ISSN 2522-6398 Vol. 8, Issue 5: 101-108, DOI: 10.25236/FER.2025.080515

Research on Digital Literacy Enhancement Strategies for Physical Education Teachers of Higher Vocational Colleges: An Analysis Based on Teaching Practices and Competency Framework

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Abstract: *Amidst the global surge of digitalization, the education sector is undergoing profound transformations, and higher vocational physical education is no exception. This study aims to explore strategies for enhancing the digital literacy of higher vocational physical education teachers based on teaching practices and competency frameworks. Through integrated methodologies including literature research, survey investigations, and case analysis, the study thoroughly examines the current state of teaching practices and the digital literacy competency framework for these educators. Key findings propose:(1) establishing a systematic training system covering digital resource acquisition, instructional design, and technology application, implemented through diversified approaches such as online-offline hybrid training, workshops, and case-based teaching, alongside sustainable training mechanisms;(2) strengthening institutional support by providing hardware infrastructure, formulating incentive policies, and fostering a supportive environment;(3) promoting teacher self-development by stimulating self-driven improvement, encouraging teaching reflection, and supporting academic exchanges and collaborations. These strategies are anticipated to effectively enhance the digital literacy of higher vocational physical education teachers, advance the modernization of physical education, improve teaching quality, and meet students' digital learning needs.*

Keywords: *Higher Vocational Physical Education Teachersdigital Literacy; Teaching Practices; Competency Framework; Enhancement Strategies*

1. Introduction

Against the backdrop of rapid advancements in digital information technology, the education sector is undergoing profound transformations. Digital technologies such as multimedia, online platforms, and virtual simulation have permeated all aspects of higher vocational physical education, driving innovations in teaching methodologies and learning models. Enhancing teachers' digital literacy has become pivotal to the modernization of higher vocational physical education. This initiative not only helps overcome the limitations of traditional pedagogy, enriches educational resources, and improves teaching quality but also addresses the personalized learning needs of students in the digital era, thereby strengthening institutional competitiveness. Grounded in teaching practices and competency frameworks, this study employs literature review, survey analysis, and case summarization to propose strategies including the establishment of systematic training systems, reinforcement of institutional support policies, and promotion of teacher self-development. The aim is to scientifically enhance teachers' digital literacy and advance the high-quality development of higher vocational physical education.

2. Current Research Status on Digital Literacy of Higher Vocational Physical Education Teachers

In recent years, domestic and international studies have increasingly focused on the digital literacy of higher vocational physical education teachers. Regarding proficiency levels, research indicates that these educators generally demonstrate intermediate digital literacy overall, with significant disparities observed in areas such as digital resource acquisition and integration, as well as the application of digital technologies [3]. While some teachers exhibit competence in utilizing multimedia tools for content delivery, deficiencies persist in leveraging online platforms for blended teaching or applying

ISSN 2522-6398 Vol. 8, Issue 5: 101-108, DOI: 10.25236/FER.2025.080515

virtual simulation technologies to enhance instruction. Concerning influencing factors, studies highlight that teachers' age, teaching experience, and disciplinary backgrounds significantly affect digital literacy levels, with younger educators showing greater receptiveness to adopting emerging technologies [7]. Additionally, institutional factors such as technological infrastructure, training opportunities, and policy support play critical roles in shaping digital competencies [10]. Nevertheless, existing research predominantly examines fragmented aspects of digital literacy, lacking a holistic and systematic theoretical framework.

3. Current Status of Teaching Practices Among Higher Vocational Physical Education Teachers

3.1 Application of Digital Technologies in Instruction

In current higher vocational physical education practices, multimedia instructional tools are widely adopted. Most teachers utilize multimedia formats such as PowerPoint presentations and videos to demonstrate sports knowledge and movement techniques, thereby enhancing students' comprehension through visual aids [1]. For instance, when explaining complex sports tactics, replaying relevant game footage helps students grasp tactical essentials more effectively. Online teaching platforms have gained increasing attention through years of promotion and application. Some educators leverage these platforms to assign tasks, distribute materials, and engage in virtual interactions with students, breaking the temporal and spatial constraints of traditional instruction [2]. Notably, during exceptional circumstances such as pandemic outbreaks, online platforms have ensured the continuity of physical education. Furthermore, select higher vocational institutions have begun experimenting with virtual simulation technologies in sports pedagogy. These technologies can recreate diverse sports scenarios, offering students immersive learning experiences. For example, in simulated skiing environments, students can preview technical essentials of skiing movements, thereby improving instructional outcomes [15]. However, the extent and efficacy of these digital technology applications vary significantly across individual teachers and institutions.

3.2 Existing Challenges and Limitations

Despite the growing adoption of digital technologies in higher vocational physical education, significant challenges persist. First, inadequate technical proficiency remains a prominent issue. While some teachers possess basic familiarity with advanced multimedia tools and online teaching platforms, their limited mastery hinders optimal utilization of these resources [2]. For instance, when using online platforms, many educators merely perform rudimentary tasks like course material distribution, failing to leverage data analytics or interactive features to drive teaching innovation [2]. Second, deficiencies in instructional resource integration are evident. Teachers struggle to effectively incorporate diverse digital resources—such as high-quality instructional videos and specialized sports databases—into pedagogical content, resulting in monotonous teaching materials that inadequately address students' heterogeneous learning needs [4]. Third, the integration of digital technologies with physical education remains superficial. Some teachers treat digital tools merely as auxiliary aids without embedding them into instructional design or methodological frameworks, thereby underutilizing their transformative potential in teaching and learning processes [15].

3.3 Causes of Identified Challenges

From the teacher perspective, two primary factors contribute to these issues. First, some educators exhibit insufficient awareness of the significance of digital technologies, demonstrating limited motivation for proactive learning and application. They tend to adhere to conventional pedagogical approaches, harboring resistance to technological innovations [13]. Second, constrained by inadequate foundational digital competencies, many teachers struggle to effectively utilize complex technologies due to a lack of systematic training in digital skills.

Regarding institutional environments, several barriers emerge. Many higher vocational colleges allocate insufficient resources to digitalize physical education, evidenced by outdated equipment, inadequate hardware provisions, and unstable network infrastructure, which collectively hinder technological integration [14]. Furthermore, the absence of robust incentive mechanisms fails to sufficiently reward or recognize teachers' achievements in digital technology adoption, thereby dampening their enthusiasm for implementation.

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Concerning training systems, existing professional development programs for physical education teachers suffer from structural deficiencies. Current training initiatives lack systematic organization and targeted content design, often overemphasizing theoretical knowledge while neglecting practical instructional demands. This disconnection from real-world teaching scenarios impedes meaningful improvement in teachers' applied digital competencies within sports pedagogy [14].

4. Analysis of Digital Literacy Competency Framework for Higher Vocational Physical Education Teachers

4.1 Competency in Digital Resource Acquisition and Integration

In the digital era, higher vocational physical education teachers must develop the capability to efficiently acquire digital pedagogical resources. This requires proficiency in utilizing tools such as search engines, specialized databases, and online educational platforms to accurately identify high-quality resources relevant to physical education, including instructional videos, animated demonstrations, and academic literature [1]. Following resource acquisition, teachers must demonstrate screening skills to critically evaluate vast repositories of materials based on instructional objectives, learner characteristics, and curricular requirements, selecting the most valuable and pedagogically significant content.

Integration competency further emphasizes the strategic synthesis of filtered digital resources with traditional teaching materials to construct a systematic, contextually aligned instructional framework. For example, integrating online basketball instructional videos with textbook content enables the design of targeted lesson plans that bridge theoretical knowledge and practical application. Such competencies are critical for diversifying educational content, enhancing instructional appeal, and addressing students'heterogeneous learning needs, thereby establishing the foundation for advancing the quality of higher vocational physical education [3].

4.2 Competency in Digital Instructional Design

When applying digital technologies to physical education curriculum design, the following critical considerations must be addressed:

Firstly, in implementing personalized instructional design, teachers should adopt diversified assessment methods based on students' physical fitness levels, motor skill proficiencies, and learning interests. This involves leveraging digital tools (e.g., learning analytics) to analyze learning behavior data and develop customized learning plans. For instance, students with limited physical capacity may follow low-intensity exercise programs, while those demonstrating advanced athletic abilities could engage in advanced training modules [3].

Secondly, in blended instructional design, educators must strategically integrate the strengths of online and offline modalities while determining appropriate weightings for each component. For example, while utilizing online platforms for pre-class assignments and collaborative task sharing, in-person sessions should focus on theoretical explanations, group practice, and facilitated peer interactions to holistically support student development [3].

To achieve optimal pedagogical outcomes, teachers must demonstrate strong instructional orchestration skills and possess proficient command of digital teaching tools. This requires substantial pedagogical experience to adapt instructional designs dynamically to contextual realities, such as adjusting content delivery based on real-time student feedback or technological constraints [9].

4.3 Competency in Digital Technology Application

Physical education teachers must cultivate multidimensional professional competencies in digitalized instructional practices, particularly in the systematic integration of diverse technologies.

Firstly, regarding motion analysis software, educators must master operational techniques to accurately capture biomechanical data (e.g., movement velocity, angular displacement, and force) during student performances. Through analytical interpretation of these data, teachers can provide precise technical feedback and evidence-based improvement strategies.

Secondly, proficiency with smart wearable devices is essential. Teachers should possess

ISSN 2522-6398 Vol. 8, Issue 5: 101-108, DOI: 10.25236/FER.2025.080515

comprehensive knowledge of device functionalities to guide students in proper usage for monitoring physiological metrics such as heart rate, step counts, and exercise duration. This enables real-time assessment of students' physical exertion levels, allowing data-driven adjustments to instructional intensity and pacing [2].

Thirdly, competency in virtual simulation technologies empowers educators to construct immersive training environments. Such technologies facilitate safe experiential learning for high-risk or complex sports scenarios—for instance, simulating alpine skiing techniques in virtual settings to minimize injury risks while optimizing skill acquisition.

These applied digital competencies collectively enhance the scientific rigor and precisionof physical education pedagogy, ultimately improving learning outcomes through technology-mediated engagement and personalized feedback [7].

4.4 Competency in Digital Instructional Assessment

Leveraging digital tools for pedagogical evaluation constitutes a critical component of enhancing teaching quality. On one hand, teachers can utilize digital instruments such as online surveys and assessment platforms to collect learning data encompassing student engagement, knowledge retention, and skill proficiency gains. On the other hand, educators must possess the capability to conduct in-depth analysis of collected data, uncovering underlying learning patterns and challenges reflected in the metrics. For instance, by analyzing students' test performance, teachers may identify prevalent deficiencies in specific knowledge domains, thereby refining instructional content and methodologies with targeted interventions [3].

Concurrently, educators should iteratively optimize pedagogical strategies based on analytical outcomes, delivering personalized learning support and guidance to students. This process facilitates continuous instructional refinement. Such digital assessment competencies empower teachers to holistically and objectively diagnose student learning trajectories, thereby enhancing the precision and efficacy of instruction [14].

5. Enhancement Strategies Based on Teaching Practices and Competency Framework

5.1 Establishing a Systematic Training System

To enhance the digital literacy of higher vocational physical education teachers, constructing a systematic training system is imperative. Grounded in the previously analyzed digital literacy competency framework, training curricula should comprehensively encompass three core components: digital resource acquisition, digital instructional design, and digital technology application.

1) Digital Resource Acquisition: Training should guide instructors in utilizing professional databases and academic search engines to effectively identify and integrate digital resources aligned with physical education needs. This includes multimodal teaching materials such as instructional video repositories, peer-reviewed journal articles, and virtual simulation experiment resources.

2) Digital Instructional Design: Curriculum development must prioritize training teachers to implement personalized instruction and blended learning through digital technologies. Specifically, leveraging the data analytics features of online teaching platforms enables the design of differentiated physical education programs, achieving systematic integration of online and offline resources to establish a multidimensional instructional support system catering to diverse cognitive levels, motor competencies, and learning styles.

3) Digital Technology Application: Training should emphasize operational protocols for digital tools in physical education contexts. For example, mastering motion analysis software allows teachers to accurately evaluate students' athletic performance and provide data-driven feedback.

Implementation Strategies:

Hybrid Training Model: Combine online and offline modalities to capitalize on their respective strengths. Online training offers flexibility by transcending temporal and spatial constraints, allowing teachers to independently access instructional videos and participate in virtual seminars to strengthen theoretical knowledge. Offline workshops provide hands-on experiences with digital technologies, fostering practical proficiency through immersive application.

ISSN 2522-6398 Vol. 8, Issue 5: 101-108, DOI: 10.25236/FER.2025.080515

Case-Based Pedagogy: Demonstrate exemplary digitalized physical education cases to stimulate critical analysis and peer discussions, enabling teachers to extract best practices and refine their instructional approaches.

Sustainable Training Mechanisms: Ensure continuous improvement by establishing regular training cycles and dynamically updating content based on teacher feedback and technological advancements [14].

5.2 Strengthening Institutional Support

Institutions play a pivotal role in enhancing the digital literacy of higher vocational physical education teachers by providing comprehensive and multilayered support.

Hardware Infrastructure Development: Schools should equip classrooms with advanced digital teaching facilities. For instance:

High-definition multimedia instructional tools can be used to deliver content through vivid and intuitive formats, improving pedagogical engagement;

Smart wearable devices are capable of real-time monitoring of students' kinematic data to inform personalized teaching strategies;

Virtual simulation teaching systems replicate diverse sports scenarios, expanding instructional breadth and depth.

Furthermore, institutions must establish high-speed, stable network infrastructure to ensure seamless digital pedagogical operations, laying a robust material foundation for technology-integrated instruction.

Policy Incentives: Schools should formulate targeted policies to develop effective incentive mechanisms. Examples include:

Teaching excellence awards should be honored to recognize educators demonstrating notable achievements in digital pedagogical practices, combining material rewards with honorary recognition to stimulate intrinsic motivation;

Digital literacy metrics should be integiated into professional promotion evaluation systems, positioning technological proficiency as a critical criterion to encourage teacher participation in digital pedagogical reforms;

Digital teaching competitions, seminars, and symposiums can be h to create platforms for showcasing innovations and fostering a proactive digital teaching environment that facilitates knowledge sharing and collective advancement [4][12].

5.3 Promoting Teacher Self-Development

Fostering teachers' intrinsic motivation and proactive engagement is pivotal in advancing their digital literacy. Strategies such as role modeling and leveraging demonstration effects of successful cases can stimulate educators' autonomous drive for improvement. Institutions should actively publicize exemplary teachers who have achieved notable success in digitalized instruction, showcasing their pedagogical outcomes and experiences. This enables peers to recognize the feasibility and advantages of digital pedagogy, deepening their understanding of digital literacy's transformative potential in teaching practices.

Encouraging reflective teaching is equally critical. Teachers should systematically apply digital literacy competencies to optimize instructional processes. Post-class, educators must conduct rigorous analyses and evaluations of technology integration, identify deficiencies, and implement corrective measures to achieve iterative refinement of classroom practices.

Furthermore, organizing peer observation and evaluation sessions facilitates mutual learning and mentorship. Through peer observations, teachers gain exposure to innovative methodologies and pedagogical techniques, broadening their instructional horizons. Collaborative exchanges foster a culture of collective growth, enabling cross-pollination of expertise and nurturing a supportive academic ecosystem [10].

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6. Monitoring and Evaluation of Enhancement Strategies

6.1 Developing an Evaluation Indicator System

Establishing a multidimensional evaluation indicator system is essential for the scientific and comprehensive monitoring of digital literacy enhancement strategies for higher vocational physical education teachers.

1) Digital Technology Application Proficiency:

Evaluate educators' operational competence across digital pedagogical tools. Key metrics include: The ability to systematically present key and complex curricular content using multimedia instructional tools; Precision in applying motion analysis software to deliver professional, individualized movement guidance.

2) Instructional Quality Assessment:

Focus on the tangible pedagogical outcomes of digital technology integration. Specific analyses should address: Whether students demonstrate significant improvements in mastering sports knowledge and skills after technology-enhanced instruction; Whether observable advancements in athletic performance metrics post-intervention can be found.

3) Student-Centered Feedback:

Learner perspectives as critical evaluation criteria through surveys assessing including students' acceptance of digital pedagogical methods,shifts in learning motivation and engagement levels and overall satisfaction withtechnology-mediated instruction should be incorporated [14].

6.2 Evaluation Methods and Procedures

Adopting diversified evaluation methods is critical to ensuring the objectivity and reliability of digital literacy assessments for higher vocational physical education teachers.

1) Questionnaire Surveys:

Student-focused questionnaires gather perceptions of instructional clarity, learning experiences, and satisfaction with digitally enhanced teaching. Teacher-focused questionnaires investigate challenges encountered in digital literacy development, perceived benefits, and aspirations for future growth.

2) Classroom Observation Protocols:

Evaluators conduct in-class observations to assess teachers' practical integration of digital resources, focusing on: The innovative design and pedagogical effectiveness of technology-mediated lessons; The strategic alignment of digital tools with instructional objectives.

3) Data Analytics Methods:

Leveraging educational platforms to extract metrics such as online learning duration, assignment completion rates, and quiz scores, enabling systematic analysis of student outcomes. Through data mining, researchers can quantify the impact of digital teaching practices on academic progress, providing empirical evidence for evaluating instructional efficacy [14][15].

Evaluation Procedures:

1) Cycle Definition: Establish evaluation timelines (e.g., per semester or academic year) for phased progress tracking.

2) Data Collection: Comprehensively gather relevant data based on the predefined indicator system, utilizing tailored methods for each dimension.

3) Analysis and Reporting: Consolidate and archive collected data, perform cross-method triangulation, and generate detailed evaluation reports to inform iterative refinements of digital literacy enhancement strategies.

6.3 Feedback and Strategic Adjustments

To ensure the rationality and efficacy of continuous improvement mechanisms for enhancing higher vocational physical education teachers' digital literacy, timely feedback based on evaluation results

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must be provided to both educators and institutions. Targeted and granular feedback enables teachers to refine their pedagogical practices. During feedback sessions, detailed analyses should highlight educators' strengths and weaknesses in digital technology application, instructional design, and implementation, thereby guiding subsequent improvements. For instance, if evaluations reveal a teacher's deficiency in selecting and integrating digital resources, customized training resources and expert mentorship should be offered.

Institutional-level feedback should focus on systemic enhancement strategies and existing challenges. Schools should evaluate:

The comprehensiveness of the training system;

The adequacy of training intensity;

The implementation efficacy of digital education policies.

If feedback indicates low teacher engagement due to monotonous training formats, schools should adopt online-offline hybrid training models to revitalize participation. Similarly, underutilized teaching equipment may necessitate optimized management protocols or enhanced operational training to maximize resource utilization.

By iteratively refining strategies based on data-driven insights, institutions can ensure the effective execution and sustainable development of digital literacy enhancement initiatives, thereby ensuring the sustained advancement of teachers' digital literacy [14].

7. Conclusion

This study demonstrates that enhancing the digital literacy of higher vocational physical education teachers is pivotal to advancing the modernization of physical education amid the global digital transformation of education. Through an in-depth analysis of digitalization's impact on physical education pedagogy, the research clarifies the strategic significance of teacher digital literacy development and identifies gaps in existing studies regarding practice-driven, competency-framed enhancement strategies.

Investigations into current teaching practices reveal multifaceted challenges, including teachers' operational inadequacies in applying digital technologies and insufficient competence in integrating instructional resources. These issues stem from multidimensional factors encompassing individual educators' mindsets and skill sets, institutional infrastructure and cultural ecosystems, as well as the comprehensiveness, relevance, and efficacy of training systems.

Furthermore, the study systematically constructs a digital literacy competency framework for higher vocational physical education teachers, delineating core competencies such as digital resource acquisition and integration, technology-mediated instructional design, applied digital tool utilization, and data-informed pedagogical evaluation, while emphasizing their critical roles in teaching effectiveness.

Building on these findings, the research proposes targeted enhancement strategies:

1) Establishing holistic training systems to address teachers' developmental needs across career stages;

2) Strengthening institutional support through hardware upgrades, software provisioning, and policy incentives to foster conducive environments;

3) Cultivating educators' lifelong learning mindset via continuous training, reflective teaching practices, and collaborative innovation.

These strategies, grounded in teaching practices and anchored by the competency framework, hold substantial practical implications for advancing physical education quality, meeting students' digital learning demands, and driving sustainable educational modernization.

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