

Application and Exploration of the Innovation of Physical Education Model Empowered by the Metaverse Technology

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Keywords: Metaverse; Physical education; Model innovation

Abstract: The concept of "metaverse" is a significant change in the development of information technology in today's world. It not only forms a highly integrated world of virtual space and physical reality but also comes as the key factor of interaction between the virtual environment and real life. This paper adopts methods of literature review, field investigation, expert interview, and logical reasoning to explore the innovation and application of the physical education model empowered by metaverse technology. Through analyzing the teaching environment, teaching model, experience, and other factors of the metaverse physical education model, the significance of the application of metaverse technology in physical education is explained. This paper also tries to explore an integrated three-dimensional education model of the virtual world and reality with reasonable structure, real experience, and the best effect, so that to provide a fundamental theoretical reference for physical education to quickly integrate into the era of science and technology and achieve sustainable and high-quality development.

1. Introduction

"Metaverse" is a 3D virtual universe composed of meta-space that can be quickly accessed by any device anywhere in the world. This term first appeared in the science fiction novel *Snow Crash* by Neal Stephenson, an American science fiction writer, in which the concepts of "metaverse" and "avatar" are proposed. People can have their own virtual avatar in the "metaverse", while this virtual world is also called the "metaverse". With the rapid development of information technology, the concept of the "metaverse" has already surpassed the assumption of the immersive three-dimensional virtual world discussed by Neil Stephenson in his science fiction. The term not only represents a high degree of integration of virtual space and physical reality but also a key factor for the virtual space to interact with the real world.

2. "Metaverse"

Studies have shown that the construction of virtual space and the implantation of the human sensory simulation system is the basis for the formation and essence of the metaverse, that is to say, all kinds of feelings formed by human sensory organs in the real world can also be obtained in the

virtual world. The virtual space combines participants, the Internet, and hardware terminals into a virtual world independent and parallel to the real environment. It will bring unprecedented changes in our life, economy, education and culture in the future[1]. We have experienced the leap-forward development from virtual reality to augmented reality and then to mixed reality, getting to know the primary form of the metaverse. With the continuous development and improvement of the application of mixed reality, the traditional education and teaching model will be greatly impacted. The continuous upgrading of the "teaching" and "learning" environment, the ever-lasting expansion of "teaching" and "learning" resources and the ongoing improvement of "teaching" and "learning" efficiency will follow the development of mixed reality. The education industry should keep up with the development of science and technology to constantly improve the learning environment and teaching system by using mixed reality technology and applying the technology to the teaching process of all subjects. Therefore, physical education will also become one of the beneficiaries of the metaverse technology. Sports universities, colleges, and teachers should apply the advanced technology and concept of metaverse to perfect and supplement the current physical education and teaching system, improve and innovate the existing education model and method according to their own level and needs, so as to enhance their own teaching level to cope with the growing learning requirements of students and make positive contributions to the development of education and the progress of the times[2].

3. Application of metaverse technology in physical education

3.1. Metaverse technology satisfies the "teaching" and "learning" requirements of the physical education environment

In order to protect people's lives and keep them safe during the COVID-19 pandemic, countries around the world have been forced to go through lockdown time, during which working at home and online teaching has become part of people's daily life. However, all the major software and platforms with online teaching functions mainly conduct teaching through video, pictures, voice and other forms. This online learning method not only lacks the learning atmosphere of an offline classroom but also seriously affects the interaction and practice experience between teachers and students, largely reducing the teaching quality and effect. In particular, sports projects that require venues and equipment often difficult to achieve the intended goals[3]. However, in the metaverse, teachers can use mixed reality technology to set up a virtual teaching scenario in advance, and students across the country can log in through any intelligent device terminal with their virtual images, forming an online environment where different time and space scenes coexist. In this space, teachers can also integrate courseware, equipment, models, and other equipment that will be used in the teaching process into this virtual space. Different from traditional two-dimensional online teaching, the objects displayed and presented in the virtual space are three-dimensional, which are consistent with the objects observed by us in our daily life. The metaverse can truly realize the great transformation of online teaching from two-dimensional plane mapping to three-dimensional holographic display, so that students can also have face-to-face communication online, gain a comprehensive understanding of the teaching content, and have one-on-one practical experience[4].

3.2. The metaverse technology enriches the "teaching" and "learning" methods of physical education

The "metaverse" is composed of countless meta spaces, with infinite expansion ability and the ability of seamless scenarios transformation, which can interactively overlay virtual scenarios and real objects to meet various elements required by physical education and teaching. The application

of the metaverse technology not only breaks away from the obstacle of integrating multiple teaching elements in one space in real physical education but also plays a significant role in stimulating students' interest in learning, improving the teaching ability and enhancing teaching quality as an extension and supplement of traditional physical education. For example, for sports education courses such as ball games and sports anatomy that require high technical and tactical skills and rely heavily on model equipment, in addition to using description or simple teaching aids to describe and demonstrate the on-spot situation, offensive and defensive positions, as well as the position of human structure and organs, teachers can also use mixed reality technology to visually display all the elements in a three-dimensional way in the virtual space of the metaverse.[5] Students can also upload their daily exercises to the virtual space through this technology and demonstrate their skills and techniques as an avatar of themselves. Deficiencies can then be found and corrected through repeated viewing, so as to realize in-depth learning for students.

3.3. The metaverse technology improves the "teaching" and "learning" experience of physical education

Through the seamless connection of mixed reality technology, the metaverse can bring participants an immersive experience. Students can learn the invisible parts through intuitive three-dimensional virtual digital information technology[6]. The abstract scenarios that can only be verbally described in traditional physical teaching can be directly presented in front of students. Long and complicated theoretical courses and tedious outdoor training will inevitably make teachers and students have a sense of burnout and exclusion, which seriously affects the teaching quality and learning effect. In the virtual environment of the metaverse where elements of space, time and characters different from reality can be designed, teachers and students can play multiple virtual characters, overcome the physical restrictions between teaching and learning, and enjoy the interactive experience and fun of being immersed in the learning environment.

4. The metaverse technology innovates the construction and realization of the physical education model

4.1. Theoretical framework of physical education model in the metaverse

Piaget and Bruner believe that the world exists objectively, but the knowledge and cognition of everything in the world and relevant interpretation vary from person to person. Because each of us has a different life background, leading to a different understanding of the outside world. Therefore, learning is not a simple transfer of knowledge from teachers to students, but a process in which students construct their own knowledge. In addition, situational teaching believes that students' learning behaviors shall be placed in scenarios similar to real life so that to achieve the teaching objective of solving practical problems[7]. Therefore, for the teaching content, we should choose practical tasks like the problem-solving process in the real world, and the tools shall be placed implicitly in the situation. The exploration process demonstrated by teachers in class shall be similar to that of experts in the real world, providing original solutions and guiding students to explore further, rather than feeding the prepared content to students in advance.

4.2. Planning and design of the metaverse physical education model

The metaverse information technology platform along with the Internet technology and mixed reality technology can interactively integrate virtual environment and real space to plan and design the metaverse physical education model. Firstly, teachers should determine the teaching content and

objectives, and design teaching strategies and teaching scenarios through computer technology; Secondly, the pre-designed teaching content, teaching objectives, teaching strategies, teaching scenes and other elements will be uploaded to the metaverse environment through intelligent devices. In this advanced three-dimensional situation where virtual and reality are comprehensively integrated, teachers can guide students with language description and technical operation, allowing them to complete learning sections including exploration, cooperation, interaction, and practice in this virtual space. Thirdly, after the course, students can enter the virtual space to review the teaching content and practice at any time. The system will form conclusive evaluation feedback to the teacher while the teacher can improve the teaching objectives and contents according to the feedback, adjust the teaching strategies and scenarios accordingly, and uploads them to the metaverse environment, thus forming a closed teaching chain[8]. Therefore, intelligent devices, which are traditionally regarded as teaching aids and tools by teachers, are transformed into essential teaching resources in teaching design. The process of feeding knowledge passively to students is also transformed into a process of conducting interactive exploration with teachers on the holographic display platform jointly built by the virtual environment and real world, thus enhancing students' interest and ability to active exploration and communication.

4.3. Comprehensive evaluation of the metaverse physical education model

Teaching evaluation is of great significance in our daily education and teaching. In the metaverse physical education model, teaching quality, learning effect, and all aspects of the curriculum can be evaluated digitally and comprehensively using effective technical means and module functions. The process and result of physical education can also be measured and evaluated. The contents of measurement include but are not limited to: Learning and assessment of theoretical courses, learning and assessment of practice courses, student performance, competition records, interactive activities, physical test and assessment, attendance, assignment and review, and other aspects[9]. Conclusive feedback will be formed with the combination of the teacher system in the metaverse platform, which can significantly improve the teaching methods and teaching design for teachers and colleges.

4.4. The realization of the metaverse physical education model

In addition to the continuous development and breakthrough of the metaverse technology, the realization of the metaverse physical education model requires deeper popularization and application of mobile intelligent terminal equipment. Only the perfect combination of technical conditions and hardware equipment can bring people into the virtual environment. Everyone creates their personal database at the same time after entering the virtual space of the metaverse. Meanwhile, with the increasingly colorful and rich daily life and social activities, the individual data also becomes increasingly diverse. Under the new system of the metaverse physical education model, teachers and students can perceive the seamless combination of reality and the virtual environment through auditory sense, visual sense, and tactile sense[10]. For example, Facebook has developed a robotic electronic skin that can be integrated with mixed reality technology. Not only the electronic skin can detect certain subtle movements, but also can it be used to interact with the virtual environment. Interaction with virtual objects will be more natural and intuitive with the support of the robot's electronic skin, and the real experience will be greatly improved. Therefore, people can also perceive and judge the existence of objects by the sense of tactile sensation in the three-dimensional virtual environment through technical design and transformation of mobile intelligent terminal equipment, so as to enjoy the vivid experience of communicating with virtual objects in the virtual space.

5. Conclusion

One of the weaknesses of the traditional education and teaching model is that theory and practice cannot be integrated, as a result, theoretical learning and practical application cannot be carried out at the same time, which results in a decrease in students' learning interest and ability, and the teaching effect is far from the objectives. The teaching platform supported by the metaverse technology can bring people a real experience sense that goes beyond reality, allowing students to "learn by doing, do while learning", reconstruct their own views on the objects of the real world, stimulate students' three-dimensional thinking and creative thinking, and help students to combine learning and thinking, deepen the implementation of concepts, strengthen skills and generate new ideas and creativity. The application of the metaverse physical education model supported by relevant technology conforms to the development of the era and the scientific concepts of modern education. It also provides an ideal technology platform for the high-level integration of physical education teaching theory and practice. Moreover, the extensive application of the metaverse in various fields in the future will also bring people into a three-dimensional, diversified, and wonderful era of science and technology.

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