

Research on the Reform Path of Physical Education Teaching in Colleges and Universities in Shandong Province under the Background of "Integration of Sports and Medicine"

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Abstract: *Under the strategic framework of Healthy China, the integration of sports and medicine has become a crucial direction for the reform of physical education (PE) in colleges and universities. The traditional PE teaching model has shown deficiencies in health promotion and personalized instruction, necessitating innovative approaches. This study aims to explore the reform paths and implementation strategies for PE teaching in colleges and universities in Shandong Province under the background of sports-medical integration. By employing a combination of literature analysis, policy research, and practical investigation, this study systematically analyzes key areas of reform, including curriculum optimization, teaching model innovation, faculty capacity enhancement, and the establishment of a physical health monitoring and evaluation system. The findings suggest that constructing a health-oriented curriculum system, strengthening personalized teaching approaches, improving the interdisciplinary competencies of PE teachers, and leveraging intelligent sports technology to optimize teaching management can effectively enhance students' health literacy and sports participation. In the future, colleges and universities should deepen interdisciplinary collaboration, refine policy support, and promote the modernization of PE teaching toward a more scientific, intelligent, and personalized approach to foster students' overall well-being.*

Keywords: *Integration of sports and medicine; Shandong Province; colleges and universities; physical education teaching; reform path*

1. Introduction

The deep integration of sports and health has become a significant trend in the reform of physical education (PE) in higher education worldwide. Under the guidance of the Healthy China strategy, PE is not only responsible for developing students' sports skills but also plays a crucial role in promoting physical and mental well-being, improving quality of life, and enhancing social adaptability[1]. As an emerging interdisciplinary model, the integration of sports and medicine emphasizes the use of scientific exercise interventions to improve individual health levels, fostering deeper connections between physical education, sports rehabilitation, and health management[2]. In this context, college PE serves as a key platform for cultivating healthy lifestyles, enhancing physical fitness, and promoting mental well-being. However, it also faces profound reform challenges in aligning with the sports-medical integration approach[3]. Integrating medical health concepts into PE teaching and achieving the coordinated development of sports education and health promotion has become a crucial issue in contemporary sports education reform.

Shandong Province, as one of China's regions with a high concentration of higher education resources, possesses numerous universities and abundant sports education facilities. However, traditional PE models in colleges and universities are still primarily focused on athletic skill training and physical fitness improvement, with limited emphasis on health promotion, disease prevention, and sports rehabilitation[4]. This has led to difficulties for some students in developing long-term healthy exercise habits, and in some cases, a lack of scientific guidance has resulted in sports injuries[5]. With the rise of the integration of sports and medicine, there is an urgent need for a comprehensive reform of PE in universities in Shandong, encompassing teaching objectives, curriculum design, and instructional methods to align with the evolving demands of higher education and public health[6].

The theoretical foundation for PE reform is rooted in multidisciplinary integration, drawing from recent advancements in exercise physiology, sports rehabilitation, and health education. Modern educational theories emphasize student-centered learning and personalized development, while health promotion models advocate for structured exercise interventions to improve individual health[7]. Consequently, PE must extend beyond mere skill training to incorporate personalized sports curricula tailored to students' physical conditions and health needs, thereby enhancing the scientific and targeted nature of PE instruction[8]. Furthermore, global trends in sports education underscore the widespread acceptance of the exercise as medicine concept. Many universities worldwide have incorporated exercise prescriptions, health monitoring, and sports rehabilitation into their PE programs, offering valuable insights for the reform of university PE in China[9].

The exploration of reform pathways requires systematic adjustments in curriculum design, faculty development, teaching methodologies, and evaluation mechanisms[10]. In terms of curriculum development, universities should establish a PE curriculum system that integrates health education, exercise prescriptions, and rehabilitation training, shifting the focus from mere skill training to comprehensive health promotion[11]. Faculty development should aim to enhance PE teachers' expertise in health education, equipping them with interdisciplinary knowledge in sports rehabilitation and health assessment, enabling them to provide scientific exercise guidance to students[12]. Teaching methodologies should leverage modern information technologies to promote a blended learning approach, incorporating smart sports equipment for precise monitoring and personalized instruction. Regarding evaluation mechanisms, universities must develop a scientifically sound assessment system that considers students' physical fitness, health status, and exercise habits to ensure the effective realization of teaching objectives.

The implementation of reform strategies should be tailored to the specific conditions of universities in Shandong, considering the diverse educational resources and student demographics across institutions[13]. Collaboration among government bodies, universities, and society is essential, with policy support, funding allocation, and faculty training serving as key measures to ensure the smooth execution of reforms[14]. Moreover, universities should establish cooperative frameworks with healthcare institutions, leveraging the expertise of hospitals and rehabilitation centers to provide professional support for PE instruction[15].

To evaluate the effectiveness of these reforms, a robust monitoring system must be established, integrating quantitative data analysis with practical feedback to assess the impact of PE reforms on students' health literacy, sports participation levels, and physical fitness improvements. Continuous long-term tracking and dynamic adjustments will be essential to optimizing PE programs and enhancing the overall quality and effectiveness of university PE instruction[16].

This study, centered on the integration of sports and medicine, explores the pathways and implementation strategies for the reform of PE in universities in Shandong Province. The findings aim to provide theoretical support and practical guidance for the innovative development of PE in higher education. By contributing to the advancement of PE reform in Shandong, this research also holds significant implications for the modernization of China's university PE system.

2. Research Subjects and Methods

This study focuses on the reform of physical education (PE) in colleges and universities in Shandong Province, with particular emphasis on key aspects such as the optimization of the PE curriculum system, innovation in teaching models, enhancement of faculty capabilities, and the establishment of a sports health monitoring and evaluation system under the background of integration of sports and medicine. The research methodology combines literature analysis, policy research, and practical investigation, systematically reviewing the theoretical foundations and practical experiences of PE reform both domestically and internationally. By analyzing policy documents and the current status of PE curricula in colleges and universities, this study explores the reform needs of PE teaching in Shandong Province. Additionally, questionnaire surveys and interviews are conducted to gather feedback from university PE teachers and students regarding the teaching reform. Empirical analysis is used to verify the feasibility of the proposed reform paths. A combination of quantitative and qualitative data analysis ensures the scientific validity and practical significance of the research findings. This study aims to provide theoretical support for the innovative development of PE in colleges and universities in Shandong Province while offering valuable insights into the modernization of university PE education in China.

3. Results and Analysis

3.1. Overview of Physical Education under the Background of "Integration of Sports and Medicine"

The integration of sports and medicine refers to the deep combination of sports and medical sciences, aiming to enhance individual health through scientific exercise interventions, thereby achieving multiple goals such as disease prevention, sports rehabilitation, and health promotion. Driven by the Healthy China strategy, college PE has gradually shifted from a traditional competition-oriented model to a health-promotion-oriented model, with the concept of sports-medical integration providing new theoretical foundations and practical pathways for PE reform[16].

Currently, college PE mainly focuses on improving students' physical fitness, cultivating interest in sports, and enhancing athletic skills. However, it still lacks emphasis on health management, sports rehabilitation, and personalized instruction. Traditional PE curricula primarily center on physical training and specialized sports skills, with limited consideration of students' individual health conditions and targeted guidance. Under the integration of sports and medicine, PE must break through the limitations of traditional models by incorporating medical, exercise physiology, and sports rehabilitation knowledge into the curriculum. By scientifically assessing students' health conditions, PE teaching should provide personalized exercise prescriptions to achieve precise and effective PE instruction.

In teaching practice, the integration of sports and medicine requires the establishment of interdisciplinary collaboration mechanisms, integrating PE with health monitoring, exercise prescriptions, and sports rehabilitation. Smart sports devices should be used to monitor physical fitness, adjust exercise intensity and content based on data analysis, and provide precise interventions tailored to different student groups. Meanwhile, PE teachers must acquire medical and health management knowledge to better guide students in scientific exercise, prevent sports injuries, and provide rehabilitation recommendations when necessary.

The reform of PE under the background of integration of sports and medicine not only enhances the scientific and targeted nature of PE but also effectively helps students develop lifelong exercise habits and improve health literacy. The promotion of this model contributes to the synergy between PE and health promotion, providing new insights and directions for the innovation of PE in colleges and universities.

3.2. Theoretical Basis for the Reform of Physical Education in Colleges and Universities in Shandong Province

The theoretical basis for the reform of PE in colleges and universities in Shandong Province is mainly derived from educational theories, sports science, health promotion theories, and research on the integration of sports and medicine, aiming to advance PE toward a more scientific, personalized, and health-oriented approach.

3.2.1. Theories of Lifelong Physical Education and Health Promotion

The lifelong PE theory emphasizes that PE is not merely a part of students' coursework during their academic years but should also help cultivate lifelong exercise habits to achieve sustained health benefits. Traditional college PE has primarily focused on competitive sports and skill training, with limited attention to health management, disease prevention, and individual development of exercise abilities. The health promotion theory advocates that individuals should be empowered through education and social support systems to gain control over and improve their health. Under the integration of sports and medicine, PE reform must incorporate health education, enabling students to master scientific exercise methods, develop lifelong exercise habits, and ultimately enhance their overall health.

3.2.2. Modern Physical Education and Diversified Teaching Theories

Modern PE theories emphasize that PE curricula should cater to diverse student needs and adopt diversified, personalized teaching models. As students' health conditions become increasingly heterogeneous, a standardized PE curriculum fails to accommodate all students. Some students may not be able to participate in high-intensity physical activities due to health conditions and may even be prone to injuries. Under the integration of sports and medicine, PE reform should integrate sports rehabilitation and exercise physiology knowledge to develop course plans that align with students'

varying health levels and athletic abilities. By implementing personalized exercise interventions, PE can be made more scientific, precise, and effective, improving both its adaptability and overall impact.

3.2.3. The Concept of "Exercise is Medicine" and Exercise Prescription Theory

The "Exercise is Medicine" concept, proposed by the international sports medicine community, emphasizes that exercise is not only a means of physical training but also a crucial approach for health promotion and disease prevention. Under this concept, PE should be closely linked with medical health management, incorporating exercise prescription theory, which involves designing scientific exercise plans based on students' physical fitness levels, health needs, and personal interests. For instance, as chronic diseases such as hypertension, obesity, and metabolic syndrome become more prevalent among young individuals, PE courses in universities should integrate medical assessments to develop low-impact, high-efficiency exercise plans tailored to specific student groups, achieving the goal of health intervention.

3.2.4. Physical Education Curriculum Evaluation and Feedback Mechanism

Modern educational theories emphasize the importance of teaching evaluation, and PE reform in colleges and universities must establish a scientific and reasonable evaluation system. Traditional PE assessment criteria have predominantly focused on physical fitness tests such as endurance, speed, and strength while neglecting students' improvement in health literacy. Under the integration of sports and medicine, PE evaluation should include health indicators (such as cardiovascular endurance, flexibility, and exercise habits), sports knowledge (such as injury prevention and health management), and mental health aspects (such as the role of exercise in emotional regulation). Furthermore, modern information technology should be utilized to establish a real-time feedback system for PE, enabling continuous tracking of students' exercise patterns and dynamic adjustments to course content to enhance teaching quality and students' health outcomes.

3.2.5. Support from Smart Sports and Big Data Analytics

Advancements in information technology have created new possibilities for PE reform. Smart sports equipment, health monitoring systems, and big data analytics provide precise data support for PE teaching. In the reform of PE in colleges and universities in Shandong Province, technologies such as wearable smart devices and online health assessment systems should be used to collect data on students' physical activities, health indicators, and exercise habits. By leveraging artificial intelligence (AI) analysis, personalized exercise guidance can be provided to students. This data-driven PE reform enhances course design, making exercise interventions more tailored and scientific, ultimately improving the accuracy and effectiveness of PE instruction.

3.3. Reform Path of Physical Education Teaching in Colleges and Universities in Shandong Province

Under the background of the integration of sports and medicine, the reform of physical education (PE) in colleges and universities in Shandong Province aims to optimize PE instruction and enhance students' health levels. The core reform paths include comprehensive innovations in the curriculum system, teaching model, faculty development, health monitoring, industry-academia collaboration, and policy support.

In terms of the curriculum system, universities should develop PE curricula oriented toward the integration of sports and medicine, incorporating sports and medical health knowledge. Courses on health promotion, sports rehabilitation, and functional exercise programs such as yoga and Pilates should be introduced to meet the diverse needs of students. Additionally, personalized PE courses should be implemented using health monitoring data to create precise exercise programs.

For teaching model innovation, blended learning, smart sports technology, and project-based instruction will enhance interactivity and relevance in PE. Through digital PE platforms, students can engage in self-directed learning, practical guidance, and real-time data feedback, forming a closed-loop learning system.

Faculty development plays a crucial role in reform. Universities must enhance teachers' interdisciplinary competencies by conducting cross-disciplinary training and establishing collaborative teaching mechanisms between PE and medical sciences. Improving faculty assessment and incentive mechanisms will further strengthen teachers' ability to implement integrated sports and medicine education.

The establishment of a sports health monitoring and evaluation system is essential for ensuring the success of the reform. A multi-dimensional evaluation system should assess not only sports skills but also health literacy and exercise habits. The application of intelligent evaluation tools will enable a more scientific and personalized approach to PE assessment.

Expanding industry-academia collaboration will support resource sharing and provide practical training platforms and technological support for PE instruction. Partnerships with medical institutions, sports technology companies, and social sports organizations will improve the practicality and informatization of PE education.

Policy support and social security mechanisms are critical for implementing the reform. Universities must seek government policy support and funding, establish supervision and feedback mechanisms, and optimize curriculum design. Additionally, enhancing health education outreach will improve students' awareness of sports and health management, fostering a deeper integration of physical education and health education.

In summary, the reform of PE in colleges and universities in Shandong Province should center on the concept of the integration of sports and medicine. Through comprehensive innovation, this reform aims to modernize, professionalize, and personalize PE education, ultimately improving students' health literacy and providing practical guidance for advancing PE in higher education.

3.4. Implementation Plan for the Reform of Physical Education Teaching in Colleges and Universities in Shandong Province

The implementation plan for PE reform in colleges and universities in Shandong Province focuses on the concept of the integration of sports and medicine, aiming to improve the scientific, practical, and sustainable nature of PE instruction through systematic measures.

Firstly, optimizing the curriculum system is essential. The integration of health promotion, sports rehabilitation, and other specialized courses should be reinforced, offering diverse PE options that cater to students' different needs. Personalized exercise interventions based on health monitoring data will provide precise guidance.

For teaching model innovation, blended learning, smart sports technology, and project-based and case-based teaching methods will enhance the practicality and effectiveness of PE instruction. This approach enables students to experience the impact of exercise on health in real-world scenarios.

Regarding faculty development, cross-disciplinary training should be strengthened to improve PE teachers' knowledge in health education, sports rehabilitation, and medical sciences. Joint training programs and collaborative teaching mechanisms between PE and medical disciplines will deepen the integration of sports and medicine. Optimizing faculty evaluation and incentive systems will encourage active participation in PE reform.

The establishment of a sports health monitoring and evaluation system is a key component of the reform. A multi-dimensional evaluation framework combined with a health monitoring system should be developed to regularly collect student health and fitness data. Based on these data, personalized exercise prescriptions can be formulated to enhance the scientific precision and effectiveness of PE instruction.

Expanding industry-academia collaboration is essential for sustaining the reform. Partnerships with medical institutions, sports technology companies, and social sports organizations will offer students access to physical health assessments, sports health consultations, and sports injury rehabilitation services. The integration of intelligent equipment and digital platforms will further support PE modernization and informatization.

Furthermore, policy support and regulatory mechanisms are fundamental for the successful implementation of the reform. Universities should actively seek government support and funding, establish a reform outcome monitoring and feedback system, and ensure the long-term effectiveness of reform initiatives. Additionally, increasing public awareness of health education through seminars, digital campaigns, and outreach programs will enhance students' understanding of the integration of sports and medicine, fostering greater engagement in health management.

In conclusion, the implementation plan for PE reform in Shandong Province emphasizes curriculum system optimization, teaching model innovation, faculty development, health monitoring and evaluation, industry-academia collaboration, and policy support. By integrating these elements, the

concept of sports-medical integration can be effectively implemented, ensuring substantial improvements in PE instruction in higher education.

3.5. Evaluation of the Effectiveness of Physical Education Reform in Colleges and Universities in Shandong Province

The evaluation of the effectiveness of PE reform in colleges and universities in Shandong Province must comprehensively consider multiple dimensions, including improvements in students' physical fitness, enhancement of health literacy, satisfaction with PE courses, the effectiveness of teaching model innovations, and faculty capacity development. Regular physical fitness data collection and health literacy surveys are essential to assess the impact of PE teaching on students' physical well-being and health management capabilities. Course satisfaction surveys, combined with enrollment numbers and course completion rates, reflect how curriculum optimization influences students' interest and engagement in sports activities.

Additionally, classroom observations and intelligent sports equipment data analysis are employed to evaluate the practical effectiveness of innovative measures such as blended learning and personalized interventions. The enhancement of faculty competencies is assessed through teacher training participation rates, teaching quality evaluations, and student feedback, verifying the impact of faculty development on overall teaching effectiveness. A multi-dimensional evaluation framework, integrating both quantitative and qualitative analysis, ensures the scientific validity and comprehensiveness of the assessment process.

By continuously refining the evaluation system, PE reform can dynamically adjust teaching strategies, ensuring the sustainability of reform efforts and guiding college PE education toward a healthier, more scientific, and more personalized direction. Through ongoing improvements, the reform of PE in colleges and universities in Shandong Province will continue to reach new heights.

4. Conclusion

This study systematically explores the reform path and implementation strategies for physical education (PE) in colleges and universities in Shandong Province under the background of the integration of sports and medicine. The findings indicate that the deep integration of sports and medical sciences has become a significant trend in PE reform, contributing to the enhancement of students' health literacy, optimization of the PE curriculum structure, innovation in teaching models, and advancement of personalized PE education.

By constructing a health-oriented PE curriculum system, optimizing teaching models, strengthening faculty development, establishing a comprehensive health monitoring and evaluation system, and expanding industry-academia collaboration, PE reform can significantly improve the scientific accuracy and effectiveness of PE instruction. The study further demonstrates that PE reform not only enhances students' physical fitness but also improves their health management skills and fosters lifelong exercise habits.

In the future, universities should continue to refine policy support, strengthen interdisciplinary collaboration, and leverage smart sports technologies to enhance the precision and efficiency of PE instruction. These measures will ensure the sustainable development of PE reform, providing scientific guidance and practical pathways for advancing PE education in the new era.

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