

Research on Challenges and Pathways for Integrating Teaching Resources in University Physical Education Courses in the Digital Age

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Abstract

Against the backdrop of deepening educational digitalization strategies, the integration of teaching resources for university physical education courses has become a critical agenda for advancing high-quality development in physical education. This study systematically examines the necessity, practical challenges, and implementation pathways of resource integration in the digital era. Findings indicate that integration plays a pivotal role in strengthening the educational function of physical education, optimizing curriculum architecture, and promoting the development of both faculty and students. However, current practice faces multidimensional constraints: at the technical level, fragmented platforms and the absence of data standards; at the organizational level, departmental silos and weak collaborative mechanisms; at the faculty level, insufficient digital literacy and resource-development capacity; and at the institutional level, inadequate policy incentives and evaluation systems. To address these systemic challenges, this paper proposes building a unified, open, and intelligent resource platform; establishing cross-departmental, co-construction and sharing mechanisms; strengthening teachers' digital-competency development; and refining policy incentives alongside a continuous-improvement-oriented quality-assurance mechanism. The aim is to forge a multidimensional, collaboratively advanced integration pathway that underpins an open, shared, and intelligently interconnected ecosystem for physical education teaching resources, thereby serving the construction of both an education powerhouse and a sports powerhouse.

Keywords

Educational digitalization; university physical education courses; teaching resource integration.

1. Introduction

In April 2025, the “Opinions on Accelerating Educational Digitalization” jointly issued by the Ministry of Education and eight other departments emphasized using digitalization “as a key breakthrough to open new avenues for educational development, shape new competitive advantages, and comprehensively support the building of an education powerhouse^[1]”. Subsequently, in May of the same year, the nation launched the Digital Education Strategy Action Plan 2.0 and released the White Paper on China’s Smart Education, marking a new phase of in-depth advancement. As strategic deployment deepens, the profound integration of information technology with education and teaching has become an inevitable trend in higher-education reform and development. Against this backdrop, university physical education courses—as crucial vehicles for fostering students’ physical and mental well-being and for implementing the fundamental mission of “cultivating virtue through education”—face unprecedented opportunities to transform teaching models and resource allocation. In reality, however, PE teaching resources still suffer from uneven distribution, low utilization, content

obsolescence, and insufficient integration, which hinders the sharing of high-quality resources, leads to redundant content development, and weakens curricular support. These structural contradictions have become key bottlenecks restraining quality improvement and the satisfaction of personalized learning needs. Hence, achieving scientific integration and efficient allocation of PE teaching resources has become essential to high-quality development. Research in this area holds significant theoretical and practical value for deepening PE reform, building a digital education ecosystem, and serving the national strategies of an education powerhouse and a sports powerhouse.

2. The Necessity of Integrating Physical Education Course Resources in the Digital Era

“The fundamental purpose of education lies in fostering virtue^[2].” As a vital component of the moral-education system, university physical education is central to cultivating sound character and comprehensive qualities. The construction and integration of PE teaching resources not only improve instructional quality but directly affect students’ physical–mental development and value formation. In an era of deep digital–intelligent convergence, optimized resource integration has become a key driver of transformation and upgrading. Overall, its necessity manifests in strengthening the educational function, optimizing curriculum systems, and promoting the joint development of faculty and students.

2.1. Resource Integration and the Educational Function of PE Curriculum

The advent of universal AI has accelerated artificial intelligence as a new engine of educational innovation^[3]. Within this context, digitalization is reshaping content and pedagogy, offering new opportunities for conceptual renewal and model transformation in university PE. Digital integration is a primary avenue for invigorating the educational function. On one hand, it breaks spatial–temporal limits and enables a smart environment of “online–offline integration and shared co-construction.” With smart platforms, cloud resources, virtual simulations, and exemplar-case videos, PE instruction has shifted from experience-based to data-driven, offering “visualized, interactive, and intelligent” learning experiences. On the other hand, systematic integration catalyzes a value reconstruction of PE curricula: beyond skills acquisition, PE can better carry ideological and political education by embedding exemplary athlete narratives, sports-spirit themes, health-behavior guidance, and social-responsibility content. Precise allocation and diverse presentation of digital resources allow ideological–political elements to be organically threaded through the whole process, advancing the integrated formation of “body, mind, and virtue.”

2.2. Teaching Resource Integration as the Key Pathway to Optimizing the Physical Education Curriculum System

Within the OBE (Outcomes-Based Education) framework^[4], university physical education (PE) curricula must urgently shift from a traditional “content-driven” model to a “goal-oriented” model. Integrating teaching resources is the foundational condition for achieving this transformation. First, at the curriculum-structure level, integrating PE resources facilitates the systematization and modularization of course content, and promotes organic alignment between theoretical instruction and practical training as well as between specialized courses and general education. By digitally integrating instructional materials, case repositories, and data platforms, institutions can build a curriculum system characterized by “goal alignment, content articulation, and resource sharing,” thereby addressing long-standing problems of fragmented objectives and siloed resources in PE teaching. Second, at the pedagogical level, resource integration drives innovation in teaching models. Traditional PE instruction has often relied on teacher demonstration and student imitation, with limited interactivity. The

integration of digital resources creates conditions for personalized and interactive teaching. Through blended learning, online–offline collaborative instruction, and intelligent assessment systems, PE instructors can employ technologies such as motion-data analytics, motion capture, and virtual simulation to deliver precision teaching and differentiated guidance. In doing so, PE courses not only upgrade their instructional models but also enhance students' engagement and learning agency. Third, with respect to curriculum evaluation, resource integration provides scientific support for quality monitoring and continuous improvement. The accumulation and sharing of digital resources render teaching processes recordable and traceable. Leveraging data analytics, instructors can conduct dynamic evaluations of students' learning processes, achieving precise alignment between instructional content and learning outcomes.

2.3. Teaching Resource Integration as an Intrinsic Requirement for Teacher Professional Development and the Transformation of Student Learning

Teachers and students are the key agents in teaching resource integration, and the enhancement of their competencies and transformation of learning approaches constitute the core foundation for effective integration. For university physical education (PE) instructors, the digital era imposes higher demands on professional competence. Traditionally, PE teachers have relied primarily on personal teaching experience and specialized technical skills. However, in the context of educational digitalization, teachers must now possess multidimensional abilities, including educational technology application, digital resource development, data analysis, and instructional innovation. On one hand, through the processes of selecting, reorganizing, and applying resources, teachers can update their pedagogical philosophies and harness the instructional potential of digital tools. On the other hand, the co-construction and sharing mechanisms of integrated platforms foster the formation of professional learning communities among teachers, facilitating experience exchange and collaborative resource creation. This, in turn, promotes the overall enhancement of the teaching workforce. For students, resource integration has fundamentally transformed learning approaches. In the era of intelligent education, physical education has transcended the mere transmission of disciplinary knowledge and skills, focusing instead on cultivating students' autonomous learning abilities in sports^[5]. Digital PE resources transcend temporal and spatial limitations, shifting the learning paradigm from "classroom-centered" to "learner-centered." Students can select learning content and control their learning pace according to individual needs, thereby realizing true personalization and autonomy in learning. Utilizing virtual simulations, wearable devices, and sports data platforms, students can conduct data-based analyses of their own athletic performance, transitioning from passive imitation to active exploration. This transformation in learning not only enhances the scientific rigor and self-regulatory capacity of physical education but also fosters students' innovative thinking and reflective abilities.

3. Challenges in Integrating University Physical Education Teaching Resources in the Digital Era

The empowerment brought by digital technology has fundamentally transformed the modes of resource production, instructional organization, and learning patterns. However, from an overall practical perspective, the integration of teaching resources for university physical education (PE) courses continues to face multiple constraints. Although some universities have preliminarily established digital platforms and resource repositories for PE courses, their development and utilization still exhibit a structural contradiction of high investment but low efficiency. A systematic, collaborative, and sustainable resource ecosystem has yet to be established. These challenges are reflected not only in the fragmentation of technology and data

but also in the weaknesses of organizational management, faculty capacity, and institutional safeguards.

3.1. Technical Dimension: Platform Fragmentation and Insufficient Data Standardization

A sound technological foundation is a prerequisite for achieving effective teaching resource integration. In recent years, universities have actively relied on “smart campus” initiatives and “digital education platforms” to develop various PE management systems, resource-sharing platforms, and course databases. However, these systems often operate independently with overlapping functions and lack unified technical standards and data interfaces, resulting in the emergence of “information silos.” On one hand, decentralized resource storage and inconsistent data formats make it difficult to achieve interoperability across systems. For example, teaching videos, physical fitness assessment data, training case studies, and competition materials are often stored on separate departmental or college servers, making unified retrieval and sharing cumbersome and resulting in low resource utilization. On the other hand, the absence of standardized metadata and resource tagging systems hampers efficient classification, retrieval, and precise recommendation of PE resources, limiting their reusability and scalability across diverse teaching contexts. Moreover, some universities remain at the preliminary stage of digital investment, focusing primarily on visible hardware construction while neglecting the sustainability and intelligence of system architecture. Consequently, the potential of intelligent analytics for PE data, learning behavior tracking, and instructional decision-making support has not been fully realized. Platform maintenance and updates lag behind technological developments, and the existing digital ecosystem lacks a mechanism for continuous and dynamic optimization. This technological fragmentation not only weakens the overall efficiency of resource utilization but also constrains the depth of digital transformation in physical education, impeding the construction of a truly intelligent, interconnected teaching resource system.

3.2. Organizational Dimension: Departmental Silos and the Absence of Collaborative Governance Mechanisms

The integration of teaching resources is not merely a technical issue but also a matter of organizational governance and structural reform. In universities, the management of physical education (PE) course resources often involves multiple departments—such as schools of physical education, academic affairs offices, and information technology centers—resulting in fragmented management authority and a lack of coordination mechanisms. Consequently, issues such as multi-headed management, redundant construction, and unclear accountability frequently arise in the processes of resource development and utilization.

On one hand, insufficient communication and misaligned interests among departments hinder effective collaboration. Different administrative units tend to operate independently in the development of teaching resources, each pursuing its own agenda without a unified top-level design or institution-wide strategic planning. On the other hand, the processes of resource development and utilization fail to form a complete closed-loop system. The absence of systematic procedures encompassing resource production, review, implementation, and feedback leads to low efficiency and limited effectiveness in resource utilization. Moreover, many universities still rely on traditional, highly bureaucratic administrative management models and have not yet established flexible and efficient governance mechanisms for resource integration. The development and utilization of PE teaching resources are often perceived as departmental responsibilities rather than as part of the university’s collective mission to enhance overall teaching quality. The lack of cross-departmental collaboration frameworks and incentive mechanisms for co-construction and resource sharing has caused integration efforts to remain largely superficial, preventing the establishment of a virtuous cycle of continuous

improvement and shared governance. Ultimately, overcoming these organizational barriers requires a shift from fragmented, department-centered management toward an integrated governance model emphasizing collaboration, shared accountability, and systemic coordination—essential conditions for realizing the sustainable integration of digital teaching resources in university physical education.

3.3. Faculty Dimension: Insufficient Resource Development Capabilities and Digital Literacy

In the process of digital transformation and upgrading of school physical education, the demand extends beyond technical specialists to include interdisciplinary professionals capable of deeply integrating technology with physical education^[6]. Although most universities have widely promoted the concept of “smart teaching,” the overall level of digital awareness and technological application among physical education (PE) teachers remains notably inadequate. On one hand, many teachers’ understanding of digital teaching resource development remains at a rudimentary level—limited to basic tasks such as “uploading materials” or “recording videos.” They often lack a systematic planning mindset that connects curriculum design, resource architecture, and learning analytics. As one PE instructor noted in an interview, “I’m used to traditional face-to-face teaching and rely heavily on direct transmission of professional skills.” This reflects a deep-rooted reliance on conventional teaching paradigms and a limited capacity for digital pedagogical innovation. On the other hand, the heavy workload and time constraints commonly faced by university PE teachers further restrict their ability to invest in the construction and integration of digital teaching resources. Structurally, the expertise of PE faculty is primarily concentrated in sports techniques and pedagogical knowledge, while their information technology backgrounds remain relatively weak. As a result, many are unable to proficiently utilize digital platforms for data analysis, interactive design, or secondary resource development. This deficiency in digital competence and pedagogical-technical integration not only limits teachers’ ability to develop high-quality digital teaching resources but also constrains the broader advancement of digitally empowered physical education. Addressing this challenge requires systematic faculty development initiatives, including digital literacy enhancement, technological training, and sustained institutional support to ensure that teachers can effectively bridge the gap between physical education expertise and technological innovation.

3.4. Institutional Barriers: Lack of Policy Support and Incentive–Evaluation Mechanisms

Institutional assurance serves as the fundamental pillar for advancing the integration of teaching resources. However, current practices in higher education reveal that the integration of physical education (PE) course resources still lacks systematic institutional design and policy support. On one hand, top-level institutional policies at most universities remain focused on general areas such as digital infrastructure development and “smart campus” initiatives, while failing to formulate specialized policies or implementation guidelines tailored to the unique characteristics of PE courses. Standards for resource construction, review procedures, and usage regulations remain incomplete, resulting in a lack of institutional foundation and enforcement capacity for resource integration. On the other hand, the existing resource management frameworks tend to emphasize outcome-based assessment, with insufficient attention to process management, quality evaluation, and user feedback. The absence of dynamic supervision mechanisms hinders the establishment of a sustainable institutional feedback loop that could facilitate continuous improvement. In terms of incentive mechanisms, achievements in resource integration have yet to be effectively incorporated into faculty evaluation systems, research performance reviews, or funding allocation processes. The input–output imbalance—whereby PE teachers’ efforts in developing and integrating teaching

resources are not adequately recognized or rewarded—diminishes their motivation to participate in collaborative resource development and sharing. This lack of coherent policy support, dynamic oversight, and incentive alignment not only weakens institutional coordination but also constrains the sustainable evolution of digital resource ecosystems in university physical education. To achieve meaningful progress, universities must establish comprehensive policy frameworks and incentive–evaluation systems that promote collaboration, recognize innovation, and ensure equitable rewards for faculty engagement in digital resource construction.

4. Pathways for Integrating University Physical Education Teaching Resources in the Digital Era

Against the backdrop of the in-depth implementation of the national educational digitalization strategy, addressing the systemic challenges in integrating teaching resources for university physical education (PE) requires multidimensional coordination across technological infrastructure, organizational governance, faculty development, and institutional innovation. Only through comprehensive reforms encompassing platform construction, mechanism optimization, capacity enhancement, and institutional assurance can universities build an open, shared, intelligently interconnected, and continuously improving system of PE teaching resources—thus achieving the deep integration of educational digitalization and the modernization of physical education.

4.1. Building a Unified and Open Platform System for Physical Education Teaching Resources

The Overall Layout Plan for Building a Digital China emphasizes the need to “unblock the main arteries of digital infrastructure and lay a solid foundation for building a Digital China”^[7]. In response to the current fragmented situation of “multi-agency construction and system segmentation” in university PE teaching resources, universities should align with the National Educational Digitalization Strategy Action Plan 2.0 to construct a unified, open, and intelligent platform system for PE resource integration.

On one hand, a unified platform architecture integrating multi-source data should be established. Standardized interfaces should enable centralized management and interconnectivity of diverse resources—such as instructional videos, training cases, course materials, and physical fitness assessment data—thus breaking down data barriers between departments and systems. The platform should feature comprehensive functionalities for resource uploading, review, indexing, sharing, and dynamic updating, forming a technical framework centered on “standardized norms, centralized storage, and tiered application.” On the other hand, platform construction should prioritize intelligent upgrading. Advanced technologies such as artificial intelligence, big data analytics, and data visualization should be incorporated to develop a data-driven PE teaching resource platform. Through learning behavior analysis, athletic data modeling, and resource recommendation algorithms, the system can realize personalized resource delivery and intelligent instructional feedback, thereby promoting precision and scientific teaching. At the institutional level, universities should leverage national and regional educational digital platforms—such as the National Smart Education Platform and local education cloud services—or engage in inter-university collaboration networks to achieve resource co-construction and sharing. This would facilitate the creation of an open and interconnected ecosystem for PE teaching resources that spans both intra- and inter-institutional boundaries, effectively supporting the modernization and high-quality development of university physical education.

4.2. Improving Cross-Departmental Collaboration Mechanisms for Co-Construction and Resource Sharing

A collaborative governance framework comprising “government guidance, university leadership, enterprise empowerment, and social participation” should be established to promote the integrated development of physical education (PE) teaching resources. By building a unified data-sharing platform, this framework can ensure the interconnection of policies, resources, and data, thereby avoiding issues such as equipment redundancy caused by “functional overlap” and underutilization stemming from “missing foundational functions,” as well as the persistence of “data silos” in teaching scenarios^[8].

First, top-level design and overall planning must be strengthened. At the institutional level, universities should establish a Leadership Group for the Digital Development of Physical Education Teaching Resources. Through unified planning and clear task allocation, responsibilities across departments—covering resource development, review, maintenance, and utilization should be precisely delineated to prevent duplication and waste. Second, a cross-departmental collaboration mechanism within universities should be developed. The School of Physical Education, as the primary instructional body, should take the lead in resource construction and content innovation. The Academic Affairs Office should coordinate instructional needs and manage curriculum data analysis, while the Information Technology Center should provide technical maintenance and platform support. Institutionalized workflows and communication mechanisms should be implemented to ensure end-to-end management of resources from creation and review to application and feedback. Furthermore, inter-university and social collaboration mechanisms should be established. Universities can leverage regional education alliances or smart sports networks to form joint consortia for PE teaching resource co-construction and sharing, promoting the cross-institutional dissemination and collaborative development of high-quality resources. Simultaneously, partnerships with sports enterprises, research institutes, and media platforms should be encouraged to jointly develop intelligent motion analysis systems, virtual training courses, and health data applications—realizing an integrated model of “industry-academia-research-application.” By establishing this multi-stakeholder co-construction and sharing mechanism, universities can significantly enhance the efficiency of PE teaching resource utilization and stimulate continuous innovation. Ultimately, this approach will foster an open, interconnected, and collaboratively evolving ecosystem for digital physical education in higher education.

4.3. Strengthening Faculty Digital Competence and Resource Development Training

Teachers serve as both the executive agents and the core innovators in the integration of teaching resources. Therefore, enhancing their digital competence and resource development capacity is fundamental to ensuring effective and sustainable implementation.

First, a comprehensive faculty digital literacy training system should be established and refined. In alignment with the Teacher Digital Literacy Standards^[9], universities should regularly organize technical training programs and pedagogical innovation workshops. Training content should encompass intelligent instructional design, sports data analytics, applications of virtual simulation technologies, and standards for digital resource development. Such initiatives aim to enable teachers to proficiently integrate digital technologies into curriculum construction and instructional practice. Additionally, leveraging the Teacher Learning Center within the National Smart Education Platform, institutions should encourage educators to engage in online learning, peer collaboration, and professional practice communities to foster continuous learning and self-directed improvement. Second, a “competition- and research-driven” practical mechanism should be established to promote application through engagement. Universities can organize teaching innovation competitions and digital resource design

contests in physical education to stimulate teachers' creativity and applied capabilities. Teachers should be encouraged to translate their teaching experiences into high-quality, reusable instructional resources—developing replicable case studies and adaptable resource templates. Moreover, universities should establish Digital Teaching Innovation Laboratories dedicated to physical education, providing faculty with technical support, equipment access, and case-based mentorship. These laboratories can serve as innovation incubators for resource development and pedagogical experimentation. Finally, the faculty incentive and evaluation systems should be optimized to ensure long-term motivation and recognition. Achievements in physical education resource development and application should be incorporated into performance assessments, professional title evaluations, and teaching award systems. Faculty members who demonstrate excellence in digital resource innovation and utilization should receive both policy advantages and material incentives. Through this integrated approach—combining training, practice, innovation, and recognition—universities can cultivate a digitally competent, pedagogically innovative, and collaboratively engaged teaching community, laying a solid foundation for sustainable digital transformation in physical education.

4.4. Refining Policy Incentives and Establishing a Quality Mechanism for Continuous Improvement

Institutional innovation serves as the core guarantee for the sustainable development of teaching resource integration. The process of integrating university physical education teaching resources requires not only technological and human capital support but also robust institutional design and policy guidance at the systemic level. To this end, a comprehensive safeguard mechanism should be established from three key dimensions: institutional construction, policy incentives, and quality monitoring.

First, it is essential to strengthen the institutional framework for digital resource integration in physical education. Universities should formulate Regulations on the Digital Construction and Management of Physical Education Teaching Resources to clearly define standards for resource development, usage protocols, and review procedures, thereby constructing a systematic framework for resource integration. Physical education courses should be incorporated into the university's overall digital development strategy, ensuring coordinated advancement alongside information technology construction, research management, and student service systems. Moreover, strict review and authorization mechanisms must be established to safeguard data security, intellectual property rights, and the lawful sharing of resources, ensuring compliance and safe utilization. Second, the incentive-oriented and evaluation mechanisms for resource development should be improved. Universities should establish policies linking the outcomes of resource construction to faculty performance, research projects, and teaching quality assessments. Faculty members who contribute to high-quality digital resource development should be rewarded through financial support and public recognition. A "resource credit system" can be explored, in which teachers' contributions to resource development, sharing, and application are quantified into credits, which are then tied to teaching evaluations, course awards, and professional advancement. Simultaneously, a multi-dimensional resource quality evaluation system should be implemented, assessing resources based on scientific content accuracy, pedagogical relevance, technical accessibility, and user feedback. Periodic publication of resource quality reports would further promote optimization and continuous improvement. Third, it is necessary to establish a continuous improvement and feedback mechanism grounded in data-driven decision-making. Resource integration is an evolving and iterative process that requires ongoing optimization informed by empirical data. A big-data-based resource utilization monitoring system should be developed to track metrics such as resource access frequency, utilization rate, and learning outcomes in real time, forming a closed-loop feedback network. By systematically collecting user feedback

from teachers and students and analyzing teaching effectiveness data, universities can periodically update and iterate resource content and platform functionality, ensuring sustained enhancement of resource quality and teaching effectiveness. Through the integration of institutional design, incentive mechanisms, and continuous data-driven evaluation, universities can establish a self-improving governance ecosystem that ensures the long-term sustainability, adaptability, and innovation capacity of digital physical education resource integration.

5. Conclusion

The digital transformation of education is propelling higher education into a new stage of systemic reconstruction and ecological innovation. Through a systematic examination of the integration of teaching resources in university physical education courses, this study reveals that the essence of this transformation lies far beyond superficial technological adoption—it represents a profound reform that reshapes educational philosophy, organizational structures, and institutional culture. The challenges identified in this process, such as “platform silos,” “departmental barriers,” “faculty skill gaps,” and “institutional deficiencies”—collectively point to a core issue of insufficient systemic governance. In response, this study proposes a four-dimensional integration pathway—anchored in technological platforms, guided by collaborative mechanisms, driven by faculty development, and sustained by institutional innovation. This framework aims to construct an organic and dynamically evolving ecosystem for physical education teaching resources, capable of achieving coherence, adaptability, and long-term vitality. Looking ahead, the digital transformation of university physical education should move beyond the instrumental level of “technological empowerment” toward the paradigmatic level of ecological reconstruction. This shift requires not only upgrading intelligent resource platforms but also cultivating a culture of interdepartmental collaboration, stimulating teachers’ creative vitality, and establishing sustainable institutional safeguards. Ultimately, through the deep integration of technology, people, and systems, university physical education can transition from large-scale provision to personalized, high-quality education—laying a solid educational foundation for nurturing well-rounded talents capable of meeting the needs of the new era.

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