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The impact of digital transformation on interdisciplinary teaching in physical education and health courses

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Abstract
This study explores the profound impact of digital transformation on interdisciplinary teaching in physical education and health courses. Virtual Reality (VR) and Augmented Reality (AR) technologies provide innovative platforms for immersive sports skill learning, virtual human anatomy, and contextual health education, significantly enhancing learning experiences and outcomes. Wearable devices play a critical role in real-time physiological data collection, personalized exercise guidance, and inter-disciplinary data sharing, paving the way for precision health management. Digital tools such as collaborative curriculum design platforms, virtual interdisciplinary research labs, and data-driven teaching evaluation systems greatly promote inter-disciplinary collaboration, optimizing the design and assessment processes. Despite challenges such as data security and teacher training, digital transformation holds the promise of revolutionary changes in interdisciplinary teaching in physical education and health courses, significantly improving teaching quality and learning effectiveness.

Keywords: Digital teaching transformation, interdisciplinary physical health education, immersive learning technologies

1. Introduction
In today's rapidly evolving digital age, the field of education is undergoing unprecedented changes. Physical education and health education, key areas for fostering students' comprehensive development, also face opportunities and challenges brought by digital transformation. With the rapid development of emerging technologies such as Virtual Reality (VR), Augmented Reality (AR), and wearable devices, the potential for interdisciplinary teaching models in physical education and health courses is increasingly evident. This study aims to explore how digital transformation reshapes interdisciplinary teaching models in physical education and health courses. By thoroughly investigating the educational applications of these innovative technologies, we hope to provide new ideas and methods for interdisciplinary teaching in physical education and health courses, enhancing teaching quality and learning outcomes. Additionally, this study will discuss the potential challenges faced during the digital transformation process, providing valuable references for educators and policymakers.

2. Educational applications of virtual reality (VR) and augmented reality (AR) technologies
2.1. Immersive Sports Skill Learning
Virtual Reality (VR) and Augmented Reality (AR) technologies have brought revolutionary changes to physical education, especially in the learning of sports skills. By creating highly realistic VR environments, educators can simulate various sports scenarios, providing students with immersive learning experiences. For instance, in basketball training, students can wear VR headsets to immerse themselves in a virtual basketball court, experiencing the atmosphere of a real game while practicing shooting, passing, and other skills. This method not only provides a safe practice environment but also automatically adjusts difficulty levels based on students' proficiency, enabling personalized learning.
Similarly, AR technology offers unique advantages for sports skill learning by overlaying digital information onto the real environment. For example, in athletics training, AR glasses can project virtual opponents or optimal routes on the track,

stimulating students' competitive spirit and optimizing their running strategies. In gymnastics teaching, AR technology can display real-time skeletal structures superimposed over standard movements, helping students intuitively understand and correct their postures. This instant feedback mechanism significantly improves learning efficiency, enabling students to master complex sports skills more quickly.

By integrating VR and AR technologies, physical education can transcend the limitations of time and space, providing students with diverse, high-quality sports skill learning experiences, fostering learning interest, enhancing engagement, and ultimately achieving better learning outcomes.

2.2. Virtual Human Anatomy Learning

Through the creation of highly realistic interactive 3D human models, VR technology allows students to explore human anatomy and motor functions in unprecedented ways. Students can use VR equipment to enter a virtual human body, observing detailed structures of muscles, bones, and organs, and even simulating the contraction and relaxation processes of muscle groups during different movements. This immersive experience greatly enhances the intuitiveness and enjoyment of learning, helping students gain a deeper understanding of the complexities of the human body.

In this virtual environment, students can not only observe but also perform interactive operations. They can disassemble and reassemble human structures, simulate physiological changes during various activities, and even zoom in to observe microscopic tissue structures. This interactive learning approach significantly improves learning efficiency, making abstract physiological knowledge concrete and tangible.

VR technology provides an ideal platform for interdisciplinary learning of sports and biology. Students can simultaneously learn sports skills and related anatomical and physiological knowledge in the virtual environment, understanding the biomechanical principles behind different movements. For example, when learning long jump techniques, students can observe the muscle exertion patterns and skeletal motion trajectories of the legs, gaining deep insights into the mechanics of force application and energy conversion processes. This interdisciplinary learning method helps students form a systematic knowledge framework, enhancing their comprehensive analytical abilities.

2.3. Contextual health education

The application of Virtual Reality (VR) technology in health education brings revolutionary changes to traditional health education methods. By creating highly realistic virtual environments, VR technology can simulate various health risk scenarios, providing students with immersive experiences that enhance health awareness and promote behavioral changes. Compared to traditional didactic education, this contextual health education approach resonates more deeply with students and encourages reflection.

For example, in smoking hazard education, VR technology can simulate the progressive damage to a smoker's lungs over time. Students can "enter" the smoker's body through VR devices, witnessing firsthand how harmful substances in cigarettes erode lung tissues and experiencing symptoms like difficulty breathing. This vivid and intense experience is far more effective than simple verbal warnings, making students more aware of the dangers of smoking and increasing their willingness to quit or avoid smoking.

3. Application of Wearable Devices in Health Monitoring and Exercise Guidance

3.1. Real-time Physiological Data Collection and Analysis

Real-time data collection allows teachers to promptly detect any abnormalities in students during exercise or daily activities. For example, heart rate data analysis can identify if a student has an abnormally high or low heart rate, which might signal discomfort or excessive fatigue. Similarly, step counts and activity level data can help teachers assess whether students are meeting their physical activity goals, thereby gauging their fitness levels.

By leveraging big data analysis, the health data of a large number of students can be deeply mined and pattern recognition can be performed. For instance, analyzing heart rate variations over different periods and activity types can help identify the main factors affecting heart rate, thus enabling the creation of more scientific exercise plans for students. Additionally, big data analysis can uncover common health issues among the student population, such as poor sleep quality or insufficient physical activity, assisting schools in formulating targeted health interventions.

Real-time data collection and analysis benefit individual students and provide data support for school health education. Schools can adjust the content and intensity of physical education courses based on analysis results, promote healthy lifestyles, and improve the overall health level of students.

3.2. Personalized exercise feedback system

A personalized exercise feedback system can be developed based on real-time data collected from wearable devices. This system can dynamically adjust exercise plans according to real-time heart rate, exercise duration, and intensity. For instance, if a student's heart rate reaches a certain threshold, the system can remind them to slow down or stop exercising to avoid health risks associated with excessively high heart rates. Conversely, if the exercise intensity is insufficient, the system can encourage the student to increase their activity level to ensure the effectiveness of the exercise.

The personalized feedback system can provide specific exercise guidance. For example, during running, the system can suggest adjustments to stride length, frequency, or running posture based on real-time data to improve exercise efficiency and reduce injury risks. For strength training, the system can guide students in adjusting training weights and repetitions based on muscle activity to avoid muscle damage caused by overtraining.

Additionally, the personalized exercise feedback system can record and analyze data from each exercise session, generating detailed exercise reports. These reports can help students understand their progress and identify areas for improvement. For example, by comparing exercise data over different periods, students can see changes in endurance and strength, pinpointing the focus of their next training sessions.

3.3. Interdisciplinary data sharing platform

The data collected by wearable devices is crucial not only for individual health but also for broader interdisciplinary data sharing, promoting collaboration among physical education teachers, health educators, and medical professionals.

An interdisciplinary data sharing platform based on wearable device data can centralize the management and sharing of health data. Physical education teachers can use the data on

the platform to understand students' exercise habits and health status, adjusting teaching plans accordingly. Health educators can analyze health trends within the student population using the data, creating targeted health education programs. Medical professionals can utilize the platform's data for early health risk screening and provide medical advice.

The interdisciplinary data sharing platform enhances collaboration among different disciplines. For example, physical education teachers and health educators can jointly analyze students' health data and develop comprehensive health intervention measures. Medical professionals can participate in school health education, providing professional health guidance and consulting services. This collaboration not only improves the effectiveness of health interventions but also enriches the content of school health education.

Moreover, the interdisciplinary data sharing platform can be used for scientific research. Researchers can utilize the platform's data to study the relationships between student health, exercise, and learning, identifying key factors affecting student health and proposing scientific intervention measures. These research findings are valuable for guiding school health education and can provide a scientific basis for formulating public health policies.

4. Digital Tools to promote interdisciplinary collaboration

4.1. Collaborative curriculum design platform

A collaborative curriculum design platform is a digital tool aimed at supporting collaboration among teachers from different disciplines, especially in areas such as physical education, health, and biology. This platform offers features like resource sharing, real-time collaboration, and version control, thereby enhancing the efficiency and innovation of curriculum design. The platform provides a rich resource library where teachers can share and find various teaching resources, including textbooks, videos, audio files, charts, and experimental data. Resource sharing allows teachers to access more teaching materials, enriching classroom content and improving teaching quality. For example, physical education teachers can use biological data to explain the effects of exercise on different body systems, while health educators can incorporate examples from physical exercise to teach healthy lifestyles.

The real-time collaboration feature allows teachers to simultaneously edit course content, conduct real-time discussions, and make modifications. This instant feedback and interaction can significantly improve the efficiency and quality of course design. For instance, teachers can use the platform's chat feature or video conferencing tools to discuss teaching ideas and methods in real-time, reaching consensus quickly and avoiding the cumbersome email exchanges and time delays of traditional course design.

4.2. Virtual interdisciplinary research and teaching platform

The virtual interdisciplinary research and teaching platform is another digital tool designed to provide an online environment for collaboration and communication among teachers from different disciplines, overcoming spatial and temporal limitations, and supporting remote meetings, resource sharing, and collaborative teaching design.

The virtual research and teaching room offers remote meeting capabilities, allowing teachers to conduct real-time communication and discussions via video conferencing tools. This method not only saves time and travel costs but also enhances communication efficiency. Teachers can share their teaching experiences and methods, discuss course design and teaching strategies, and even conduct joint interdisciplinary teaching activities. For example, physical education teachers and health educators can co-plan a themed course on "Health and Exercise," exchanging teaching plans and specific implementation details through video conferencing.

The virtual research room supports resource sharing, allowing teachers to upload and download various teaching resources, including courseware, exam questions, case studies, etc. Resource sharing enables teachers to learn from and borrow each other's materials, enriching their teaching content and methods. The platform also provides online tools like whiteboards and document editors to help teachers collaborate and create in a virtual environment.

The virtual research room also features collaborative teaching design capabilities, enabling teachers to co-edit and design teaching plans online. This collaboration not only improves the quality of course design but also promotes academic exchange and cooperation among teachers. For instance, health educators can use biological knowledge to design course content on human health, while physical education teachers can arrange related sports activities and exercises based on this content, forming a complete interdisciplinary teaching plan.

4.3. Data-driven teaching effectiveness evaluation system

A data-driven evaluation system can collect and integrate teaching data from different disciplines, including students' academic performance, classroom behavior, participation, and feedback. By analyzing this data, the overall effectiveness of interdisciplinary teaching can be comprehensively understood. For example, data from physical education courses can be compared and analyzed with data from health education courses to identify differences in student performance across subjects, evaluating the actual effects of interdisciplinary teaching.

This system also uses data visualization technology to present evaluation results in charts, dashboards, and other forms. This visual representation allows teachers to clearly see various indicators of teaching effectiveness, such as changes in student performance and participation trends, enabling better understanding and analysis of teaching effectiveness. For example, through visualized performance analysis charts, teachers can identify which teaching segments are most effective and which need improvement.

The data-driven evaluation system can also generate detailed evaluation reports, providing specific suggestions for teaching improvement. Based on the analysis results, the system can suggest adjustments to teaching methods, optimizing course content, and even implementing personalized teaching to enhance students' learning outcomes and participation. These suggestions help teachers improve their teaching methods and provide data support and decision-making basis for school education management.

5. Conclusion

Digital transformation, through the introduction of VR, AR technologies, and wearable devices, has significantly enhanced the interdisciplinary teaching effectiveness of physical education and health courses. Immersive learning environments and real-time physiological data collection have promoted students' understanding and application of

sports skills and health knowledge. Collaborative curriculum design platforms and virtual research rooms have strengthened interdisciplinary collaboration among teachers. The data-driven teaching effectiveness evaluation system has helped optimize teaching strategies, achieving more efficient educational outcomes.

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