



Digital transformation in physical education: Opportunities and challenges in higher education

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DOI: <https://doi.org/10.66856/ijpees.2026.8.2.8040>

Abstract

The rapid advancement of digital technologies has significantly transformed higher education worldwide, including the field of physical education. Digital transformation offers numerous opportunities to enhance teaching effectiveness, student engagement, and learning outcomes through online platforms, mobile applications, wearable devices, and artificial intelligence. However, the implementation of digital transformation in physical education also presents various challenges, such as technological infrastructure limitations, digital competency gaps among instructors and students, and concerns regarding practical skill development. This study aims to examine the opportunities and challenges of digital transformation in physical education within higher education institutions. Using a survey of university students and physical education instructors in Vietnam, the study identifies key benefits and barriers associated with digital technology adoption. The findings provide recommendations for universities and policymakers to effectively promote digital transformation in physical education.

Keywords: Digital transformation, physical education, higher education, educational technology, Vietnam

Introduction

Digital transformation has emerged as one of the most influential trends reshaping higher education systems worldwide. Driven by rapid advances in information and communication technologies, artificial intelligence (AI), cloud computing, big data analytics, mobile applications, and online learning platforms, universities are increasingly integrating digital technologies into teaching, learning, assessment, and institutional management. The transition from traditional educational models toward digitally enhanced learning environments has become a strategic priority for higher education institutions seeking to improve educational quality, accessibility, efficiency, and student engagement.

The importance of digital transformation in education became particularly evident during and after the COVID-19 pandemic. Educational institutions around the world were forced to adopt online teaching and digital learning solutions to maintain academic continuity. This unprecedented situation accelerated the adoption of digital technologies and highlighted their potential to support flexible, inclusive, and learner-centered education. Consequently, digital transformation is no longer considered a temporary solution but rather a long-term strategy for educational development and innovation.

In the context of higher education, digital transformation involves more than simply introducing technological tools into classrooms. It represents a fundamental change in educational philosophy, pedagogical approaches, organizational structures, and learning experiences. Digital technologies facilitate interactive learning, personalized instruction, collaborative knowledge construction, and real-time assessment. Students are increasingly expected to develop digital competencies alongside disciplinary knowledge to meet the demands of the digital economy and the future labor market.

Within this broader transformation, physical education (PE) presents a unique context. Traditionally, physical education has been characterized by face-to-face instruction, practical skill development, physical activity participation, and direct interaction between instructors and students. Unlike many theoretical subjects, PE relies heavily on movement-based learning experiences and physical performance assessment. Therefore, integrating digital technologies into physical education requires innovative approaches that preserve the practical nature of the discipline while leveraging technological advantages.

Recent developments indicate that digital technologies can significantly enhance physical education teaching and learning. Learning management systems (LMS), mobile fitness applications, wearable devices, online instructional videos, virtual reality (VR), augmented reality (AR), and artificial intelligence have expanded the possibilities for delivering PE programs. These technologies enable students to access learning materials anytime and anywhere, receive personalized feedback, monitor physical activity levels, and engage in self-directed learning. Furthermore, digital tools support instructors in tracking student progress, assessing performance, and designing more flexible and interactive learning environments.

Wearable technologies such as smartwatches, fitness trackers, and heart-rate monitors have become increasingly popular in physical education settings. These devices provide real-time data on physical activity, exercise intensity, energy expenditure, and health indicators, thereby supporting evidence-based teaching and learning practices. Similarly, mobile applications allow students to monitor exercise routines, establish fitness goals, and receive individualized recommendations. Such innovations contribute to enhancing students' motivation, participation, and overall learning experiences.

Artificial intelligence is also beginning to influence physical education and sports training. AI-powered systems can analyze movement patterns, evaluate performance, provide personalized exercise recommendations, and assist in injury prevention. Although the application of AI in educational contexts remains at an early stage, its potential to improve learning outcomes and instructional effectiveness has attracted increasing attention from researchers and practitioners.

Despite these opportunities, digital transformation in physical education is accompanied by numerous challenges. One major concern is the adequacy of technological infrastructure. Effective implementation requires reliable internet connectivity, digital devices, software platforms, and technical support systems. Many higher education institutions, particularly in developing countries, continue to face resource limitations that hinder digital adoption.

Another challenge relates to digital competencies among instructors and students. Successful digital transformation depends not only on technology availability but also on users' ability to effectively utilize digital tools. Physical education lecturers may require additional training to integrate technology into pedagogical practices, while students may experience varying levels of digital literacy and readiness. The digital divide remains an important issue affecting equitable participation in technology-enhanced learning.

Furthermore, the practical and performance-based nature of physical education creates specific difficulties for digital implementation. Assessing motor skills, movement quality, teamwork, and physical performance through digital platforms may be more challenging than assessing cognitive learning outcomes. Concerns have also been raised regarding reduced social interaction, limited opportunities for direct skill correction, and potential decreases in physical activity engagement when digital technologies are not appropriately designed and implemented.

In Vietnam, digital transformation has become a national priority under the government's broader digital development strategy. The education sector has actively promoted the application of information technology and digital learning solutions to improve educational quality and management effectiveness. Universities have invested in learning management systems, online teaching platforms, and digital resources to support educational innovation. However, research focusing specifically on digital transformation in physical education remains relatively limited.

Most existing studies have concentrated on digital learning in general higher education contexts, while the unique characteristics and challenges of physical education have received less attention. Moreover, empirical evidence regarding students' and lecturers' perceptions of digital transformation in Vietnamese physical education programs remains scarce. Understanding these perceptions is essential for identifying both opportunities and barriers associated with digital implementation and for developing appropriate strategies to support sustainable transformation.

Therefore, this study was conducted to examine the opportunities and challenges of digital transformation in physical education within higher education institutions. Specifically, the study investigates the current use of digital technologies, explores perceived benefits and barriers, and identifies potential solution directions for improving digital transformation practices. The findings are expected to

contribute to the growing literature on educational technology and physical education while providing practical implications for universities, policymakers, and educators seeking to enhance the quality and effectiveness of physical education in the digital era.

The results of this study may support the development of more flexible, innovative, and student-centered physical education programs that align with contemporary educational trends and the requirements of digital society.

Research Design

The study was designed as a descriptive cross-sectional investigation combined with solution-oriented analysis. The purpose of the study was to examine the opportunities and challenges of digital transformation in physical education within higher education institutions and to identify practical recommendations for improving implementation effectiveness.

Participants

A total of 475 participants were involved in the study, including:

- 450 students enrolled in physical education courses at the University of Finance – Marketing;
- 15 physical education lecturers;
- 10 educational administrators.

Students were selected using convenience sampling to ensure representation across different academic years and genders.

Variables

The study focused on the following variables:

1. Current use of digital technologies in physical education;
2. Opportunities of digital transformation in physical education;
3. Benefits of digital learning for students;
4. Challenges affecting digital transformation implementation;
5. Institutional readiness for digital transformation;
6. Expert evaluation of future development solutions.

Methods

The following methods were employed:

Document Analysis

Relevant documents, policies, scientific articles, and previous studies related to digital transformation, educational technology, higher education, and physical education were reviewed to establish the theoretical foundation of the study.

Questionnaire Survey

A structured questionnaire was administered to students to collect information regarding their experiences, perceptions, and evaluations of digital transformation in physical education.

Expert Interview

Interviews were conducted with physical education lecturers and educational administrators to obtain professional opinions regarding opportunities, challenges, and development strategies.

Mathematical Statistics

Data were processed using SPSS 22.0 software. Descriptive statistics including frequency, percentage, mean score (Mean), and standard deviation (SD) were used to analyze the collected data.

Procedure

The study was conducted in the following stages:

1. Reviewing theoretical and practical literature on digital transformation in education and physical education;
2. Developing and validating survey instruments through expert consultation;
3. Conducting questionnaire surveys among students;
4. Collecting expert opinions from lecturers and administrators;
5. Processing and analyzing collected data;
6. Identifying key opportunities and challenges;
7. Proposing solution directions to enhance digital transformation in physical education within higher education institutions.

Results

Scores collected were statistically analysed using descriptive statistics. The findings are presented below.

Table 1: Current Use of Digital Technologies in Physical Education among UFM Students (n = 450)

Technology	n	%
Learning Management Systems (LMS)	392	87.1
YouTube instructional videos	376	83.6
Mobile fitness applications	314	69.8
Online assessment tools	285	63.3
Wearable devices	158	35.1
AI-assisted learning tools	124	27.6

The results in Table 1 indicate that Learning Management Systems (87.1%) and instructional videos (83.6%) were the most commonly used digital technologies in physical education. Mobile fitness applications were also widely utilized (69.8%). However, the adoption of wearable devices and AI-assisted learning tools remained relatively low, suggesting that advanced digital technologies have not yet been fully integrated into physical education practices.

Table 2: Students' Perceptions of Opportunities of Digital Transformation

Opportunity	Mean	SD	Rank
Flexible learning access	4.42	0.67	1
Enhanced student engagement	4.31	0.71	2
Improved communication	4.18	0.75	3
Personalized learning	4.11	0.79	4
Real-time performance monitoring	3.97	0.84	5

As shown in Table 2, flexible learning access received the highest evaluation (Mean = 4.42), followed by enhanced student engagement (Mean = 4.31). Students generally perceived digital transformation as a positive factor that improves accessibility and interaction within physical education courses.

Table 3: Perceived Benefits of Digital Learning in Physical Education

Benefit	Mean	SD	Rank
Convenience	4.36	0.72	1
Increased motivation	4.21	0.77	2
Better self-learning	4.15	0.74	3
Physical activity monitoring	4.04	0.81	4
Better learning outcomes	3.96	0.85	5

The findings presented in Table 3 reveal that convenience was the most important benefit perceived by students (Mean = 4.36). Increased motivation and improved self-learning capabilities also received high ratings. These results suggest that digital technologies can support more flexible and student-centered learning experiences.

Table 4: Challenges of Digital Transformation in Physical Education

Challenge	Mean	SD	Rank
Difficulty in assessing practical skills	4.37	0.69	1
Limited digital competencies	4.21	0.74	2
Inadequate infrastructure	4.09	0.77	3
Financial constraints	3.95	0.82	4
Data privacy concerns	3.72	0.89	5

Table 4 shows that the most significant challenge was the difficulty of assessing practical physical skills through digital platforms (Mean = 4.37). Respondents also highlighted limited digital competencies and infrastructure constraints as major barriers to effective implementation.

Table 5: Evaluation of Institutional Digital Readiness

Evaluation Item	Mean	SD	Level
Internet infrastructure	3.89	0.81	Good
LMS support system	4.02	0.76	Good
Lecturer digital competency	3.76	0.83	Fair
Student digital competency	3.91	0.79	Good
Availability of digital resources	3.68	0.86	Fair

The results in Table 5 indicate that institutional readiness was generally evaluated at a moderate to good level. LMS support systems received the highest rating (Mean = 4.02), whereas the availability of digital resources and lecturer digital competency were evaluated less favorably.

Table 6: Expert Evaluation of Major Solution Directions

Solution Direction	Mean	SD	Rank
Improve digital infrastructure	4.58	0.59	1
Enhance lecturer digital competencies	4.51	0.62	2
Integrate AI and emerging technologies	4.38	0.67	3
Develop digital learning materials	4.29	0.71	4
Strengthen institutional policy support	4.15	0.76	5

According to Table 6, experts considered improving digital infrastructure the most important solution direction (Mean = 4.58), followed by enhancing lecturers' digital competencies (Mean = 4.51). The findings suggest that successful digital transformation requires both technological investment and human resource development.

Overall, the results demonstrate that digital transformation offers substantial opportunities for improving physical education in higher education institutions. Nevertheless, significant challenges related to infrastructure, digital competency, and practical skill assessment must be

addressed to ensure successful and sustainable implementation.

Discussion

This study examined the opportunities and challenges associated with digital transformation in physical education within higher education institutions. The findings indicate that digital transformation has become an increasingly important component of physical education, creating new possibilities for teaching innovation, learning flexibility, and student engagement. At the same time, the study identified several challenges that may hinder effective implementation if not adequately addressed.

One of the most significant findings is the widespread use of Learning Management Systems (LMS), instructional videos, and mobile fitness applications among students. The high utilization rates of these technologies suggest that digital learning tools have become an integral part of contemporary physical education. This trend reflects broader developments in higher education, where digital platforms are increasingly used to support teaching, communication, and assessment activities. The findings demonstrate that students are generally willing to engage with digital technologies when these tools are accessible and relevant to their learning needs.

The results further revealed that flexible learning access was perceived as the most important opportunity provided by digital transformation. This finding is understandable because digital technologies enable students to access learning materials regardless of time and location. Such flexibility is particularly beneficial for university students who often face competing demands from academic studies, part-time employment, and personal responsibilities. Through digital platforms, students can review instructional videos, access course materials, and complete learning activities at their own pace, thereby enhancing learning convenience and accessibility.

Another important opportunity identified in this study is the enhancement of student engagement. Respondents indicated that digital technologies contribute positively to learning motivation and participation. Interactive content, multimedia resources, and technology-supported learning activities can make physical education more attractive and engaging. Previous studies have suggested that students tend to respond positively to technology-enhanced learning environments because they provide greater autonomy, interactivity, and personalized learning experiences. The findings of the present study support these observations and highlight the potential of digital transformation to modernize traditional physical education practices.

The study also found that students highly valued the convenience and self-learning opportunities provided by digital technologies. This result suggests that digital transformation supports the development of learner autonomy, which has become an important objective in modern higher education. By utilizing digital resources, students can take greater responsibility for their own learning processes, monitor their physical activity levels, and seek additional information beyond classroom instruction. Such learning behaviors contribute to the development of lifelong learning competencies and healthier lifestyles.

Despite these opportunities, the findings revealed several significant challenges. The most serious challenge identified

by respondents was the difficulty of assessing practical physical skills through digital platforms. Unlike many academic subjects, physical education emphasizes movement performance, technical skill execution, physical fitness, and direct instructor feedback. These elements can be difficult to evaluate accurately in online or technology-mediated environments. Although video submissions and digital assessment tools provide alternative solutions, they may not fully replace face-to-face observation and immediate feedback. Therefore, universities should carefully consider how digital technologies can complement rather than completely replace practical learning activities.

Limited digital competencies among lecturers and students were also identified as important barriers. Effective digital transformation requires not only technological infrastructure but also the knowledge and skills necessary to use digital tools effectively. Some lecturers may experience difficulties adapting to new technologies, designing digital learning materials, or integrating technology into physical education instruction. Similarly, students possess varying levels of digital literacy, which may affect their ability to participate effectively in technology-enhanced learning environments. These findings suggest that continuous professional development and digital skills training should be prioritized. Infrastructure limitations represent another challenge highlighted in this study. Although respondents generally evaluated institutional readiness positively, concerns remain regarding internet connectivity, availability of digital resources, and technological support systems. Adequate infrastructure is a fundamental prerequisite for successful digital transformation. Without reliable technological support, the effectiveness of digital learning initiatives may be significantly reduced. Consequently, higher education institutions should continue investing in technological infrastructure to support long-term digital development.

The expert evaluation further emphasized the importance of improving digital infrastructure and enhancing lecturers' digital competencies. These two solution directions received the highest ratings, indicating that both technological and human factors play critical roles in successful implementation. Investment in infrastructure alone is insufficient if lecturers and students are not adequately prepared to utilize digital tools. Similarly, highly skilled users cannot maximize the benefits of digital technologies if technological resources remain limited. Therefore, digital transformation should be approached as a comprehensive and integrated process.

The findings of this study have several practical implications for higher education institutions. First, universities should continue expanding digital infrastructure and ensuring equitable access to technology for all students. Second, professional development programs should be organized to strengthen lecturers' digital competencies and pedagogical skills. Third, digital learning materials specifically designed for physical education should be developed to improve instructional quality and student engagement. Fourth, universities should explore emerging technologies such as artificial intelligence, wearable devices, and mobile fitness applications to support innovative teaching and learning practices.

Overall, this study demonstrates that digital transformation offers substantial opportunities for enhancing physical education in higher education institutions. However, achieving successful and sustainable implementation

requires coordinated efforts involving infrastructure development, capacity building, curriculum innovation, and institutional support. By addressing existing challenges while leveraging technological opportunities, universities can create more effective, flexible, and student-centered physical education programs that meet the demands of the digital era.

Conclusion

This study investigated the opportunities and challenges associated with digital transformation in physical education within higher education institutions. The findings revealed that digital technologies have become increasingly integrated into physical education teaching and learning, particularly through the use of Learning Management Systems, instructional videos, mobile fitness applications, and online assessment tools.

The results demonstrated that digital transformation provides several important opportunities for higher education institutions. The most significant benefits identified by participants included increased learning flexibility, enhanced student engagement, improved communication, personalized learning experiences, and greater convenience in accessing educational resources. These advantages indicate that digital technologies have the potential to improve both the effectiveness and accessibility of physical education programs.

However, the study also identified several challenges that may hinder successful implementation. The most critical barriers included difficulties in assessing practical physical skills through digital platforms, limited digital competencies among lecturers and students, inadequate technological infrastructure, financial constraints, and concerns regarding data privacy and security. These challenges highlight the need for comprehensive institutional strategies to support digital transformation initiatives.

The evaluation of institutional readiness suggested that universities have made considerable progress in developing digital learning environments. Nevertheless, further improvements are needed in infrastructure development, digital resource availability, and professional training programs for lecturers. Expert evaluations also emphasized that investment in digital infrastructure and the enhancement of digital competencies should be prioritized in future development plans.

Based on the findings, five major solution directions are proposed. First, universities should continue investing in digital infrastructure and technological support systems. Second, professional development programs should be strengthened to improve lecturers' digital competencies. Third, digital learning materials specifically designed for physical education should be developed and expanded. Fourth, emerging technologies such as artificial intelligence, wearable devices, and fitness applications should be integrated into teaching and learning activities. Finally, institutional policies and strategic planning should be enhanced to support sustainable digital transformation in physical education.

Overall, this study concludes that digital transformation presents substantial opportunities for improving the quality and effectiveness of physical education in higher education. Although several challenges remain, a systematic and strategic approach that combines technological investment, human resource development, and educational innovation

can significantly enhance the implementation of digital transformation and contribute to more flexible, engaging, and student-centered physical education programs.

Acknowledgments

The author would like to express sincere appreciation to the University of Finance – Marketing, Vietnam, for supporting this research. The author also gratefully acknowledges all students, lecturers, and educational administrators who participated in the study and contributed valuable information. Special thanks are extended to the anonymous reviewers and editorial board members for their constructive comments and suggestions that helped improve the quality of this manuscript.

References

1. Bond M, Bedenlier S, Marín VI, Händel M. Emergency remote teaching in higher education: Mapping the first global online semester. *International Journal of Educational Technology in Higher Education*,2021;18(1):1–24.
2. Bozkurt A, Jung I, Xiao J, Vladimirschi V, Schuwer R, Egorov G, *et al.* A global outlook to the interruption of education due to COVID-19 pandemic. *Asian Journal of Distance Education*,2020;15(1):1–126.
3. Dwivedi YK, Hughes L, Coombs C, Constantiou I, Duan Y, Edwards J, *et al.* Impact of COVID-19 pandemic on information management research and practice. *International Journal of Information Management*,2020;55:102211.
4. García-Morales VJ, Garrido-Moreno A, Martín-Rojas R. The transformation of higher education after COVID disruption. *Technological Forecasting and Social Change*,2021;171:120–129.
5. Vial G. Understanding digital transformation: A review and research agenda. *Journal of Strategic Information Systems*,2019;28(2):118–144.
6. Verhoef PC, Broekhuizen T, Bart Y, Bhattacharya A, Dong J, Fabian N, *et al.* Digital transformation: A multidisciplinary reflection and research agenda. *Journal of Business Research*,2021;122:889–901.
7. UNESCO. *Global Education Monitoring Report 2023: Technology in Education*. UNESCO, 2023.
8. OECD. *Digital Education Outlook 2023: Towards an Effective Digital Education Ecosystem*. OECD Publishing, 2023.
9. Huang R, Liu D, Thili A, Yang J, Wang H. *Handbook on Facilitating Flexible Learning During Educational Disruption*. Smart Learning Institute, 2020.
10. Dhawan S. Online learning: A panacea in the time of COVID-19 crisis. *Journal of Educational Technology Systems*,2020;49(1):5–22.
11. Alenezi M. Digital transformation in higher education: Challenges and opportunities. *Education Sciences*,2023;13(4):365.
12. Bond M. Schools and emergency remote education during the COVID-19 pandemic. *Educational Technology Research and Development*,2022;70(1):17–24.
13. Casey A, Goodyear VA, Armour K. *Digital technologies and learning in physical education*. Routledge, 2021.
14. Goodyear VA, Kerner C, Quennerstedt M. *Young people's uses of wearable healthy lifestyle*

- technologies. *Sport, Education and Society*,2019;24(3):212–225.
15. Kerner C, Goodyear VA. The motivational impact of digital technologies in physical education. *Physical Education and Sport Pedagogy*,2022;27(2):143–157.
 16. Papastergiou M. Digital game-based learning in physical education. *Computers & Education*,2021;170:104223.
 17. Yu J, Jee Y, Kim J. Wearable technology applications in physical education and sports. *Sustainability*,2022;14(8):4678.
 18. Crompton H, Burke D, Gregory KH. The use of mobile learning in higher education. *Computers & Education Open*,2021;2:100043.
 19. Alhumaid K. Four ways technology has negatively changed education. *Journal of Educational and Social Research*,2021;11(4):10–20.
 20. Chiu TKF. Applying digital technology in education: Challenges and opportunities. *Education and Information Technologies*,2022;27(4):5615–5632.
 21. Tang Y, Hew KF. Effects of using digital learning technologies in higher education. *Interactive Learning Environments*,2022;30(6):1042–1058.
 22. Venkatesh V, Morris MG, Davis GB, Davis FD. User acceptance of information technology: Toward a unified view. *MIS Quarterly*,2003;27(3):425–478.
 23. Davis FD. Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*,1989;13(3):319–340.
 24. Nguyen TH, Tran TT, Pham HM. Digital transformation in Vietnamese higher education institutions: Current status and future directions. *Journal of Asian Education*,2023;12(2):145–159.
 25. Ministry of Education and Training of Vietnam. *Digital Transformation Strategy in Higher Education 2021–2025, Vision to 2030*. Hanoi, Vietnam, 2024.