



## Professional learning experiences of university Physical Education lecturers in digital technology

*Experiencias de aprendizaje profesional de profesores universitarios de Educación Física en tecnología digital*

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### Abstract

**Introduction:** Quality Physical Education (PE) and sport education increasingly depend on lecturers' capacity to integrate digital technology, manage pedagogical knowledge, and redesign active learning experiences that promote participation, collaboration, and reflective practice. **Objective:** This study explores how university Physical Education lecturers in Indonesia interpret digital technology and transformation as drivers of invention in PE teaching and professional learning.

**Methodology:** We collected an explanatory sequential mixed-methods design from ninety-eight participants and analyzed the data thematically through professional development observations with follow-up semi-structured interviews on digital technology and transformation as well as technology-enabled pedagogy that creates supportive environmental conditions for learning. **Results:** The analysis discovered significant findings regarding how digital technology and transformation could enhance reflective PE practice and serve as developing for redesigning PE instruction, as well as for creating supportive environmental conditions in PE pedagogy. **Discussion:** The findings suggest that an effective managerial environment helps PE lecturers co-construct new teaching strategies that integrate technology with movement-based learning goals, aligning with calls for quality PE that advances inclusion, collaboration, and lifelong physical activity habits.

**Conclusions:** Strengthening environmental support for digital technology and transformation in PE could improve lecturers' professional learning, promote pedagogical invention, and improve the quality of Physical Education and sport education in higher education programs preparing future PE teachers.

### Keywords

Physical Education; teacher professional development; digital technology; digital transformation; higher education.

### Resumen

**Introducción:** La calidad de la educación física y la educación deportiva depende cada vez más de la capacidad del profesorado para integrar la tecnología digital, gestionar el conocimiento pedagógico y rediseñar experiencias de aprendizaje activo que promuevan la participación, la colaboración y la práctica reflexiva.

**Objetivo:** Este estudio explora cómo el profesorado universitario de educación física en Indonesia interpreta la tecnología digital y la transformación digital como motores de innovación en la enseñanza de la educación física y el desarrollo profesional.

**Metodología:** Se recopiló información mediante un diseño explicativo secuencial de métodos mixtos de noventa y ocho participantes y se analizaron los datos temáticamente a través de observaciones de desarrollo profesional, complementadas con entrevistas semiestructuradas sobre tecnología digital y transformación digital, así como sobre pedagogía basada en la tecnología que crea entornos favorables para el aprendizaje.

**Resultados:** El análisis reveló hallazgos significativos sobre cómo la tecnología digital y la transformación digital pueden mejorar la práctica reflexiva en educación física y servir como catalizador para rediseñar la instrucción en educación física, así como para crear entornos favorables en la pedagogía de esta disciplina.

**Discusión:** Los hallazgos sugieren que un entorno de gestión eficaz ayuda al profesorado de educación física a co-construir nuevas estrategias de enseñanza que integran la tecnología con los objetivos de aprendizaje basados en el movimiento, en consonancia con la demanda de una educación física de calidad que promueva la inclusión, la colaboración y los hábitos de actividad física a lo largo de la vida. **Conclusiones:** El fortalecimiento del apoyo ambiental a la tecnología digital y la transformación en la educación física puede mejorar el aprendizaje profesional de los docentes, promover la innovación pedagógica y mejorar la calidad de la educación física y deportiva en los programas de educación superior que preparan a los futuros profesores de educación física.

### Palabras clave

Educación Física; desarrollo profesional docente; tecnología digital; transformación digital; educación superior.

## Introduction

Contemporary higher education is being reshaped by digital technology and transformation, which requires universities to integrate technology not only as a delivery mechanism but also as part of how knowledge is created, shared, and applied in teaching and learning (Turdaliyev et al., 2024; Widodo et al., 2024). Integrating technology into educational practices could improve the organization of information, enhancing interaction, innovation, and continuous growth among learners (Kiran et al., 2025; Rusmanto et al., 2023). In the context of Physical Education (PE) and sport-related instruction, several factors contribute to the transformation, including the expectation that PE lecturers teach movement skills, health behaviors, teamwork, and competence in engaging, evidence-based ways that align with current sport science and educational policy (Kiran et al., 2025; Rusmanto et al., 2023; Turdaliyev et al., 2024).

Environmental support plays a crucial role in transforming individual learning skills and in creating the right conditions. The digital technology and transformation in higher education represents an essential revolution in instructional and research practices within global academic contexts (Indarto et al., 2024; Mulato et al., 2024). In universities, beneficial educational institution information systems can enhance teaching innovation by linking lecturers to creative pedagogical concepts, facilitating digital collaboration, and promoting classroom reflection (Botagariyev et al., 2024; Setyawati et al., 2025). When applied to PE, digital technology and transformation could support the effective sharing of teaching strategies for motor skill development and active lifestyles, documentation of best practices in physical activity instruction, and ongoing professional development of lecturers teaching movement, sport, health, and physical activity (Bolatuluy Omarov et al., 2025; Mulato et al., 2024; Setyawati et al., 2025).

Likewise, digital transformation, considered the planned integration of digital technology into education and universities, provides potential for adaptive teaching and learning, information-based thinking, and a dynamic design of curriculum (Fernández et al., 2023). Additionally, digital technology and transformation in universities creates opportunities for PE lecturers to record technique demonstrations, analyze motor performance, manage student training data, scaffold reflective practice, and integrate physical activity theory, such as physiology, biomechanics, injury prevention, etc., with guided practice in real or simulated environments (He et al., 2024; Lin et al., 2022). However, not all higher education universities provide equal support (Rahman, 2019; Widodo & Riandi, 2013). For various growing regions, such as Indonesia, lecturers highlight difficulties including inadequate digital technology and transformation and a lack of organizational encouragement for their professional development and technological change (Nur et al., 2017; Pudjiarti et al., 2022; Susanty et al., 2019). These constraints can directly affect the quality of PE instruction, including the ability to engage in developmentally appropriate activity sessions.

### ***The importance of digital technology and transformation in Physical Education***

Physical Education and sport-related programs are uniquely practice-based activities. PE lecturers should integrate physical activity, injury prevention, health education, and movement analysis while also addressing motivation, teamwork, inclusion, and student well-being (Corbin, 2021; Goossens et al., 2024). This statement declares that PE is no longer just for teaching games. It is now a curriculum, an assessment, and a way of teaching that is based on evidence for lifelong physical activity and health. Enriching digital technology and transformation for PE lectures could be beneficial to develop the ability to use, understand, and evaluate digital technologies to access, manage, communicate, and create information safely and appropriately. For example, digital technology and transformation could support social learning among PE lecturers by enabling them to share movements, hybrid instructional suggestions, online assessment rubrics for skill competence, and reflections on what motivates inactive students in the digital world and real conditions. Such outcomes can be achieved through capturing and reviewing students' motor performance, such as movement technique, posture, and range of motion; personalizing feedback for strength, conditioning, and injury risk; and aligning PE activities with broader university health goals (Juditya et al., 2025; Supriyani & Sari, 2023; Zulkifli & Danis, 2022).



## ***Aim of the study***

This study employed an explanatory sequential mixed-methods design involving ninety-eight participants and thematically evaluated the data through professional development observations followed by semi-structured interviews with Indonesian Physical Education lecturers in relation to their teaching and movement-related courses to understand how PE lecturers perceive and implement digital technology and transformation in their teaching practices.

In this study, we focus in addressing three questions:

1. How do lecturers in Physical Education and related programs perceive and experience digital technology and transformation in their teaching?
2. In what ways do digital technology and transformation contribute to pedagogical redesign in PE, including the teaching of physical activity for health, teamwork, and performance?

The authors argued that by focusing on lecturers' lived experiences in Physical Education, sport pedagogy, and physically active learning, this study directly connects digital technology and transformation. Additionally, it extends previous research demonstrating how digital technology and transformation as well as technological invention in facilitating environmental conditions combine to shape pedagogy, curriculum, motor behavior, physical activity for health, and lecturer professional development in higher education.

## **Method**

### ***Research design***

This study was based on an explanatory sequential mixed-methods design, which applied the questionnaire and follow-up with the interviews to explore social interaction and contextual experience of lecturers in Indonesian universities (Creswell, 2007; Patton, 2014). A qualitative interpretative design was utilized to facilitate an in-depth examination of participants' perceptions and the significance they attribute to professional activity. In accordance with the guidelines established by Lincoln & Guba (1985), the research aimed to generate a comprehensive interpretation of lecturers' experiences and to explain the complex university and cultural factors that impact technological advancement in Indonesian higher education. However, the questionnaire offered a broad overview of critical concerns, but the interview data yielded comprehensive responses. This framework is well-suited for analyzing pedagogical innovation in Physical Education, given that the teaching of physical activity is inherently social, embodied, and contextual, exemplified by lecturers adapting activities in real time based on safety, motivation, facilities, and student ability. The study aims to provide a comprehensive consideration of how lecturers comprehend and apply digital technology and transformation in their Physical Education practices rather than testing predefined hypotheses.

### ***Participants and context***

The total number of participants was ninety-eight university lecturers from Indonesian universities, with a restricted proportion of university lecturers participated in the professional development program, with approximately 39.3% in attendance. The university lecturers demonstrated geographical diversity, representing various institutions around Indonesia, with a majority from Yogyakarta (48.4%), prior to Jakarta (30.3%) and Bandung (9%). This geographic distribution emphasizes regional saturation and national involvement contexts. However, we focused on only twenty-three university lecturers from the Physical Education (PE) background in Indonesian universities in purposive sampling who had experience with digital learning or digital technology in the professional development program. For this study, the authors emphasize insights from lecturers who (a) teach Physical Education, sport, or movement-related content; (b) integrate physical activity and health outcomes in their instruction; or (c) design practical coursework involving motor skills, teamwork, or embodied/active learning. These lecturers operate in both urban and regional universities, reflecting diverse access to sports facilities, digital infrastructure, and university support.

## **Data collection**

### *The questionnaire*

Initially, quantitative and qualitative data were gathered from participants through an online questionnaire. The authors disseminated the questionnaire using random sampling; participants were chosen from a specific group with relevant experiences, such as Indonesian lecturers engaged in professional development within university programs. The questionnaire, delivered to participants using an online platform, was completed by ninety-eight lecturers throughout Indonesia.

### *The interview*

Secondly, the qualitative interviews were conducted in twenty-three lecturers following a professional development program at Indonesian universities. The program was implemented by Indonesian organizations and universities, using qualitative methods such as semi-structured interviews to examine various aspects of lecturers' work, including class planning and implementation, information exchange regarding teaching methods, technology utilization for enhanced learning, movement analysis, physical activity participation, assessment practices, and the impact of environmental conditions on opportunities in Physical Education. The workshops encompassed discussions on digital technology and transformation, as well as technological invention in pedagogical performance. The authors provided descriptive notes detailing the events, actions, and dialogues of the university lecturers. This interview aimed to collect information regarding digital technology, transformation, and performance in teaching and learning, with a particular emphasis on lecturers' experiences in fostering and promoting suitable environmental conditions. The observation took place during the program's implementation, while the open-ended questions emerged post-program.

## **Data analysis**

In the data analysis, the authors ensured participants' anonymity by using codes. The procedure is intended to take reasonable care to avoid the disclosure of identity details. The primary goal of the analysis was to evaluate the data to identify classifications and trends that highlight university lecturers' perceptions of the professional development program. The authors developed a comprehensive understanding of the data by reviewing the conversation recordings and reading all transcripts. Additionally, we provided a descriptive summary and engaged in discussions regarding the findings with other authors. The university lecturers were given permission to share their experiences during the discussion. The data were analyzed with qualitative software (NVivo) and interpreted through thematic investigation in order to identify, analyze, and convey patterns in the dataset from all recorded conversations and transcripts (Creswell & Creswell, 2017; Patton, 2014).

This study analyzed participants' narratives to contextualize lecturers' interpretations of their lived experiences with digital technology and transformation in skill facilitation, alongside the influence of their environmental conditions (Creswell & Creswell, 2017). Data were derived from interviews with twenty-three lecturers from the Physical Education (PE) background in Indonesian universities. This narrative was emphasized to clarify the participants' reflections on their experiences with digital technology and transformation in teaching and learning. The inductive approach was used to analyze the interview, which enhanced the reliability of the analysis. Therefore, the present study analyzes participant narratives regarding their experiences to offer a comprehensive understanding of digital technology and transformation. Analyzing narratives establishes a timeline that correlates perceptions of past and present events while also considering how these interactions shape participants' understandings of their perspectives. Concentrating on the narrative offers a comprehensive historical perspective of the participant's reflections on their experience, offering detailed insights as the story developed (Patton, 2014). Furthermore, this study implemented multiple validation strategies to ensure the credibility and confirmability of findings. Member checking was conducted with selected participants, informal debriefing was performed with external researchers using qualitative methods, and triangulation was applied across interviews and observations, as well as a record of analytic decisions and coding revisions that was carefully documented in NVivo.

## Results

The study primarily focuses on a comprehensive analysis of the participants' perspectives to examine the professional learning experiences of university lecturers in Physical Education regarding digital technology and transformation. Leveraging positioning theory, the investigation uncovers particular practices that facilitate reflection on lecturers' comprehension and implementation of innovation in Physical Education and movement-oriented instruction. To ensure anonymity, all participants are assigned an interview code (e.g., P1, P2, P3).

### *Professional learning experiences*

After participating in the professional development program, the authors discussed the experiences with the PE lecturers, describing the participants as professional learners. Through in-depth interviews, we calculated that PE lecturers have systematically captured the professional development needed to support safer physical activity sessions and to align PE teaching with university expectations for innovation and health promotion. For example, PE lecturer P4 argued that "attending a professional development program helps to understand how to improve the perspective that is developed, transferred, organized, and applied within educational and administrative contexts, particularly in activity-based subjects in PE actions". Likewise, another PE lecturer, P8, highlighted that "effective information sharing improves efficiency and prevents repeated mistakes in planning and supervising physical activity sessions when class sizes are large or facilities are limited". Additionally, sharing works to engage fewer active students, document modifications for students with different physical abilities, and align activity sessions with learning outcomes related to health literacy and movement competence in PE activities. Conversely, P5 lecturer explained, "the professional development in the PE program is crucial for understanding the phenomena associated with information development in injury prevention indications and class safety routines". The program is essential to supporting safer, more inclusive, and more intentional physical activity teaching. Furthermore, the PE lecturers described the professional development program as essential for building and sharing practical teaching know-how, such as warm-up progressions, motor skill drills, injury-prevention strategies, class safety routines, inclusive task modifications, and motivational strategies to keep students physically active. From this analysis, the university lecturers' responses suggested that higher education should promote and develop the integration of professional development in the PE programs.

### *Digital technology for teaching pedagogy*

Digital technology could help create an environment that encourages PE lecturers to adopt active movement-based pedagogy. Ensuring access to resources and tools in higher education significantly influences PE lecturers' willingness to engage with the working culture related to current digitalization challenges. According to the in-depth interviews, PE lecturers consistently stated that digital technology at the university strongly influence culture and the ability to innovate in active movement-based pedagogy for Physical Education. In this term of digital technology that facilitates environmental conditions, we could explore accessibility to facilities, such as gyms, courts, and open space; availability of basic technology, such as cameras, tablets, and projectors for video feedback; and leadership that encourages collaboration instead of isolating lecturers in their classes. When these supports occur, lecturers feel trusted to try new approaches, such as recording student movement to promote self-analysis, integrating tactical games approaches, or connecting conditioning drills with discussions of injury prevention and wellness. Some PE lecturers have expressed their concerns. For instance, P14 lecturer, described "feeling more motivated to try new teaching strategies with digital tools when the university supports teamwork through regular workshops". In other words, another argument from the P3 lecturer stated that "I felt less able to innovate, less confident in applying new methods, and less capable of sustaining high-quality physical activity instruction". These findings explore the barriers for PE lecturers in university support, such as limited training, no time for reflection, and unequal access to facilities between central and regional campuses. In a similar vein, the P7 lecturer highlighted that "the relationship between digital technology in supporting environmental conditions is one of the critical aspects determining how information, ideas, and expertise are shared, including how PE lecturers discuss, collaborate, and maintain ethics in university". From the thematic analysis of the PE lecturers' narrative reflections, we concluded the challenges and barriers that related to the implementation of digital technology for teaching pedagogy as presented in Figure 1 below.





According to the reflective practice, after professional development activities, PE lecturers reported being better able to analyze student learning patterns and adjust teaching, including in skill-based and movement-based sessions. Digital transformation enhances the effectiveness of physical activities by improving safety, motivation, and skill difficulty progression. It includes digital resources such as accessible digital repositories, recording tools, shared planning documents, and university support that make PE curriculum innovation scalable rather than individual. Additionally, it fosters peer networks of lecturers who collaborate to create drills, task progressions, and assessment strategies for motor skill development and physical conditioning. Hence, in the PE context, this means digital transformation is enabling a professional learning community where teaching movement becomes documented, discussable, and improvable. These findings suggestively enhance PE lecturers' digital capabilities, which positively impact their technological invention performance in higher education. For example, P9 shared the experience of learning in digital tool effectiveness, stating, "using digital tools helps me to connect with my colleagues from different universities. I learn how they teach and adapt their methods". Additionally, P12 argued that "after the training, I realized I could analyze student learning patterns and adjust my teaching; I felt informed members had a significant impact on my abilities. With this regard, I can expand my strategies for learning on digital transformation, as well as develop my capability in using technologies to assist with my working". These findings indicate that university lecturers actively construct new ways of teaching approaches through digital exchange rather than passively receiving information. The response underlines the significant constraints imposed by insufficient digital transformation, which should be improved to facilitate PE lecturers' environments.

### ***Technology-enabled pedagogy***

Advancing technological pedagogy in PE activities has incorporated diverse behaviors and fostered innovative investigation in higher education. Innovation is perceived as a means to exhibit technological and cognitive proficiency through research and development endeavors in many fields related to the generation of innovation. PE lecturers repeatedly argued that technology is not just an add-on; it changes how they teach. Several described using technological pedagogy such as creating instruction more student-centered and exploratory, e.g. students viewing their recorded movement and suggesting self-corrections, supporting teamwork, communication, and shared responsibility during physical activity, integrating theory such as physiology, biomechanics, injury prevention, nutrition for performance with practice in a single session.

This study started examined PE lecturers' perceptions of the objectives of technology-enabled pedagogy, its significance, and its influence on higher education. PE lecturers consider technology-enhanced pedagogy key to ensuring the relevance of PE in relation to contemporary health and sports standards, including the adaptation of instructional methods to enhance learning outcomes, management efficacy, and peer collaboration. This study examined the different perspectives of PE lecturers from Indonesia. Indeed, P17 claimed that "investigating technological pedagogy is essential for higher education objectives, including analyzing innovation trends, fostering university creativity, and modifying instructional methods". This argument corresponds with P13, which stated that "discovering knowledge in technological pedagogy will enhance our ability to interpret, adapt to, and shape the future of technology in manners that promote growth, sustainability, and social prosperity". The importance of integrating technological pedagogy in universities can be analyzed to improve learning results, enhance managerial efficiency, promote peer collaboration, support teaching methods, and promote a culture of innovation. P19 emphasized that "technological pedagogy challenges historical development patterns and their impact on human progress, while promoting PE activities through teaching and learning". P16 suggested that "recognizing technological innovation is essential, as it provides a primary accelerator for progress. Technological pedagogy allows PE lecturers to link on-field activities to quantifiable learning objectives, produce evidence of advancements in motor skills, effort, or tactical understanding, and support course modifications to administrators. It provides the insights and understanding necessary to analyze how new ideas are created, nurtured, and assimilated into society to generate value, alter the environment, and shape future advancements". Accordingly, the results of this study demonstrated that PE lecturers responded positively to the implementation of technologically enabled pedagogy in their pedagogical practices through supporting environment for encouraging continuous innovation, creativity, and collaboration.

## Discussion

This study demonstrates that new thinking in university Physical Education occurs through the interplay of three factors: digital technology for teaching pedagogy, digital transformation in higher education, and technology-enabled pedagogy for supporting environments to reform pedagogy in physically active learning environments. This undertaking examines digital technology in teaching pedagogy, contributes in the development of PE lecturers, and facilitates access to both facilities and fundamental digital technologies. When leadership encourages collaboration, PE lecturers experience empowerment to innovate. Furthermore, PE lecturers exhibit a greater propensity to experiment with new activity methods, incorporate technology into their pedagogy, and employ successful methodologies.

Firstly, facilitating environments in urban and regional universities enables PE lecturers to eliminate obstacles in providing consistent quality in physical activity instruction and motor skill development. These findings coincide with earlier research highlighting the significance of supportive environments in enhancing learning experiences, promoting communication, motivation, and coordination skills, and cultivating a collaborative team atmosphere for the advancement of digital technology in pedagogical practices (González-Mohíno et al., 2024). The university digital policy and support and professional development in digital technology significantly influences the willingness of PE lecturers to participate in an innovative working culture in digital technology in teaching pedagogy. This result supports other studies that have examined similar connections, such as the work of Rusmanto et al. (2023) found that integrating digital technology effectively facilitates environmental conditions and enhances the understanding of university effectiveness, development, and existence. In addition, this study aligns with Kiran et al. (2025), who argue that digital technology is essential for transforming the organization of information and developing creative instructional approaches. Therefore, in Indonesian higher education, the facilitation of environments is inconsistent; this study underscores the importance for policy and resource alignment to maintain collaboration and experimentation in digital technology for pedagogical practices.

Secondly, the digital transformation in higher education serves as an opportunity for pedagogical development. Effective teaching in Physical Education depends on experiential knowledge, including the safe introduction of complex movements, the motivation of uncertain students, variation of intensity, the differentiation of tasks for multiple ability groups, and the management of injury risk and recovery. In this study, PE lecturers recognized a methodical method to capture, refine, and disseminate their expertise, ensuring it becomes integrated into the collective memory of the university rather than remaining solely in individual recollection. This directly facilitates curriculum development, ensures consistency across instructors, and promotes ongoing enhancement in pedagogy. Physical Education lecturers participating in professional development programs reported increased digital literacy, higher problem-solving skills, and greater confidence in using technology into their instruction. These findings align with existing literature, highlighting the significance of developing new knowledge and enhancing work efficiency, which has received attention in the context of the effectiveness of physical activities by improving safety, motivation, and skill difficulty progression. For example, Indarto et al. (2024) explained the idea of the digital resources, such as accessible digital repositories, recording tools, shared planning documents, and university support, that make PE curriculum innovation scalable. It is crucial for assessing students, emphasizing the various strategies, processes, and technologies employed to efficiently use individual knowledge capabilities. Likewise, Botagariyev et al. (2024) emphasized that the impact of the digital transformation in higher education is to improve communication, productivity, and skills, such as enhancing collaboration and decision-making. Additionally, this study improves the digital technology and transformation, particularly in innovation performance within educational universities. These findings are supported by studies from Botagariyev et al. (2024) and Setyawati et al. (2025), which identified that teaching innovations in universities are linked to creative pedagogical concepts, facilitate digital collaboration, and promote classroom reflection.

Thirdly, technology-enabled pedagogy accelerates reflective practice in PE activities. PE lecturers did not frame technology as a replacement for physical activity. Rather, they framed it as a feedback and coordination layer that enhances physical practice. PE lecturers used video, shared repositories, and communication platforms to analyze student performance and engagement in activity sessions, organize among colleagues, and justify pedagogical decisions to administrators. This is essential for areas like



motor behavior analysis, evidence-based strength and conditioning progressions, inclusive adaptation for special needs, and building students' self-efficacy in physical activity. Technology-enabled pedagogy functions not merely as a tool but as a catalyst for pedagogical redesign. When lecturers use digital platforms to support collaborative learning, data-driven feedback, or multimedia instruction, they move from using technology as substitution toward transformation with shifting consistent with the model of technology integration. The findings suggest that the multiple skills of technological innovation, such as fostering university creativity or adapting instructional approaches, could be important aspects for helping educational university' goals. This study supports the findings of Turdaliyev et al. (2024), who argued that using technology effectively can enable strategies to achieve university goals, such as improving ongoing university practices and promoting effective knowledge management technologies. In similar veins, the importance of integrating technological innovation in educational university can be explored to improve learning results, enhance management efficiency, increase peer collaboration, support teaching methods, and create a culture of innovation. The findings support the argument presented by Widodo et al. (2024) that the integration of technology within educational environments enhances the learning experience for students and suggests a creative environment promotes positive behavior and outcomes. The results of this study point out the interaction of technology-enabled pedagogy and university outcomes could promote a basis for lecturers to collaborate, exchange expertise, and cultivate professional networks. The higher education environment promotes the development of new knowledge, increasingly supported by digital tools, collaboration platforms, and training opportunities. Technology-enhanced pedagogy optimizes these processes by increasing efficiency, fostering creativity, and encouraging multidisciplinary collaboration in teaching and research. This outline enriches the literature by outlining the digitally supported and university-embedded process, which promotes recent recommendations for higher education institutions to incorporate effective strategies alongside digital technology, transformation, and innovation initiatives. Thus, the findings show that digital technology and transformation are not just theoretical management concepts. This study illustrates that enhancing Physical Education requires the development of frameworks intended to improving individual skills and knowledge through technology-enabled pedagogy in educational institutions, thereby fostering multidisciplinary PE experiences.

## Conclusions

This study investigated digital technology and transformation for innovative teaching through the professional learning experiences of Physical Education lecturers. This study of Indonesian university lecturers, as well as those responsible for Physical Education, sport-related instruction, and activity-based coursework, shows that digital technology and transformation play a decisive role in shaping how physical activity is taught, assessed, and continuously improved in higher education. By integrating digital technology and transformation, this study demonstrates how PE lecturers act as agents of pedagogical innovation. It exposes that sustainable educational transformation depends not only on technology availability but also on cultivating collaborative environments, continuous learning, and university cultures. These insights contribute directly to the innovative teaching mission by illustrating how universities can translate digital technology and transformation into enduring innovations in teaching and learning. Accessibility to supportive leadership, shared resources, and professional learning communities directly affects whether PE lecturers can design engaging, health-oriented, and safe physical activity experiences; knowledge management is foundational for improving PE pedagogy. By capturing and circulating practical teaching knowledge, such as safe progressions, strategies for inclusive engagement, and feedback for motor skill development, universities can standardize quality and reduce fragmentation in how physical activity is taught, and digital transformation is a catalyst for reflective, evidence-based teaching in physical activity settings. Technology is being used not merely to deliver content but to observe, analyze, and improve physical performance, teamwork, motor learning, and engagement, all of which are central to curriculum, pedagogy, and evaluation in Physical Education. This study points out that reframing digital technology and transformation as supporting movement pedagogy and physical activity promotion aligns with the curriculum and pedagogy in Physical Education, motor behavior, assessment and evaluation, sport and conditioning, and lecturer development in health- and activity-oriented teaching.



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## References

- Botagariyev, T., Mambetov, N., Aralbayev, A., Mukhanbetaliyev, A., Ispulova, R., & Akhmetov, N. (2024). Web-Based Technologies in Middle School Physical Education. *Retos*, *51*, 172-178. <https://doi.org/10.47197/retos.v51.100310>
- Corbin, C. B. (2021). Conceptual physical education: A course for the future. *Journal of sport and health science*, *10*(3), 308-322.
- Creswell, J. W. (2007). *An Introduction to Mixed Methods Research*.
- Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications.
- Fernández, A., Gómez, B., Binjaku, K., & Meçe, E. K. (2023). Digital transformation initiatives in higher education university: A multivocal literature review. *Education and information technologies*, *28*(10), 12351-12382
- González-Mohino, M., Donate, M. J., Guadamillas, F., & Cabeza-Ramírez, L. J. (2024). Knowledge-oriented leadership for improved coordination as a solution to relationship conflict: Effects on innovation capabilities. *Knowledge Management Research & Practice*, *22*(4), 388-403. <https://doi.org/10.1080/14778238.2024.2306338>
- Goossens, L., Cardon, G., Witvrouw, E., Verhagen, E. A., & De Clercq, D. (2024). An Injury Prevention Programme in Physical Education Teacher Education Students: Process Evaluation Using the RE-AIM Sports Setting Matrix. *Translational sports medicine*, *2024*(1), 5717748.
- He, Q., Chen, H., & Mo, X. (2024). Practical application of interactive AI technology based on visual analysis in professional system of physical education in universities. *Heliyon*, *10*(3). <https://doi.org/10.1016/j.heliyon.2024.e24627>
- Indarto, P., Nasuka, N., Hidayatullah, M. F., Sulaiman, S., Setyawati, H., Raharjo, H. P., & Suryadi, D. (2024). *What is the learning model of physical education in the digital era?: Literature review of various studies*. *Retos: nuevas tendencias en educación física, deporte y recreación*, (61), 156-163. <https://doi.org/10.47197/retos.v61.109583>
- Juditya, S., Pratiwi, F., & Zakaria, D. A. (2025). The role of digital tools in developing physical education teachers' digital competence: A case study of a platform. *Retos: nuevas tendencias en educación física, deporte y recreación*, (67), 876-887. <https://doi.org/10.47197/retos.v67.110921>
- Kiran, V., Amarnath, R., Nusarath Jaha, G., Katiyar, P., Rangaswamy, R., & Sinha, A. (2025). *Evaluating the effectiveness of virtual reality-based rehabilitation programs for post-injury recovery in adolescent athletes: A mixed-methods study*. *Retos*, *65*, 1184-1192. <https://doi.org/10.47197/retos.v65.111674>
- Lin, Y.-N., Hsia, L.-H., & Hwang, G.-J. (2022). Fostering motor skills in physical education: A mobile technology-supported ICRA flipped learning model. *Computers & Education*, *177*, 104380. <https://doi.org/10.1016/j.compedu.2021.104380>
- Lincoln, Y., & Guba, E. (1985). *Naturalistic inquiry*. Newberry Park, CA: Sage.
- Mulato, N., Hidayatulloh, F., Purnama, S. K., & Syaifullah, R. (2024). Optimization of learning physical education in digital era: A systematic review. *Retos*, *54*, 844-849. <https://doi.org/10.47197/retos.v54.105211>
- Nur, R. N. N., Fauzi, A. M., & Sukoco, H. (2017). Strategies of Knowledge Management Implementation for Academic Services Improvement of Indonesian Higher Education. *Journal of Information & Knowledge Management*, *16*(04), 1750032. <https://doi.org/10.1142/S0219649217500320>
- Omarov, N. B., Zhunusbekov, Z., & Aliyev, I. (2025). Tecnologías Innovadoras en la Educación Física y su Impacto en el Desarrollo de las Habilidades Motoras de los Estudiantes: Revisión Sistemática de la Literatura. *Retos: nuevas tendencias en educación física, deporte y recreación*, (67), 643-658. <https://doi.org/10.47197/retos.v67.113225>



- Patton, M. Q. (2014). *Qualitative research & evaluation methods: Integrating theory and practice*. Sage publications.
- Pudjiarti, E. S., Lisdiyono, E., & Werdiningsih, R. (2022). Knowledge management to develop comprehensive networking of university-industry collaboration in technology and innovation performance. *International Journal of Data and Network Science*, 6(2), 461-468. <https://doi.org/10.5267/j.ijdns.2021.12.008>
- Rahman, A. (2019). Restrictive versus facilitative teacher professional development: A case from three public schools in Indonesia. *Asia Pacific Education Review*, 20(4), 673-686.
- Rusmanto, R., Tomoliyus, T., Sulastion, A., Gazali, N., Abdullah, K. H., Gil-Espinosa, F. J., & Setiawan, E. (2023). *Virtual reality to promoting sports engagement and some technical skills in junior football athletes: A 12-week randomized controlled trial*. *Retos*, 50, 1129-1133. <https://doi.org/10.47197/retos.v50.100319>
- Setyawati, H., Pramono, H., & Rumini, R. (2025). Development of a web-based athletic sports learning model in sports talent schools. *Retos*, 65, 1018-1031. <https://doi.org/10.47197/retos.v65.112871>
- Supriyani Siregar, E., & Sari, I. P. (2023). Development of Audio-Visual Media on the Physical Motor Development of Students in Big Kindergarten. *JTP-Jurnal Teknologi Pendidikan*, 25(3), 363-370. <https://doi.org/10.21009/JTP2001.6>
- Susanty, A. I., Yuningsih, Y., & Anggadwita, G. (2019). Knowledge management practices and innovation performance: A study at Indonesian Government apparatus research and training center. *Journal of Science and Technology Policy Management*, 10(2), 301-318. <https://doi.org/10.1108/JSTPM-03-2018-0030>
- Widodo, A., Irianto, D. P., Graha, A. S., Yudanto, Y., Hardianto, D., Sutapa, P., Kauki, M. K., Ali, S. K. S., Kristiyanto, A., & Pratama, K. W. (2024). *The personalized system of e-modul instructions in physical education online learning*. *Retos*, 56, 319-327. <https://doi.org/10.47197/retos.v56.103515>
- Widodo, A., & Riandi. (2013). Dual-mode teacher professional development: Challenges and re-visioning future TPD in Indonesia. *Teacher Development*, 17(3), 380-392.
- Zulkifli, A. F., & Danis, A. (2022). Technology in physical education: Using movement analysis application to improve feedback on sports skills among undergraduate physical education students. *Social Sciences and Humanities Open*, 6(1). <https://doi.org/10.1016/j.ssaho.2022.100350>.

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