional and unvaried, lacking interactivity and interest, and it is difficult to stimulate students' interest and enthusiasm in learning. Furthermore, from the perspective of the teaching staff, although the overall quality of PE teachers in colleges and universities is constantly improving, there are still some problems such as backward teaching concepts and outdated teaching methods (Guo, 2020; Wang & Huang, 2021). According to the statistics of online questionnaires on PE teaching satisfaction in three colleges and universities in the early stage (Table 1), about 13.76% students think that the PE teaching methods in colleges and universities are not innovative or attractive. In addition, the number of PE teachers in some colleges and universities is insufficient, which makes it difficult to meet the diverse learning needs of students. Finally, from the perspective of sports facilities and resources,

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Table 1. Statistical table of physical education teaching satisfaction questionnaire from three universities

Index	Very dissatisfied	Dissatisfied	Common	Satisfied	Very satisfied
Practicality of physical education curriculum	6	212	384	925	1460
Frontier of physical education curriculum	558	421	431	919	658
Teaching methods of physical education curriculum	411	706	670	730	470
Teachers' quality of physical education curriculum	7	195	376	927	1482
Teaching style of physical education curriculum	208	358	669	910	842
Teaching environment of physical education curriculum	311	521	691	1016	448
Teaching forms of physical education curriculum	389	332	592	907	767

although most colleges and universities have dedicated sports facilities and venues, there are still problems with imperfect facilities and insufficient venues, resulting in 27.85% of students feelings below average satisfaction. This limits the development of physical education teaching and students' participation in sports activities to some extent.

Multimedia describes a combination of more than one media type, such as text (letters or numbers), symbols, images, pictures, audio, video, and animation, usually with the help of technology to enhance understanding or memory (Guan et al., 2018). Hardware and software used to create and run multimedia applications are called multimedia technology (Kapi et al., 2017). Multimedia technology is a comprehensive technology that integrates text, image, audio, video, and other information forms. Multimedia technology has some characteristics such as integration, diversity, and interactivity, which enable people to exchange information or ideas through digital and printed elements. In this case, digital and printed elements refer to multimedia-based applications or tools used to convey information to people to help them better understand concepts (Abdulrahman et al., 2020).

In fact, the emergence of information and communication technology is changing all aspects of human effort, especially the education sector (Abdulrahman et al., 2020). The progress of Internet and information technology has also promoted the intergenerational evolution of higher education. The first generation is traditional face-to-face learning, the second generation is online learning, also known as e-learning or distance learning, and the third generation is blended learning . In physical education teaching in colleges and universities, multimedia technology can be displayed through various forms of media, which makes abstract and complex physical education knowledge and skills intuitive and vivid and helps to stimulate students' interest and enthusiasm in learning (Hai et al., 2023). Multimedia technology, with its rich forms of expression, intuitive teaching content, and efficient interactive mode, has brought revolutionary changes to college physical education.

The necessity and significance of applying multimedia technology to college physical education teaching are self-evident. On the one hand, multimedia technology can make up for the shortcomings of traditional teaching methods, make physical education teaching more vivid and interesting, and improve students' enthusiasm for and participation in learning (Zhang & Xia, 2021). On the other hand, multimedia technology can help students understand and master sports knowledge and skills more intuitively, which improves the learning effect (Yan, 2021). To sum up, the application of multimedia technology in college physical education teaching has important practical significance and broad development prospects.

Against this background, this paper expounds the application forms of multimedia technology in college physical education from three aspects: video teaching, audio teaching, and virtual reality technology. Then, the effect of applying multimedia technology in physical education teaching is analyzed through case studies. This paper will provide a useful reference for the innovation and development of physical education in colleges and universities.

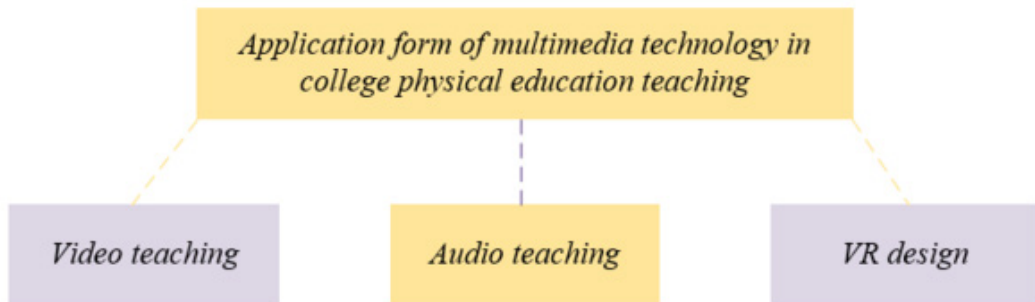
LITERATURE REVIEW

Meng's (2023) research mainly discusses the transformation and development of teachers' roles in college English teaching reform. Firstly, it analyzes the problems existing in the traditional college English teaching mode, such as the teacher-led teaching mode, students' passive acceptance of knowledge, lack of interaction and practical links, and more. Subsequently, the transformation and development of teachers' roles are discussed, from knowledge imparting to learning guidance, from educators to learners, and from evaluators to tutors. Then, it puts forward the methods and strategies to change the role of teachers, such as advocating the student-centered teaching concept, providing diversified learning resources and activities, and establishing a positive learning environment. Meng's research aims to improve the quality of classroom teaching and create a high-quality and high-level education model. However, it focuses on the integration of existing new technologies for analysis and exploration.

Kotiash et al. (2022) confirmed the necessity of extensive use of information and communication technology. They expound the advantages of using multimedia technology and the main direction of its practical application in education. They also summarize some factors that are helpful to improve the effectiveness of using multimedia learning. Furthermore, they point out that when choosing multimedia teaching tools, teachers must consider the uniqueness of a particular subject in order to provide scientific details, conceptual devices, and the characteristics of methods to study its laws. Multimedia technology must conform to the goals and objectives of the course and be an indispensable part of the learning process. Li and Wang (2021) focused on the analysis of the current situation of physical education in colleges and universities and reflected on the problem that traditional physical education in colleges and universities struggles to stimulate students' interest in sports, resulting in low activity participation rate and inability to exercise. Based on the rapid development of artificial intelligence technology, their research studies how to improve the effectiveness of physical education and makes a comparative analysis of physical education in a university by experimental methods. The results show that physical education based on artificial intelligence can obviously improve students' strength, speed, endurance, and agility, which provides more important references for improving the effectiveness of physical education in colleges and universities.

The exploration of multimedia technology in physical education teaching is still continuing, including artificial intelligence, virtual reality, and so on. Ding et al. (2020) designed and put forward a system for college physical education based on virtual reality technology, which is composed of the Internet of Things, cloud platforms, and mobile clients, aiming at the problems of single teaching methods and insufficient distance teaching ability in the current college physical education teaching process. The system collects relevant data from the Internet of Things and interacts with the virtual reality scene in real time, rendering the scene through the cloud and experiencing the virtual reality through the mobile terminal. Through the analysis of specific experimental cases and user feedback information in a university, the results prove that the system has a good effect in the university sports virtual reality system, which provides scientific reference for deepening the university sports reform. Turdaliyev et al. (2024) aim to determine the influence of VR-assisted teaching on the performance of 10 physical education students in three universities in western Kazakhstan. Correlation analysis shows that VR-assisted training is closely related to the higher performance of city championships and the higher quality of physical training, which reflects the effective application of VR in physical education. Video games integrate sports activities into people's leisure time in an interesting and

Figure 1. Application form of multimedia technology in college physical education teaching



popular way. Guo (2024) combined 3D reconstruction technology in computer vision, constructed a set of human body shape reconstruction models, and applied it to physical exercise and teaching effect evaluation. This is a new attempt to incorporate multimedia technology in physical education.

Many reports and studies have emphasized how the use of digital technology is becoming more and more popular in the promulgated teaching process (Department of Education and Skills, 2020; European Commission, 2020). However, the evidence about its influence on teaching and learning has been evaluated differently. Henderson et al. (2017) confirmed the importance of digital technology to students' learning experience by exploring students' actual experience of digital technology during academic study and investigating 1658 undergraduates, but they also showed that digital technology did not change the nature of university teaching. Therefore, university educators may need to ease their enthusiasm for learning supported by technology and better understand the reality of the way students meet with digital technology. Sargent and Calderón's (2021) systematic review shows that most technology-enhanced interventions do not use digital technology in a revolutionary way but are only a substitute for teachers' direct tools without functional changes.

Chen & Xia's (2012) research not only summarizes the advantages of multimedia technology in college physical education but also puts forward some problems in the application process of multimedia technology. For example, the quality of multimedia courseware is difficult to guarantee, the traditional concept of physical education rejects new technology, and the introduction of multimedia technology leads to the neglect of teaching subjects themselves. Therefore, more in-depth research is needed for the mature application of multimedia technology in college physical education.

Based on the above research, this paper analyzes the effect of applying multimedia technology to actual scene teaching, thus providing strong support for the significance and value of applying multimedia technology in college physical education teaching.

MATERIALS AND METHODS

Application Form of Multimedia Technology in College Physical Education Teaching

With the rapid development of information technology, multimedia technology gradually occupies an important position in college physical education with its unique advantages (Cai & Dai, 2023). This paper will discuss in detail the application of multimedia technology in college physical education teaching, mainly from the three dimensions shown in Figure 1.

Video Teaching

As an integral part of multimedia technology, video teaching plays an important role in college physical education.

The Production and Selection of Teaching Videos

The production of teaching video is the first step of video teaching. Teachers need to plan and make videos carefully according to the teaching content and objectives and the actual situation of students. In the production process, we should pay attention to the quality and sound quality of the video, as well as the accuracy and vividness of the content. At the same time, teachers also need to select videos suitable for teaching from the massive video resources to ensure that the video content matches the teaching needs (Laaser & Toloza, 2017).

The Application of Video in Skill Demonstration and Decomposition

Through video teaching, teachers can clearly show the demonstration process of sports skills, so that students can intuitively understand the essentials of action. For complex skill movements, teachers can use the functions of video pause and playback to decompose the movements and help students master the skill points step by step (Shi et al., 2021). This teaching method is helpful for students to understand the skill movements better and improve the learning effect.

Application of Video in Action Error Correction and Feedback

Video teaching can also be used for action error correction and feedback. Teachers can record students' actions, compare them with standard actions, find out students' wrong actions, and correct them (Zulkifli & Danis, 2022). At the same time, teachers can also use videos to give feedback on students' learning progress and achievements to help students understand their learning situation and adjust their learning strategies.

Audio Teaching

Audio teaching also plays an important role in college physical education.

The Application of Background Music in Creating Classroom Atmosphere

Background music is an important part of audio teaching, which can create a good classroom atmosphere and stimulate students' interest in learning. Teachers can choose suitable background music according to the teaching content and objectives to create a relaxed and pleasant atmosphere for the classroom and help students to devote themselves to learning better (Ázmi et al., 2023).

The Application of Phonetic Explanation in the Teaching of Action Essentials

Voice explanation is another form of audio teaching. Teachers can explain the essentials, skills, and matters needing attention regarding sports movements in detail through voice explanation to help students better understand and master the movement skills. In addition, voice explanation can also be used in conjunction with video teaching, so that students can listen to the teacher's explanation while watching the video and deepen their understanding of the main points of action.

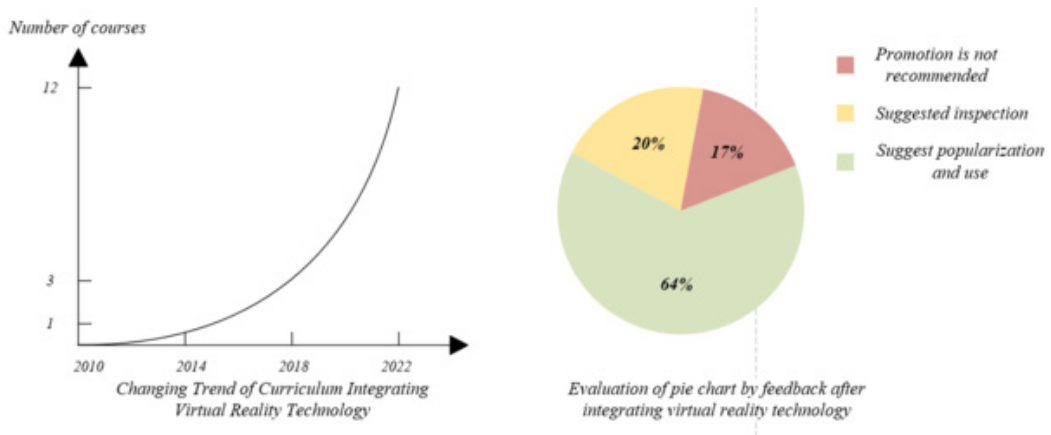
Virtual Reality Technology

As the latest development of multimedia technology, virtual reality technology has brought revolutionary changes to college physical education. In recent years, the application of virtual reality technology in college teaching has expanded (Li et al., 2021). As shown in Figure 2, by the end of 22 years, nine courses have been integrated with virtual reality technology in college teaching, of which 63% are recommended for popularization and use by feedback evaluation of the effect of teaching.

The Application of Virtual Reality in Simulating Sports Scenes

Virtual reality technology can simulate real sports scenes and provide students with an immersive learning experience. Students can practice various sports movements and simulate competitions in the virtual environment and feel the real sports atmosphere and scene. This teaching method is helpful to stimulate students' interest and enthusiasm in learning and improve the learning effect (Zhang & Tsai, 2021).

Figure 2. The application of virtual reality technology in colleges and universities



The Application of Virtual Reality in Enhancing the Learning Experience

Virtual reality technology can also enhance students' learning experiences by simulating different sports environments and conditions. For example, in the virtual environment, students can experience the influence of different weather, venues, and opponents on sports to adapt to various actual competition scenes better (Le Noury et al., 2022). In addition, virtual reality technology can also provide students with rich feedback and evaluation mechanisms to help them understand their own performance and shortcomings and adjust their learning strategies.

Therefore, multimedia technology has a wide range of applications in college physical education teaching. Through the rational use of multimedia teaching methods such as video teaching, audio teaching, interactive teaching software, and virtual reality technology, teachers can create a vivid, interesting, and efficient learning environment for students. This helps to stimulate students' interest and enthusiasm in learning and to improve the learning effect and teaching quality.

Case Analysis of the Application of Multimedia Technology in College Physical Education Teaching

The following are some application cases of multimedia technology in college physical education teaching, which show the practical role of multimedia technology in improving teaching quality and enhancing the effect of students' learning.

Case 1: The Application of Video Technology in Basketball Teaching

In basketball teaching at a university, the teacher adopted video technology to assist the teaching. They first recorded a series of demonstration videos of basic basketball skills, including shooting, dribbling and defense. These videos not only show the correct action essentials but also enable students to observe the details of each action clearly through multi-angle shooting and close-ups, such as the basketball offensive and defensive actions shown in Figure 3. In class, teachers play videos for students to watch first and then conduct field teaching. In this way, students can have a preliminary understanding of movements in advance and master skills faster in field teaching. At the same time, teachers can also use video to correct mistakes, record students' wrong actions, and compare them with correct actions, so that students can more intuitively understand their own problems.

Through the analysis of case one, another group of comparative data based on multimedia technology in college basketball teaching is obtained. Twenty-four freshmen with no basketball background were selected from the basketball course in University A, and they were divided into

Figure 3. Basketball offensive and defensive actions



Table 2. Teaching method of basketball teaching in groups in university A

Group	Book form	FLASH animation	Video teaching	Actual combat training	Intra-group confrontation
A	√			√	√
B	√	√	√	√	√

two groups (A and B) for a semester's course teaching, which was taught by the same teacher. The teaching methods of each group are shown in Table 2.

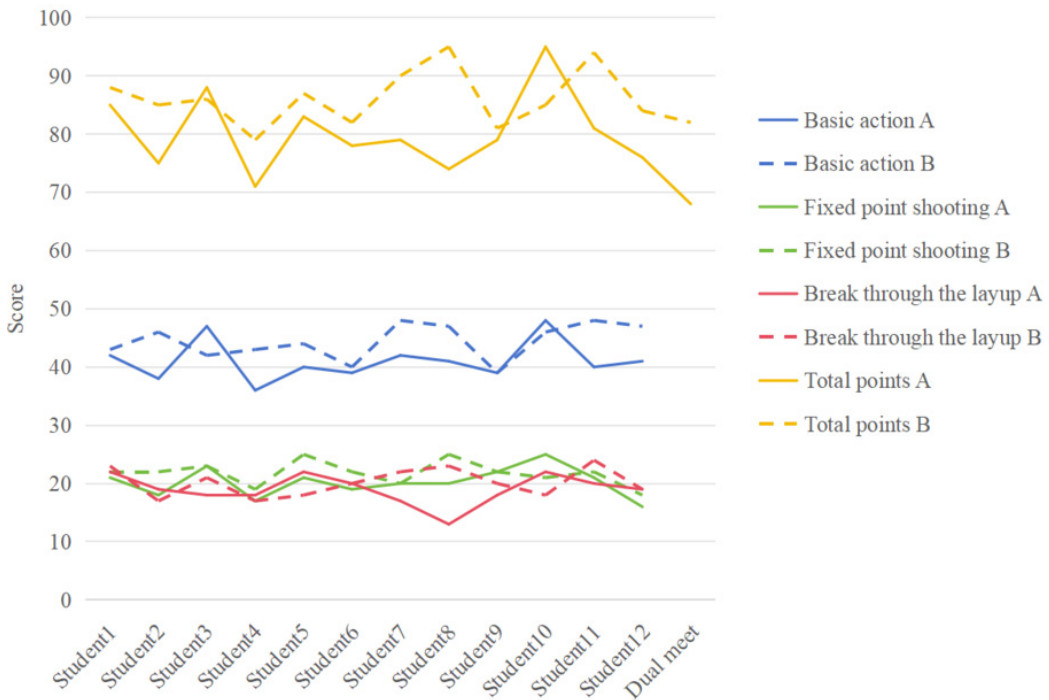
From Table 2, we can see that Group A adopts the traditional teaching method while Group B adopts the combination of traditional and multimedia technology to carry out teaching. At the end of the period, 24 people were assessed with a 100-point system in a single-player basketball course and group competition assessment, in which the scoring method was: total score = basketball basic action assessment score (50 points) + fixed-point shooting score (25 points) + breakthrough layup score (25 points); the group match assessment was recorded according to the final scores of both sides, and the assessment time was two games (20 minutes/game) or until one side scored 100 points.

Case 2: Application of Virtual Reality Technology in Gymnastics Teaching

A university introduced virtual reality technology into gymnastics teaching, which provided students with a brand new learning experience. Through virtual reality equipment, students could enter a simulated gymnasium and practice various gymnastics movements. In the virtual environment, students could freely choose different movements to practice and check whether their movements were standard at any time. At the same time, the system could also give feedback and suggestions according to students' performance to help students master skills better. This teaching method not only makes the material feel fresh and interesting, but it can also encourage bold attempts and exercises in a safe environment. With the aid of virtual reality technology, students can master the essentials of gymnastics movements more quickly and improve their sports skills.

University A selected 20 freshmen with no gymnastics foundation from the gymnastics course and divided them into two groups (A and B), which were taught by the same teacher for one semester. Group A adopted the traditional teaching method, while Group B adopted the traditional teaching method combined with virtual reality technology. At the end of the period, 20 people were assessed on the 100-point system of single gymnastics course, and the scoring method of the 100-point system

Figure 4. Statistical of basketball teaching assessment data in universities A



of single gymnastics course was: total score = completion score (50 points) + action standard (25) + fluency (25). The results of two groups of gymnastics scores were analyzed.

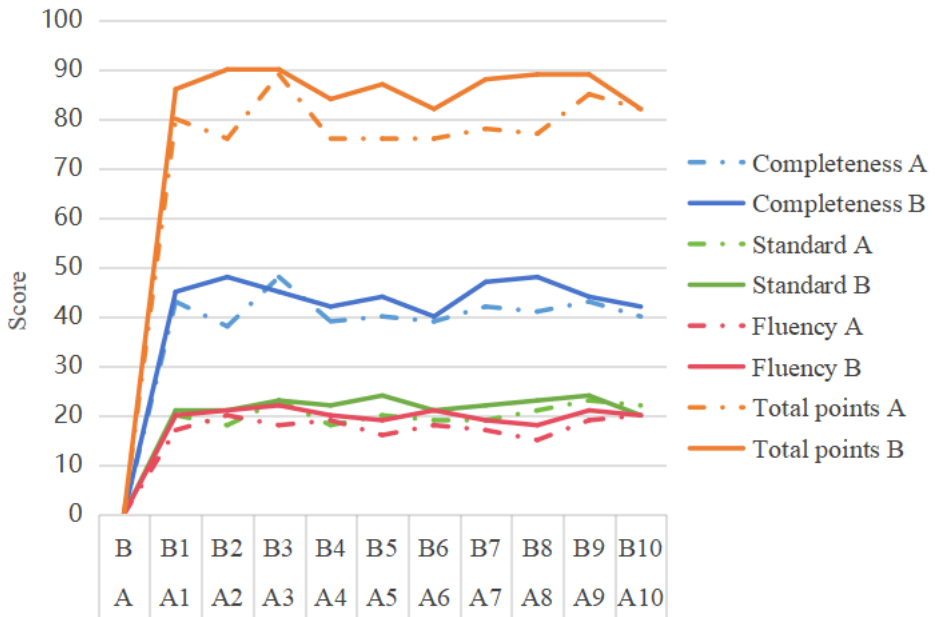
RESULT

In the analysis of case 1, the assessment data of 24 people and two teaching groups are shown in Figure 4.

From the data in the above table, we can easily see that for students' personal scores, the total final assessment score of Group A with traditional teaching methods is slightly lower than that of Group B with multimedia technology, and there is only one high-grade student (90 points or above) in Group A, while Group B has three. There are four people in Group A in the middle segment (80-85) while there are eight people in Group B, and there are seven people in the low segment (below 80 points) in Group A and only 1 person in Group B. In the final match, Group B also won by 14 points. By watching animated videos before training, athletes can have a keen insight into their technical shortcomings and those of their teammates in the process of sports. This process of self-examination not only helps them identify problems but also motivates them to correct their mistakes and improve the quality of sports through targeted technical action teaching and in-depth study of basketball knowledge. At the same time, cultivating athletes' good habits of watching in training and learning can enable them to improve themselves constantly in practice and form excellent sports habits. By combining theoretical knowledge with practical training, athletes' tactical awareness will be significantly enhanced, and then their ability to choose technical and tactical actions in the competition will be enhanced, so their overall sports performance will be better.

The results of case 2 were analyzed, and the final assessment data of the two groups are shown in Figure 5.

Figure 5. Statistical table of gymnastics teaching evaluation data in colleges and universities



As can be seen from the above figure, for students' individual gymnastics scores, the total final assessment score of group A with traditional teaching method is slightly lower than that of group B with virtual technology teaching, and there are no high-level students (90 points or above) in Group A, while there are two in group B. There are four people in Group A in the middle segment (80-85) while there are eight in Group B, and there are six people in the low segment (below 80 points) in Group A, while there are none in Group B. Through virtual reality equipment, students can freely choose different actions to practice and check whether their actions are standard at any time. The system can also give feedback and suggestions according to students' performance to help students master skills better. With the aid of virtual reality technology, students can master the essentials of gymnastics movements more quickly and improve their sports skills.

From the results of the above two research cases, we can know that compared with the simple traditional teaching method, students' sports achievements can be effectively improved with the assistance of multimedia technology. The assistance of multimedia technology can not only attract students' interest but also make up for the shortcomings of traditional teaching; it can also provide students with better learning resources and environments, thus improving teaching.

DISCUSSION

Although multimedia technology has shown remarkable advantages and potential in college physical education teaching, there are still some problems and challenges in the actual application process. Firstly, there are problems of technical threshold and operation difficulty in technical application. Due to age and technical background, some PE teachers have limited ability to master and apply multimedia technology, so it is difficult to incorporate this technology fully into their teaching. At the same time, some complicated multimedia equipment and software operation may also bring troubles to teachers, which affects the teaching efficiency and effect. Secondly, the quality and quantity of teaching resources is also an important factor restricting the application of multimedia

technology. At present, although there are some multimedia teaching resources available, on the whole, the types and quantities of these resources are still limited, so it is difficult to meet the teaching needs of different majors and levels. At the same time, there are some problems in the quality of some teaching resources, such as blurred pictures and distorted sound, which affect students' learning experience (Lange & Costley, 2020).

In order to fully realize the potential of multimedia technology, scientific and reasonable application strategies must be formulated to overcome the challenges faced when implementing multimedia technology in physical education. This paper proposes the following strategies.

Firstly, physical education teachers in colleges and universities should emancipate their minds and improve their computer application ability. At the same time, physical education teachers in colleges and universities should attach importance to the application of multimedia technology and use it flexibly. For example, virtual reality technology can be used to simulate sports scenes so that students can practice their skills in a virtual environment; or, interactive teaching software can be used to provide students with personalized learning paths and feedback mechanisms. These innovative teaching methods and means can help to stimulate students' interest and enthusiasm in learning and improve the effect of teaching.

Secondly, colleges and universities should regularly organize teachers to participate in multimedia technology application training so that they can master basic operating skills and teaching methods. They should invite experts to give lectures or give on-site guidance to help teachers solve problems encountered in practical application. By providing an online learning platform, teachers can improve their ability level regarding multimedia technology through autonomous learning and online courses.

Lastly, colleges and universities should establish a teaching resource database. Schools can introduce excellent teaching resources from inaccessible areas at the same time to enrich the teaching resource pool continuously. In addition to purchasing ready-made sports teaching videos, audio, and other materials, teachers can also be encouraged to make their own teaching resources, such as teaching courseware and micro-lesson videos, to improve the quality of multimedia courseware. They can then upload the teaching resources to realize sharing. At the same time, we can cooperate with other universities or institutions to share high-quality teaching resources and realize the exchange of needed resources. At the same time, colleges and universities should do a good job in the management of resource pool and create a teaching resource pool system platform for maintenance and management. It is also necessary to classify and manage resources, label them, and more, to allow teachers to find and use them. In addition, it is necessary to update and optimize the teaching resource database regularly to maintain the timeliness and development of resources.

CONCLUSIONS

Through in-depth discussion on the application of multimedia technology in college physical education teaching, we can clearly see that multimedia technology has brought revolutionary changes to physical education teaching. It not only enriches the teaching methods and improves the teaching effect but also stimulates students' interest in learning and promotes their overall development to a certain extent. However, we should also clearly realize that there are still some limitations and challenges in the application of multimedia technology. For example, some teachers are not proficient in multimedia technology, the quality of multimedia teaching resources is uneven, and there are adaptability problems brought about by the iteration of technology updates. Therefore, we need to strengthen teacher training further, improve teaching resource database, and promote the deep integration of multimedia technology and traditional teaching in order to full realize its advantages in teaching. Finally, the evaluation and feedback of the effect of teaching also needs attention in the application of multimedia technology. Due to the diversity and complexity of multimedia technology, teachers must learn how to evaluate its effect in teaching objectively and accurately and how to adjust and improve teaching according to the evaluation results. With the continuous development of science

and technology, the application of multimedia technology in college physical education will be more extensive and in-depth. On the one hand, we can expect more advanced multimedia technologies to be introduced into physical education, such as augmented reality (AR) and mixed reality (MR), which will bring more possibilities for physical education. On the other hand, we also need to pay attention to the deep integration of multimedia technology and physical education and explore more innovative teaching modes and methods to meet the needs of physical education in colleges and universities in the new era, which will be the further research direction in the future.

This paper discusses the effective application strategy of multimedia technology in college PE teaching from the following four dimensions. Firstly, it is very important to improve teachers' abilities at applying multimedia technology. Colleges and universities should regularly organize teachers to participate in multimedia technology application training and invite experts to give lectures or on-site guidance. Teachers can also improve their application level of multimedia technology through autonomous learning and online courses. Teachers should actively explore the innovative application of multimedia technology in physical education teaching, and design creative teaching schemes in combination with students' actual situation and teaching content.

Secondly, teaching resources are the foundation of multimedia teaching, and a perfect multimedia teaching resource library can provide rich teaching materials and references for teachers. Colleges and universities should increase investment in the construction of multimedia teaching resource database and constantly enrich the types and quantity of teaching resources.

Thirdly, while enriching teaching resources, we also need to pay attention to the quality and management of resources. Colleges and universities should establish a strict resource audit mechanism to ensure the teaching quality and applicability of the stored resources. Lastly, teachers should keep pace with the times and master the latest multimedia skills, but not rely entirely on multimedia technology. We should always insist on teaching with multimedia technology as an auxiliary tool; teachers should grasp the essence of physical fitness teaching and make full use of the status of the teaching subject.

The application of multimedia technology in college physical education teaching is a field full of opportunities and challenges. We need to explore and practice with an open mind and innovative spirit to promote the reform and development of physical education in colleges and universities and contribute to the all-round development and healthy growth of students. At the same time, we also need to pay attention to the update and iteration of technology and constantly improve our technical level and application ability to meet the needs of the times.

DATA AVAILABILITY

The figures and tables used to support the findings of this study are included in the article.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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