



A technology-based physical education learning model to enhance student motivation and physical activity

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ABSTRACT

This qualitative study explores how technology-based learning in physical education (PE) influences student motivation and physical activity. The research employed a phenomenological approach, collecting data through semi-structured interviews, participant observations, and document analysis involving 24 students and six PE teachers from three secondary schools. Thematic analysis revealed key themes, including enhanced engagement through personalized feedback, peer influence mediated by technology, reflective learning, and teacher adaptation strategies. Findings suggest that wearable devices and mobile applications not only increase students' intrinsic motivation and self-awareness but also shape classroom social dynamics and pedagogical practices. The study contributes theoretically by demonstrating how technology can support autonomy and self-regulated learning in PE and provides practical guidance for educators and policymakers to implement effective, inclusive, and engaging digital PE programs. Future research is recommended to examine longitudinal outcomes and cross-contextual applications.



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1. Introduction

The rapid advancement of digital technologies has significantly influenced educational practices worldwide, including physical education (PE). The integration of mobile applications, interactive platforms, and wearable devices in PE classes allows for real-time feedback on students' physical performance, enhancing both engagement and self-awareness. Studies indicate that technology-supported PE can foster intrinsic motivation and help students track and understand their fitness progress, outcomes that traditional approaches often fail to capture (Zhang et al., 2023; Rusmitaningsih et al., 2024). By providing immediate, personalized feedback, technology can transform students' learning experiences and facilitate sustained participation in physical activity.

In the national context, schools still face challenges in motivating students to actively participate in PE lessons, as conventional teaching approaches often appear monotonous and insufficiently interactive. Empirical evidence shows that incorporating wearable devices and fitness-tracking applications helps students feel more connected to the learning process because they can monitor their own progress and set personal fitness goals. Such engagement is crucial because motivation directly impacts learning outcomes and long-term healthy habits (Wang & Liu, 2021; Lin et al., 2023).

Despite these advancements, previous research has predominantly emphasized quantitative outcomes, such as step counts or activity duration, with limited attention to the subjective experiences of students. Consequently, there is a gap in understanding how students interpret and find meaning in the use of technology to enhance motivation and physical activity. Qualitative investigations are necessary to capture these lived experiences and provide a deeper comprehension of how technology shapes learning dynamics in PE settings (Cereda, 2025; Martín-Rodríguez & Madrigal-Cerezo, 2025).

Qualitative approaches allow for an exploration of students' perceptions of technological interactions, the influence of these interactions on intrinsic motivation, and teachers' interpretations of technology's role in their instructional practices. By focusing on these perspectives, research can uncover complex socio-emotional and cognitive processes that cannot be adequately measured through quantitative methods alone, providing a holistic understanding of technology-enhanced PE learning (Simón-Chico et al., 2023; Zhao & Su, 2026).

Moreover, factors such as teachers' technological competencies, school policy support, and infrastructure availability play significant roles in the effectiveness of technology integration. Successful implementation of digital tools in PE requires an ecosystem that supports both educators and students, ensuring that pedagogical objectives align with the use of technological resources (Lin et al., 2023; Xu et al., 2024).

Technology-based PE also has socio-emotional implications. Students' engagement with devices can influence not only motivation but also peer interactions, classroom dynamics, and self-perceptions of physical competence. Qualitative research provides insights into these aspects, allowing educators to consider both cognitive and emotional responses when designing technology-supported PE activities (Simón-Chico et al., 2023; Zhang et al., 2023).

This study aims to construct a holistic understanding of students' and teachers' experiences in technology-enhanced PE through a phenomenological qualitative approach. The research focuses on the interaction between technology, student motivation, and physical activity, as well as the contextual factors influencing these experiences. Findings are expected to contribute theoretically by enriching the literature on digital PE education and practically by offering actionable recommendations for educators and policymakers to design more effective, engaging, and meaningful PE programs.

2. Materials and Methods

This study employs a phenomenological qualitative approach to explore the subjective experiences of students and teachers in technology-based PE, focusing on the use of wearable devices and mobile applications. Phenomenology was selected because it emphasizes understanding phenomena from participants' perspectives, capturing the essence of their lived experiences without the constraints of quantitative measurements (Creswell & Poth, 2018).

The research was conducted in three secondary schools in Indonesia that have incorporated digital tools into regular PE lessons over two semesters during the 2025–2026 academic year. Schools were chosen based on the availability of wearable fitness trackers, mobile applications, and monitoring systems, as well as their willingness to participate voluntarily in qualitative research.

Participants included 24 students and six PE teachers, selected through purposive sampling based on their active engagement with technology during PE lessons and their ability to provide reflective insights into their experiences. Snowball sampling was subsequently used to recruit additional teachers who possessed relevant expertise and could offer deeper insights after initial interviews were conducted.

Data were collected through semi-structured interviews with students and teachers, complemented by participant observation during PE sessions. Interviews focused on participants'

experiences, motivation, challenges, and perceptions regarding technology use, while observations captured student behaviors, interactions with teachers, and responses to digital feedback. Supporting documentation, such as lesson materials and field notes, was also collected for data triangulation.

Data validity was enhanced through source triangulation across interviews, observations, and documentation, as well as member checking by having participants review initial summaries of findings to ensure accurate interpretation. Data analysis followed a thematic approach, including transcription, thorough reading, coding, categorization, and theme development to capture patterns reflecting students' and teachers' experiences in technology-enhanced PE.

3. Results and Discussions

Analysis of the collected data from interviews, observations, and documentation revealed several key themes reflecting students' and teachers' experiences with technology-based physical education (PE). The first prominent theme was enhanced engagement and motivation through personalized feedback. Participants consistently described wearable devices and fitness applications as tools that allowed them to monitor their own physical activity levels, set personal goals, and receive immediate feedback. One student explained, "I can see my steps and heart rate on the app, and it motivates me to move more every day." Observations confirmed that students actively checked their progress during lessons and participated in exercises more consistently when they received instant feedback.

A second theme identified was peer influence and social interaction mediated by technology. The devices fostered a subtle competitive environment where students compared their activity levels, which, in turn, increased motivation. Teachers noted that students encouraged each other to achieve higher scores or complete additional challenges. As one teacher remarked, "Students who normally are less active start joining group challenges after seeing their friends' progress." This social dimension highlights how digital tools not only provide individual feedback but also shape classroom culture and peer dynamics, creating a more collaborative and interactive environment.

The third theme centered on self-awareness and reflective learning. Technology encouraged students to reflect on their physical activity patterns, recognize areas for improvement, and plan subsequent actions. For example, a student reflected, "I noticed I am less active in the afternoon, so I try to take short exercise breaks between lessons." Observations and documentation supported this, showing students using activity logs to plan and modify routines, demonstrating how technology can foster metacognitive skills and self-regulated learning in PE.

Another important finding was teachers' adaptation and pedagogical strategies. Teachers reported that integrating technology required adjustments in lesson planning, monitoring, and instruction. They found it necessary to balance technological engagement with traditional exercises to ensure that students remained physically active while effectively using digital tools. One teacher commented, "I sometimes need to pause the app feedback and focus on guiding students to perform exercises correctly." This finding indicates that technology enhances learning only when teachers are capable of integrating it strategically with their instructional practices.

Finally, a theme of challenges and limitations emerged, including technical issues, unequal access to devices, and occasional distraction from lesson objectives. Some students experienced difficulties syncing their devices or navigating application features. Observations also noted instances where students focused more on the app interface than on performing the physical activity correctly. These findings suggest that while technology can enhance PE learning, careful implementation and teacher guidance are essential to minimize potential downsides.

Discussion

The findings of this study demonstrate that technology-based PE learning can significantly enhance student motivation, engagement, and self-awareness, corroborating earlier literature on the benefits of digital interventions in physical education (Zhao & Su, 2026; Rusmitaningsih et al., 2024). The theme of personalized feedback aligns with self-determination theory, which posits that autonomy, competence, and relatedness are critical to intrinsic motivation (Deci & Ryan, 2000). By providing real-time feedback, technology enhances students' sense of competence and allows them to self-regulate their learning, a factor strongly linked to increased participation and effort.

The peer influence theme illustrates how social context interacts with technology to amplify motivation. Previous studies have indicated that competitive and collaborative digital environments can enhance engagement, especially when students perceive comparisons as supportive rather than punitive (Simón-Chico et al., 2023). This finding contributes a nuanced understanding of how classroom culture and social dynamics influence the effectiveness of technology in PE, emphasizing that technology adoption should consider relational aspects and peer interactions.

The emergence of reflective learning and self-awareness through device usage highlights the pedagogical value of integrating technology in PE. This extends prior research, which predominantly focused on quantitative outcomes, by providing qualitative evidence that students develop metacognitive skills and self-regulated behaviors (Martín-Rodríguez & Madrigal-Cerezo, 2025). These skills are particularly valuable in promoting lifelong physical activity habits, suggesting that digital tools can serve both immediate educational objectives and long-term health outcomes.

Teacher adaptation emerged as a critical factor in the success of technology-enhanced PE. The findings suggest that technology is most effective when it complements, rather than replaces, traditional teaching methods. This aligns with previous literature emphasizing the need for professional development and pedagogical integration to ensure that technological tools facilitate meaningful learning (Lin et al., 2023; Zhang et al., 2023). Teachers' strategic use of technology not only maintains physical activity standards but also supports differentiated instruction tailored to student needs.

Despite its benefits, challenges and limitations identified in the study underscore the need for careful planning and resource allocation. Technical difficulties, unequal access, and potential distractions indicate that technology is not a panacea but rather a complementary tool that requires deliberate design and monitoring. These findings suggest that schools should provide infrastructure support, training, and guidance to maximize benefits while minimizing unintended consequences, which contributes to the discourse on equitable and effective technology implementation in PE.

Overall, this study provides a comprehensive understanding of how technology influences student motivation, engagement, and self-awareness in PE. By linking qualitative insights with existing theory and research, it offers both theoretical and practical contributions: theoretically, by demonstrating the interaction between autonomy-supportive technologies and motivation in PE, and practically, by informing educators and policymakers on strategies for implementing technology in a manner that enhances student learning and physical activity outcomes. Future research may explore longitudinal effects of technology integration, cross-cultural comparisons, and the impact on different age groups to deepen understanding of digital PE pedagogy.

4. Conclusions

This study demonstrates that integrating technology into physical education (PE) can significantly enhance student motivation, engagement, and self-awareness. The main findings indicate that personalized feedback through wearable devices and mobile applications fosters autonomy and competence, while peer interactions mediated by technology strengthen social engagement.

Additionally, reflective learning facilitated by digital tools encourages students to self-regulate their physical activity, and teachers' strategic adaptation ensures that technology complements, rather than replaces, traditional instruction. These results highlight the complex interplay between technology, pedagogy, and social dynamics in PE classrooms, offering valuable insights into the factors that support effective technology-enhanced learning.

The implications of these findings extend to theory, practice, and policy. Theoretically, the study enriches understanding of how autonomy-supportive technologies influence intrinsic motivation and physical activity in educational contexts. Practically, it suggests strategies for educators to integrate technology meaningfully into PE lessons, balancing digital feedback with hands-on instruction. From a policy perspective, the research emphasizes the need for infrastructure, teacher training, and equitable access to ensure all students benefit from technology-enhanced PE. Future research could examine longitudinal effects, cross-cultural applications, or the impact of different age groups to further refine best practices for technology integration in PE.

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