

The Impact and Practice of Interdisciplinary Approaches on School Physical Education

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Abstract

With the advancement of the core competency education concept, the transformation of school physical education (PE) has become a crucial issue in China's education reform. Traditional PE teaching, which often focuses narrowly on skill acquisition and physical performance, faces limitations in cultivating students' comprehensive competencies. In response, interdisciplinary teaching has emerged as a key strategy to enhance both the depth and breadth of learning experiences in PE. The purpose of this study is to explore the influence and implementation models of interdisciplinary approaches within the framework of China's Compulsory Education Physical Education and Health Curriculum Standards (2022 Edition). Using a combination of theoretical analysis and practical case studies, this research investigates how thematic integration, technology-enhanced learning, and innovative assessment systems can enrich the PE learning process. The findings reveal that interdisciplinary methods not only strengthen students' athletic participation and interest but also promote cognitive understanding, emotional engagement, and value-based development. Furthermore, the integration of digital tools and cross-subject collaboration enhances the relevance and adaptability of PE in contemporary education. Several challenges remain, including disciplinary boundaries, insufficient teacher preparedness, and technological implementation difficulties. The study suggests that future development should emphasize building problem-oriented interdisciplinary communities, enhancing professional training for teachers, and improving technological infrastructure. These measures will support the evolution of PE toward a more integrated, intelligent, and student-centered pedagogical model that aligns with the goals of holistic education and sustainable learning development.

Keywords: *Interdisciplinary teaching, Physical education, Thematic learning, Educational technology, Curriculum integration.*

A. Introduction

The 2022 Compulsory Education Physical Education and Health Curriculum Standards in China explicitly position “cross-disciplinary thematic learning” as one of the five core content modules within Physical Education (PE). This paradigm shift reflects a broader educational movement toward competency-based education, emphasizing students' comprehensive development rather than rote acquisition of isolated skills (Ministry of Education of the People's Republic of China [MOE], 2022). The integration of PE with other domains—such as moral, intellectual, and aesthetic education—highlights the recognition that physical activity serves not only as a means of enhancing fitness but also as a vehicle for cultivating character, cognition, and creativity (Liu & Chen, 2023).

Traditional PE instruction has long been constrained by compartmentalized, discipline-based teaching models that emphasize physical training and standardized assessment while neglecting emotional, cognitive, and social dimensions (Li & Zhang, 2021). Consequently,

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students often experience a disconnect between physical learning and other domains of personal growth. The interdisciplinary approach aims to overcome these limitations by fostering connections between PE and other academic disciplines, enabling students to apply cross-domain knowledge and problem-solving skills in authentic, real-world contexts (Zhao, 2022).

The “interdisciplinary approach” in education refers to a curriculum design paradigm that integrates knowledge, methods, and perspectives from multiple fields to address complex problems (Beane, 1997). Within PE, this approach can manifest in various ways—such as integrating biology to explain body function, mathematics for performance data analysis, or moral education to enhance teamwork and sportsmanship (Chen & Li, 2023). Through such synthesis, PE becomes a dynamic context where students’ cognitive, emotional, and physical competencies are developed synergistically, aligning with the goals of holistic education (Zhu, 2022).

Recent research indicates a worrying decline in physical fitness and motivation among students, partially due to repetitive, one-size-fits-all PE models (Zhang & Liu, 2020). To counter this, interdisciplinary strategies offer both theoretical and practical pathways for reorienting PE from a narrow focus on “physical performance” toward “whole-person development.” This includes nurturing physical health alongside mental resilience, emotional regulation, social cooperation, and aesthetic appreciation (Wang, 2023).

This paper therefore undertakes a systematic exploration of the impact mechanisms and implementation strategies associated with interdisciplinary PE. It examines the alignment of such approaches with contemporary educational policies, analyzes practical models from schools implementing interdisciplinary teaching, and identifies challenges and opportunities in this transformation. By doing so, the study contributes theoretical insights and actionable recommendations for educators and policymakers aiming to enhance the quality and relevance of school PE in the context of China’s competency-based education reform.

B. Methods

This study adopts a qualitative research design with a multiple case study approach to explore the mechanisms and implementation models of interdisciplinary Physical Education (PE) in the context of China’s Compulsory Education Physical Education and Health Curriculum Standards (2022 Edition). The qualitative design was chosen because it allows for an in-depth understanding of how interdisciplinary practices are conceptualized, implemented, and experienced in real school environments. By examining multiple school cases, the research seeks to capture variations in pedagogical strategies, teacher collaboration, and curriculum adaptation. The study is interpretive in nature, aiming to generate contextualized insights rather than generalized conclusions (Creswell & Poth, 2018).

The research was conducted in three sequential stages. The first stage involved a comprehensive review of relevant policy documents, curriculum standards, and prior academic literature to establish a theoretical framework for interdisciplinary PE. The second stage consisted of field observations and semi-structured interviews in four selected primary and secondary schools known for implementing interdisciplinary teaching models. In the final stage, the collected data were triangulated and interpreted to identify emerging themes and patterns. Ethical approval was obtained prior to data collection, and all participants provided informed consent to ensure transparency and research integrity.

Data were gathered through three complementary methods: document analysis, classroom observation, and semi-structured interviews. Document analysis was used to examine school-

based curricula, lesson plans, and assessment rubrics to understand how interdisciplinary elements were integrated. Classroom observations were conducted over a six-week period to capture real-time teaching practices, student engagement, and instructional strategies. Additionally, semi-structured interviews were carried out with PE teachers, interdisciplinary team coordinators, and school administrators to obtain insights into their perceptions, challenges, and experiences in implementing cross-disciplinary approaches. Each interview lasted approximately 45–60 minutes and was audio-recorded with participant consent.

Data analysis followed the principles of thematic analysis (Braun & Clarke, 2006). All qualitative data—interview transcripts, observation notes, and document excerpts—were coded and categorized using NVivo software to identify recurring concepts and relationships. Thematic coding focused on four key domains: (1) curriculum design and integration, (2) teaching strategies and practices, (3) challenges in implementation, and (4) educational outcomes. Data triangulation was employed to enhance validity by comparing findings across multiple sources and participant perspectives. The analytical process was iterative, moving from initial descriptive coding to higher-level interpretive themes, which formed the basis for the study's findings and discussion.

C. Results and Discussion

1. Foundations of Interdisciplinary Physical Education (PE)

The interdisciplinary approach to Physical Education (PE) is grounded in three key theoretical frameworks that collectively enrich the educational experience by integrating physical, cognitive, and social dimensions of learning. The first, Embodied Cognition Theory, emphasizes the inseparable connection between bodily movement and cognitive development, positing that thinking arises through the body's active engagement with the environment (Wilson, 2002; Barsalou, 2008). In interdisciplinary PE, this is exemplified in activities such as the “Long March Obstacle Run,” where students physically reenact historical journeys by climbing, running, and navigating obstacles. Such tasks not only test endurance but also embody historical and geographical understanding. Through this “body–environment–cognition” paradigm, students achieve deeper comprehension and empathy, internalizing abstract historical values through physical experience (Gallagher, 2015; Stolz, 2015).

Building on the embodied perspective, Social Constructivism underscores that learning occurs through social collaboration, shared meaning-making, and cultural context (Vygotsky, 1978). Within PE, this framework promotes cooperative inquiry and collective problem-solving, where teamwork becomes both a means and an end of learning. Roux's (2020) Values-Based PE initiative in South Africa, inspired by Olympism and Ubuntu philosophy, exemplifies how sports education can integrate ethical and cultural dimensions by fostering human interconnectedness and social responsibility. Through such collaborative and value-centered activities, students not only refine athletic competencies but also cultivate respect, empathy, and civic consciousness (Light & Harvey, 2015; Casey & Goodyear, 2015).

A third foundation, Technology-Enhanced Learning Theory, brings a contemporary dimension by integrating digital tools to personalize and optimize learning outcomes. Educational technologies, including AI-assisted monitoring and motion-tracking systems, enable adaptive feedback loops that support individualized progress (Laurillard, 2012; Conole, 2013). By providing real-time data on heart rate, posture, and movement efficiency, instructors can adjust lessons to fit students' unique needs and capacities (Casey et al., 2017; Baek & Touati, 2021). This “monitoring–feedback–optimization” model not only enhances physical

performance but also develops students' digital literacy and reflective thinking, aligning PE with 21st-century educational priorities (Chen & Sun, 2020).

Ultimately, the educational value of interdisciplinary PE lies in its capacity to transcend traditional, skill-centric paradigms. By merging movement, collaboration, and technology, it fosters motor competence, health literacy, ethical reasoning, and critical thinking (Kirk, 2010; Armour, 2011). Such integration nurtures students' holistic growth—intellectually, emotionally, socially, and technologically—equipping them to become well-rounded, culturally aware, and socially responsible individuals. As scholars such as Bailey et al. (2009) highlight, physical activity should be recognized not merely as a domain of bodily training but as an essential investment in human capital and lifelong learning.

2. Practical Pathways for Interdisciplinary PE Implementation

Thematic Integration: Authentic Context-Driven Learning

Cross-disciplinary thematic activities are primary vehicles for implementation, designed under the "Physical Education as the core, multiple disciplines as supplements" principle:

Case 1: Military-Themed Endurance Run—"Rapid Reinforcement March"

Integrates history (border conflicts), geography (terrain navigation), and national defense education (military strategy). Student teams execute "wounded rescue" and "supply transport" missions, applying map-reading and tactical decision-making during variable-pace running, concurrently building endurance and teamwork.

Case 2: Red Culture Obstacle Course—"Retracing the Long March"

Obstacles like "Luding Bridge" (balance beams) and "Snowy Mountain" (climbing frames) incorporate history, mathematics (distance calculation), and music (marching rhythms), enhancing motor skills and spatial reasoning while deepening historical appreciation.

Technology Empowerment: Reconstructing Teacher-Student Interaction

Information technology serves as a cornerstone in advancing interdisciplinary Physical Education (PE) by bridging physical practice, cognitive engagement, and digital literacy within a unified pedagogical framework. The integration of AI-powered devices has revolutionized classroom dynamics by enabling real-time monitoring and feedback mechanisms. For instance, Yangzhou Yucai Experimental School's Smart PE Screens display immediate jump rope or long jump data, allowing students to visualize their performance metrics and engage in healthy competition through ranking systems. Simultaneously, AI cameras automatically detect technical errors such as jump fouls, thereby enhancing both fairness and precision in skill assessment. These intelligent systems not only improve instructional efficiency but also embody the Technology-Enhanced Learning paradigm by enabling dynamic data-driven instruction and personalized feedback loops (Laurillard, 2012; Casey et al., 2017). Through such digital scaffolding, students transition from passive participants to active learners who can self-monitor, reflect, and improve continuously—a process that aligns closely with 21st-century competencies in problem-solving and adaptive learning (Conole, 2013; Chen & Sun, 2020).

Complementing these innovations, Interactive Response Systems (IRS) and WeChat Mini-Programs further enrich interdisciplinary learning by fostering interactivity, collaboration, and continuity between online and offline environments. IRS tools, through handheld devices or tablets, allow instructors to conduct real-time quizzes, analyze postural accuracy, and instantly identify collective errors during lessons such as Visual Health sessions. This immediate feedback loop transforms traditional PE into a participatory, evidence-informed learning environment. Meanwhile, university-developed WeChat Mini-Programs extend the classroom into a digital

ecosystem that supports activity registration, performance tracking, and gamified engagement through leaderboards and reward systems. These platforms create a seamless “online–offline” integration, encouraging sustained motivation and social participation (Baek & Touati, 2021). By incorporating gamification and community-based interaction, technology not only enhances physical learning outcomes but also cultivates digital citizenship and self-regulated learning behaviors. In essence, the strategic use of information technology in PE transforms conventional instruction into an interactive, data-informed, and socially connected experience that supports both physical literacy and holistic education (Kirk, 2010; Armour, 2011)..

Innovative Assessment: From Skill Mastery to Holistic Competency

Interdisciplinary teaching in Physical Education (PE) requires an evaluation system that reflects the complexity of integrated learning outcomes, emphasizing not only physical performance but also cognitive, emotional, and cultural dimensions. Process-oriented assessment represents a shift from traditional product-based evaluation to a more holistic and continuous form of measurement. In this model, wearable technologies play a critical role by collecting physiological data—such as heart rate variability and step frequency—to gauge endurance, focus, and stress levels during activities (Casey et al., 2017). However, quantitative indicators are complemented by qualitative dimensions that capture teamwork, leadership, and creative engagement. For example, in military simulation exercises, evaluators assess cooperation and role adherence, while activities like hand-drawn route mapping are used to measure creativity and spatial reasoning. Such a comprehensive approach aligns with contemporary pedagogical theories emphasizing learning as an embodied, social, and reflective process (Barsalou, 2008; Stolz, 2015). By integrating both objective and subjective indicators, process-oriented assessment ensures that student learning is appraised as a multidimensional journey rather than a singular outcome.

Equally important is the incorporation of culturally responsive and rubric-based evaluation frameworks to ensure inclusivity and equitable representation within interdisciplinary PE. Culturally responsive assessment integrates ethnic-minority traditions and local cultural practices—such as embedding the Yi Torch Festival into Long March-themed activities—to counterbalance Han-centric biases and affirm diverse cultural identities (Banks, 2016; Gay, 2018). This not only strengthens cultural understanding but also situates learning within authentic, community-relevant contexts. Meanwhile, rubric-based evaluation tools, such as South Africa’s knowledge–skill–value assessment scale, quantify learning outcomes across domains like attitude formation, interdisciplinary application, and collaborative engagement (Roux, 2020). These multidimensional rubrics enable educators to measure not just what students know and can do, but also how they apply ethical reasoning and intercultural sensitivity in practice. Through such inclusive and criterion-based systems, interdisciplinary PE evolves into a platform for cultivating critical consciousness, social responsibility, and holistic student development..

3. Implementation Challenges and Countermeasures

Despite the numerous advantages that interdisciplinary approaches offer, several key bottlenecks continue to pose significant challenges:

Disciplinary Silos: One of the primary issues is the persistence of disciplinary silos. In many instances, activities are designed in a way that superficially juxtaposes different subjects without establishing deep, meaningful conceptual links. For example, in the "Long March" case study, terrain types and obstacle designs are often presented in a disconnected manner, lacking a cohesive integration that would enhance understanding and engagement. This fragmented approach undermines the potential benefits of interdisciplinary learning.

Solution: To address this issue, it is essential to anchor the design of interdisciplinary activities to overarching Big Ideas. These Big Ideas serve as a unifying framework that connects various subjects seamlessly. For instance, the concept of "patriotism" can be used as a central theme to integrate subjects such as history, physical education (PE), and strategic thinking. By doing so, students can appreciate the interconnectedness of different disciplines and gain a more holistic understanding of the topic.

Teacher Capacity Gaps: Another critical challenge is the significant gap in teacher capacity regarding interdisciplinary design. According to a recent survey, a staggering 78% of teachers lack the necessary experience in developing interdisciplinary curricula. This deficiency is particularly pronounced in areas such as technology integration (e.g., the operation of Interactive Response Systems or IRS) and scenario development. The lack of expertise in these areas hampers the effective implementation of interdisciplinary projects, limiting their potential impact on student learning.

To overcome these challenges, targeted professional development programs and collaborative workshops can be instrumental. By equipping teachers with the requisite skills and knowledge, we can bridge the capacity gaps and foster a more conducive environment for interdisciplinary education. Additionally, providing ongoing support and resources can help teachers confidently integrate various disciplines, thereby enhancing the overall educational experience for students.

D. Conclusion

Interdisciplinary approaches have profoundly transformed the paradigm of Physical Education (PE), expanding its focus beyond traditional skill-based instruction toward a model that fosters holistic student development. This shift enriches students' learning experiences by integrating physical, cognitive, and cultural dimensions, thus cultivating comprehensive competencies aligned with the goals of modern education. The interdisciplinary model strengthens engagement, deepens conceptual understanding, and situates PE within a broader framework of moral and intellectual growth. To sustain this transformative trajectory, three strategic directions are vital: establishing issue-driven interdisciplinary communities that align PE with real-world initiatives such as the Healthy China program; advancing adaptive educational technologies through accessible, AI-supported platforms like WeChat-based systems; and embedding interdisciplinary competencies within teacher education programs to promote continuous professional growth and cross-school collaboration.

As Zhang Ruilin emphasizes, the future of PE depends on its evolution from a "discipline-centered" toward a "problem-centered" model—one that redefines how knowledge, skills, and values intersect in the educational process. This paradigm shift signifies more than a methodological innovation; it represents a strategic re-envisioning of the PE ecosystem as a dynamic, integrative field. By weaving together diverse disciplinary perspectives and addressing authentic societal challenges, Physical Education can become a driver of both personal and social transformation. Interdisciplinarity, therefore, stands not merely as an instructional method but as a foundational principle guiding the future evolution of PE toward greater relevance, inclusivity, and holistic impact.

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