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Digital Technology Integration Strategies to Increase Student Engagement Physical Education Learning: Narrative Review

Termpetch Sookhanaphibarn[1], Putri Nur Alifah[2*]

[1]Faculty of Applied Arts, King Mongkut's University of Technology North Bangkok, Bangkok, Thailand
[2]Faculty of Sport Health Science, Universitas Negeri Surabaya, Surabaya, Indonesia

[*]**Correspondence Email:** *24060464091@mhs.unesa.ac.id*

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ABSTRACT

In the learning process, physical education demands student involvement that goes beyond the physical realm and includes cognitive as well as affective aspects. Although digital technology is rapidly being adopted in the classroom, current literature does not adequately address how it should be used in physical education at the secondary school level. To synthesize digital technology integration strategies and their relation to the three aspects of student engagement, namely behavioural, cognitive, and affective, this paper presents a narrative review. After searching the Scopus database for publications from 2021 to 2026, 78 papers were found. The papers were selected through a gradual procedure that included examination of titles, abstracts, and full texts, based on pre-established eligibility criteria. In the end, two studies met all the requirements and underwent thematic analysis. The synthesis shows that digital technologies including flipped learning, video, apps, and tracking devices increase engagement not only through their presence, but also through pedagogical functions such as maximizing activity time, facilitating individualization, providing feedback, and encouraging reflection. Although affective engagement is under supported by statistical evidence and cognitive engagement is still in the early stages, behavioural engagement has the strongest evidence. This article highlights the need for further research with robust designs and multidimensional engagement measurement instruments, as well as concludes that teacher roles, digital competence, and the balance between technology use and physical activity time are important factors determining successful integration.

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INTRODUCTION

In the school curriculum, Physical Education occupies a distinctive position because it has many goals and does not stop at the mastery of motor skills (Al Ardha et al., 2024; Trial et al., 2021). These subjects also contribute to students' cognitive, social, and affective development through structured moving experiences (Jastrow et al., 2022). Unlike most other subjects that take place in a relatively static learning environment, physical education makes physical activity at the core of its learning process (Zhou et al., 2025). Consequently, the success of physical education learning is not enough to be measured by the achievement of movement skills alone, but also by the extent to which students are actually actively involved throughout the learning process (Stringfellow et al., 2024). The construct of student engagement becomes relevant at this point, as it describes how students participate in activities, pay attention, exert effort, and respond to their learning experiences (Stringfellow et al., 2024). In the context of physical education, this engagement is multidimensional and is generally mapped into three dimensions: behavioral, cognitive, and affective engagement (Noetel et al., 2023).

The development of digital technology opens up opportunities for physical education teachers to design more varied learning through the use of various learning platforms, digital materials, applications, and technology-based pedagogical approaches (Al Ardha et al., 2024; Wang et al., 2023). Smartphone applications, learning videos, wearable devices, gamification, digital learning platforms, and feedback-based technology are now available to support the delivery of materials, monitoring activities, providing feedback, reflection, and individualizing student learning experiences (Jastrow et al., 2022; Knoke et al., 2024). The presence of this technology in turn allows learning to be more interactive, while accelerating students' access to information and feedback (Jastrow et al., 2022; Knoke et al., 2024). This potential shows that digital technology can play a role in supporting student engagement in various aspects of physical education learning, including participation, motivation, interaction, activity monitoring and receiving feedback (Patil, 2024; Knoke et al., 2024).

However, the availability of digital technology does not only result in higher student engagement (Jastrow et al., 2022; Vulpe & Mijaica, 2025). Its effectiveness depends heavily on how the technology is aligned with learning objectives, pedagogical strategies, physical activity characteristics, student needs, and the role of teachers as facilitators (Østerlie et al., 2022; Saiz et al., 2025). When technology is only placed as a complement without a clear pedagogical function, it does not necessarily contribute to student engagement (Jastrow et al., 2022). On the other hand, technology used to expand activity opportunities, provide feedback, support reflection, or adapt the learning experience to students' needs has the opportunity to become an integral part of pedagogical strategies that support student engagement (Jastrow et al., 2022; Knoke et al., 2024).

This problem becomes more complex considering that research on digital technology in physical education tends to use very diverse outcomes, ranging from motivation, technology acceptance, usability, physical fitness, motor skills, to learning outcomes (Jastrow et al., 2022; Knoke et al., 2024; Youness et al., 2026). These variables are indeed related to the

student's learning experience, but they cannot be simply equated with student engagement. Motivation basically describes a student's drive to do an activity, while engagement refers to the manifestation of that involvement during the learning process (Stringfellow et al., 2024;(Miao et al., 2024; Nur et al., 2023). A student may be highly motivated, but may not necessarily show equal behavioral, cognitive, or affective involvement (Nagy et al., 2022). This conceptual difference shows that research that specifically examines the integration of technology to support engagement needs to be distinguished from research that merely evaluates students' responses to technology, This distinction is important so that the contribution of technology to engagement is not inferred solely based on students' acceptance or positive response to technology (Dimo et al., 2024; Stringfellow et al., 2024).

Students' proximity to technology does not only guarantee that technology will be used effectively as a means of learning. In the context of physical education, a pedagogical integration is needed that can connect students' digital experiences with learning goals and activities (Hamilton et al., 2023; Mammadov & Schroeder, 2023). This condition opens up opportunities for physical education teachers to integrate various digital strategies and technologies, such as flipped learning, video feedback, physical activity applications, tracking tools, and interactive digital media (Knoke et al., 2026; Jastrow et al., 2022). However, the use of technology in physical education still needs to maintain its main characteristics as movement-based learning. The use of digital media that is not designed pedagogically has the potential to reduce the time of physical activity or increase sedentary behavior, so its use needs to be adjusted to the goals and characteristics of learning (Jastrow et al., 2022; Knoke et al., 2024).

A number of previous studies have indeed shown the potential of digital technology in supporting student engagement through various mechanisms, such as increasing motivation, providing feedback, strengthening interactions, support for independent learning, and personalizing learning experiences (Knoke et al., 2024; Kristiyandaru et al., 2023; Youness et al., 2026). Digital materials accessed before learning, for example, can reduce the need for in-person instruction delivery during face-to-face learning in the classroom so that more face-to-face time can be allocated to practice and practice skills (Østerlie et al., 2022; Yip & Cheng, 2023). On the other hand, videos, apps, and tracking tools have proven to be useful for providing feedback, supporting self-monitoring, and encouraging student reflection on the activities that have been carried out (Knoke et al., 2024; Mödinger et al., 2022; Vulpe & Mijaica, 2025). This pattern suggests that the relationship between technology and engagement is not solely determined by the type of device used, but by the pedagogical function and the way in which the technology is placed in the learning process (Jastrow et al., 2022; Vulpe & Mijaica, 2025).

The problem is that although the use of digital technology in physical education is growing, empirical evidence on how its integration relates to *student engagement*, especially in the context of secondary schools, is still limited and shows heterogeneity in the types of technology, learning design, and outcomes studied (Jastrow et al., 2022; Youness et al., 2026; Jastrow et al., 2022). Existing studies use different types of technology, learning strategies, engagement indicators, and implementation contexts, so that technology integration

strategies that can consistently support behavioral, cognitive, and emotional engagement dimensions in physical education have not been comprehensively synthesized (Nkomo et al., 2021; Jastrow et al., 2022). This condition underlies the need for a synthesis that specifically examines how digital technology is integrated into secondary school physical education learning, the forms of engagement it targets, and the conditions that support or hinder its implementation (Zhong et al., 2025; Jastrow et al., 2022; Vulpe & Mijaica, 2025).

Based on these problems, this narrative review aims to synthesize research on digital technology integration strategies in physical education learning at the secondary school level. More specifically, this review identifies the type of technology used, pedagogical strategies in integrating these technologies, the reported dimensions of student engagement, and the supporting and inhibiting factors for its implementation. Through this synthesis, it is hoped that a more targeted understanding of how digital technology can be used as a pedagogical tool to support student involvement, without sacrificing the characteristics of physical education as movement activity-based learning.

METHODS

Review Approach

This article uses a narrative review approach to identify and synthesize research narratives on the integration of digital technology in physical education learning at the secondary school level. The choice of narrative approach is based on the high diversity of relevant literature, both in terms of the type of technology, pedagogical strategies, research design, learning context, and student engagement indicators used. With data characteristics like this, interpretive and thematic synthesis is considered more appropriate than quantitative synthesis such as meta-analysis.

This review is not directed to calculate the magnitude of the effect of technology use statistically. The main focus is to understand the integration pattern of digital technology, the pedagogical functions that accompany it, the forms of student involvement that emerge, and the contextual conditions that also affect the implementation of technology in physical education learning.

Review Question

The review is guided by one key question: How is digital technology integrated into secondary physical education learning to support student engagement, and what contextual factors influence its implementation? To answer these questions, the review sets five specific objectives:

1. Identify the types of digital technologies used in secondary school physical education learning.
2. Identify pedagogical strategies used to integrate digital technologies.
3. Identify the dimensions and indicators of student engagement reported in the study.
4. Synthesize how digital technology integration relates to behavioral, cognitive, and affective engagement.

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5. Identify factors that support and hinder the implementation of digital technology in physical education learning.

Scope of the Review

This review focuses on empirical research involving high school students in the context of physical education learning in schools, with the age range of participants being around 12-18 years. The digital technologies covered include applications, videos, wearable devices, gamification, digital platforms, tracking tools, and technologies used for feedback, monitoring, assessment, reflection, or collaboration.

The main outcome that the review is concerned with is student engagement, which is understood as student involvement in the learning process covering three dimensions: behavioral, cognitive, and affective engagement. This review does not limit itself to research that compares the use of technology with conventional learning, given that the main focus is to understand how technology is pedagogically integrated in the learning process, not just to prove its superiority over other methods.

Literature Search

The literature search was conducted through the Scopus database, which was chosen for its broad coverage of the fields of education, sports science, and technology. The search was conducted on September 10, 2026 for the publication period 2021-2026. The search strategy is prepared based on three main concepts: digital technology, physical education, and secondary school. Terms with similar meanings in each concept are combined using the Boolean OR operator, while the three main concepts are combined using the AND operator. The term engagement is deliberately not made a mandatory component in the search, considering that this strategy risks missing articles that use other terms such as participation, involvement, or on-task behavior. The relevance to student engagement is then determined through the screening stage. The initial search yielded 78 articles, which were then filtered based on population suitability, learning context, use of digital technology, and their relationship to student engagement.

Eligibility Criteria

A literature is considered for inclusion if it meets the following eight criteria:

1. engaging high school students;
2. carried out in the context of physical education learning in schools;
3. using digital technology as part of the learning process;
4. technology has a clear pedagogical function, such as delivering materials, feedback, assessment, monitoring, reflection, or collaboration;
5. report student engagement or indicators that clearly represent student engagement;
6. is empirical research;
7. issued in the period 2021-2026; and
8. Full text is available for assessment.

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Articles are not used as primary sources if they only discuss motivation, technology acceptance, usability, satisfaction, physical fitness, or motor performance without accompanying indicators of student involvement. Reviews, editorials, protocols, or conference abstracts are also not included as primary studies.

Operational Definition of Student Engagement

In this review, student involvement is understood as the active involvement of students in the physical education learning process, which consists of three dimensions, namely behavioral, cognitive, and affective involvement. These dimensions are identified based on the indicators reported in the included research study.

Behavioral Engagement

These dimensions include active participation, on-task behavior, engagement in learning activities, persistence, skill practice, and physical activity, as long as these aspects are indeed used by related research as indicators of engagement during learning.

Cognitive Engagement

These dimensions include attention, engagement with information, active learning, reflection, and self-regulated learning.

Affective Engagement

These dimensions include interest, enjoyment, enthusiasm, emotional engagement, and positive experiences during the learning process. Motivation in this review is not treated as a synonym for student engagement. Research that only measures motivation, technology acceptance, usability, satisfaction, or intention to use technology, without being accompanied by indicators of engagement, is not considered direct evidence of student engagement.

Data Synthesis

Studies that meet the inclusion criteria are analyzed thematically. Information from each study is organized based on study characteristics, type of technology, pedagogical strategies, student engagement indicators, key findings, as well as supporting and inhibiting factors for implementation. The synthesis was then carried out by identifying patterns that emerged across the research, in order to explain the relationship between the form of technology integration, the resulting learning mechanisms, and the observed dimensions of student engagement. Given that the number and characteristics of the available studies are still limited and heterogeneous, the results are presented narratively and are not intended to produce quantitative effect estimates

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RESULTS

Identification and Selection of Studies

A literature search on the Scopus database which was carried out on September 10, 2026 yielded 78 articles. The articles then went through a screening process based on titles and abstracts, taking into account the suitability of the population, the learning context of physical education, the use of digital technology, and its relationship with student engagement.

From this process, 17 articles were retained for further exploration at the full text stage. Four of them could not be obtained in full text form, leaving 13 articles that could be fully assessed based on eligibility criteria.

At the full-text screening stage, most of the articles were excluded because the outcomes measured did not directly represent student engagement. Some of them focused on motivation, technology acceptance, usability, physical fitness, motor performance, or technology development alone, without evaluating student involvement in learning. Some other articles did use digital technology, but did not place it as part of the pedagogical strategy of physical education learning.

After going through all the assessment stages, two studies were declared to meet all inclusion criteria and included in the narrative synthesis. This figure confirms that of the 78 articles identified in the initial search, only a small percentage specifically linked the integration of digital technology to student involvement in secondary school physical education learning.

Table 1. Study Selection Process

Stages	Quantity
Identified articles from Scopus	78
Article after screening title + abstract	17
Full text cannot be obtained	4
Full text assessed eligibility	13
Full text removed	11
Studies included in the narrative review	2

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Characteristics of Included Studies

Both studies that met the inclusion criteria showed different approaches in integrating digital technology into physical education learning. The first study used a quantitative approach with a comparative design between flipped learning and hands-on learning, while the second study used a qualitative approach to explore students' experiences of the use of digital media in physical education.

Killian et al., (2022) involved 56 7th grade male students from two physical education classes in schools with low socioeconomic conditions. This study applied a comparative quantitative approach by utilizing Chromebooks, digital materials, videos, learning management systems, and formative assessments in the framework of flipped learning. The indicators used included physical activity, MVPA, activity participation, and skill practice.

Meanwhile, Knoke et al., (2026) using a qualitative approach involving 15 high school students. Data were collected through semi-structured interviews and analyzed using qualitative content analysis. The digital media covered included videos, tablets, apps, and tracking tools, which were associated with individualization of learning, feedback, reflection, and learning about health.

Table 2. Characteristics of Included Studies

Author	Country	Design	Participants	Technology	Integration Strategy	Engagement Indicator	Key Findings
(Killian et al., 2022)	United States	Quantitative, comparative	56 7th grade male students	Chromebooks, digital materials, videos, LMS, formative assessments	Flipped learning before and during learning	MVPA, activity participation, skill practice	Flipped learning increases MVPA time and provides more time for skill practice
(Knoke et al., 2026)	Jerman	Qualitative	15 high school students	Videos, tablets, apps, tracking tools	Digital media for individualization, feedback, reflection, and health learning	Student-reported behavioral engagement and reflective engagement	Technology is accepted when it has pedagogical value, supports feedback/reflection, and does not reduce movement time

Patterns of Digital Technology Integration

The synthesis of the two studies shows that digital technology does not simply function as an auxiliary device, but is placed in a specific learning structure and strategy. Although the types of technology and research designs are different, the two studies show a relatively similar pattern of integration, namely technology is used to improve the efficiency of learning time, provide a more individualized experience, provide feedback, support self-monitoring, and encourage reflection.

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Based on these findings, four main pedagogical functions of digital technology were identified in this synthesis, namely: (1) optimizing learning time through flipped learning; (2) supporting individualization of learning; (3) providing feedback and self-monitoring; and (4) supporting reflection and active learning.

Flipped Learning and Optimization of Active Learning Time

Flipped learning places digital learning materials before the face-to-face session takes place. This approach allows part of the information delivery process to be moved outside of practice time, so that face-to-face time can be used more optimally for physical activities and skill training.

Killian et al., (2022) noted that classes that applied flipped learning had a percentage of learning time in moderate-to-vigorous physical activity (MVPA) of 74.84%, compared to 53.12% in traditional learning classes. The duration of MVPA was also higher in the flipped learning group, which was 24.16 minutes compared to 17.20 minutes. Flipped learning classes also had a larger proportion of time for skill practice and free play.

These findings indicate that one of the potential functions of digital technology in flipped learning is to cut down on passive instructional time, while shifting more face-to-face time to movement activities. Technology in this context is not the goal of learning itself, but a tool to optimize the structure of learning time.

Individualization of Learning

The second strategy identified is the use of digital media to adapt the learning process to the needs and abilities of students. In the study (Knoke et al., 2024), Students view videos, tablets, apps, and tracking tools as means of supporting more individualized learning.

Individualization has special relevance in physical education, given the level of physical ability and motor skills of students that tend to be heterogeneous (Knoke et al., 2024; Jastrow et al., 2022). Technology allows access to information or feedback that is more appropriate to the needs of each student, thus potentially increasing the relevance of the learning experience and encouraging students to more actively manage their own learning process (Cui et al., 2024; Mejeh et al., 2024).

However, the findings on individualization in this review are largely derived from students' experiences and perceptions. Therefore, individualization is more accurately understood as a potential mechanism that can support engagement, rather than as direct evidence that technology consistently increases student engagement.

Feedback and Self-Monitoring

Digital technology opens up opportunities for faster feedback and facilitates self-monitoring. Apps and tracking tools can help students access information about their activities or performance directly. Knoke et al., (2026) found that students view performance feedback and self-monitoring as one of the main benefits of using digital media. This mechanism has the potential to support student engagement as they no longer only receive information from teachers, but also gain the opportunity to observe, evaluate, and understand

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their own learning process. This pattern shows the interconnectedness between technology and cognitive engagement: students are involved in the process of receiving information, processing it, and then using it to understand or evaluate their performance.

Reflection and Active Learning

In addition to feedback, digital technology can also encourage the reflection process. Videos, applications, and visual media allow students to re-observe their activities or performance, so that learning does not stop at the stage of implementing movements alone (Mödinger et al., 2022). Knoke et al., (2026) shows that digital media is able to present feedback loops that support reflection on students' activities and efforts. In this context, technology provides space for students to connect the experience of making movements with the process of observation and evaluation. The use of technology for reflection ultimately expands the learning experience of physical education, from simply doing physical activity to a process that also involves observation, understanding, evaluation, and self-regulation (Mödinger et al., 2022; Shearer et al., 2021).

Dimensions of Student Engagement

Based on the synthesis of the two studies, the evidence on student engagement is most clearly observed in behavioral engagement, while cognitive engagement shows evidence that is still developing, and affective engagement is still very limited.

Table 3. Identified Dimensions of Student Engagement

Dimensions	Indicator	Evidence
Behavioral Engagement	MVPA, activity participation, skill practice, involvement in learning activities.	Killian et al. (2022)
Cognitive Engagement	Reflection, self-monitoring, engagement with information, individualized learning.	Knoke et al. (2026)
Affective Engagement	Enjoyment, interest, positive experience.	The evidence is still limited; more emerge as an indirect mechanism

On the study Killian et al., (2022), behavioral engagement is reflected primarily through an increase in MVPA and the proportion of time spent on skill practice. This data shows that flipped learning is able to provide more opportunities for students to be physically engaged during learning. It should be noted that MVPA in this review is treated as one of the indicators of behavioral engagement, not a single representation of overall student engagement, considering that engagement is essentially a multidimensional construct.

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On the study Knoke et al., (2026), Student involvement is more reflected through their experience of the learning process, especially in the aspects of individualization, feedback, self-monitoring, reflection, and engagement with health information. These findings mainly provide an overview of cognitive engagement. The evidence on affective engagement is still relatively limited. Interest, enjoyment, and positive experiences do appear in students' experiences of using technology, but they are not yet the main outcomes that are measured specifically using engagement instruments.

Facilitating and Inhibiting Factors

The synthesis of the second study shows that the potential effectiveness of digital technology in supporting engagement is not solely determined by the existence of the technology itself. Pedagogical and contextual factors also play a role in determining how technology is received and utilized in the learning process. Supporting factors identified include:

1. A clear pedagogical value, namely technology has a function that directly supports learning goals.
2. Individualize learning, so that students can gain learning experiences according to their needs and abilities.
3. Quick feedback, which helps students understand their performance.
4. Self-monitoring and reflection, which allows students to engage in the evaluation of the learning process.
5. Efficiency of learning time, especially when technology is used before face-to-face learning.
6. Maintenance of physical activity time, so that the use of technology does not replace movement activities.

On the other hand, the inhibiting factors identified include limited infrastructure, teachers' digital competence, privacy concerns, distractions, social pressure, as well as concerns that the use of technology can reduce physical activity time. Students' acceptance of technology appears to be conditional. Technology is more readily accepted when students understand its pedagogical value, feel the real benefits of its use, and still have adequate opportunities for physical activity.

DISCUSSION

Technology as a Pedagogical Tool Rather Than an Independent Driver of Engagement

The available research synthesis confirms that digital technology cannot be seen as a factor that automatically increases student engagement (Ha et al., 2025; Knoke et al., 2024; Jastrow et al., 2022). The two included studies actually show that the benefits of technology only arise when it is placed in a learning design with a clear pedagogical function. These findings shift the way we view technology in physical education. The relevant question is no longer just whether a device or app is capable of increasing engagement, but rather how it is used in learning structures to create conditions that allow students to be actively engaged.

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On the study (Killian et al., 2022), Technology is used within the framework of flipped learning to move part of the process of delivering information beyond face-to-face time. As a result, face-to-face time can be utilized more for physical activity and skill training, placing technology as a pedagogical instrument that changes the distribution of learning time. This pattern illustrates that the contribution of technology to engagement can occur through indirect mechanisms. Technology does not increase engagement simply because it is used, but because its use changes the learning experience so that students have more opportunities to be active (Jastrow et al., 2022; Knoke et al., 2024).

Mechanisms Linking Digital Technology and Student Engagement

Based on the synthesis of the two studies, there are several mechanisms that can explain the relationship between technology integration and student engagement, including optimization of activity time, individualization of learning, feedback, self-monitoring, and reflection. Optimization of activity time is primarily related to behavioral engagement. When basic materials are delivered through technology before a face-to-face session, the time previously allocated for instruction delivery can be diverted to movement activities and skill training.

Individualization, feedback, and self-monitoring have a stronger relationship with cognitive engagement (Huang et al., 2026). Through this mechanism, students gain the opportunity to observe their performance, understand information, monitor their development, and evaluate their learning process, a process that in turn can increase the cognitive engagement that accompanies movement learning (Yan et al., 2026).

Reflection then acts as a link between behavioral and cognitive engagement. Students engage in physical activity, obtain information about their performance, and then use this information to evaluate their experiences and determine steps to improve (Mödinger et al., 2022). Through this process, technology creates a kind of feedback loop between activities, information, evaluations, and subsequent actions. These patterns can be summarized in the following conceptual flow:

Digital Technology → Pedagogical Integration → Learning Mechanism → Student Engagement

In this flow, digital technology plays a role as a source or medium, while pedagogical strategies determine how the technology produces certain learning mechanisms. This mechanism ultimately has the potential to influence the forms of engagement that emerge.

Behavioral Engagement: Strongest Evidence

Among the three dimensions of engagement, the evidence on behavioral engagement was the clearest finding in the included studies. The use of flipped learning was shown to be associated with a higher proportion of MVPA time as well as a greater time allocation for skill practice. These findings are important in the context of physical education, given that physical activity is a fundamental component of the learning process. Technology that is able

to cut passive instructional time while providing more opportunities to move has direct relevance to the characteristics of this subject.

However, the increase in MVPA should not be interpreted as evidence that all dimensions of student engagement are also increasing. MVPA is more appropriately positioned as one of the indicators of behavioral engagement, rather than a single representation of overall student engagement. This difference is important to underline, as students can show high levels of physical activity without equivalent cognitive or affective involvement. Further research needs to use a truly multidimensional approach, so that behavioral engagement does not become the only representation of student engagement.

Cognitive Engagement: Emerging Evidence

Evidence of cognitive engagement primarily emerges through the use of technology for individualization, feedback, self-monitoring, and reflection (Mödinger et al., 2022; Chen et al., 2026). Through this mechanism, students get the opportunity to interact with information about their activities or performance, then use this information to understand the learning process undertaken. This shows that technology has the potential to expand the learning function of physical education, from just the ability to perform movements, to a process that also involves observation, understanding, evaluation, and reflection on the movement. However, the available evidence on cognitive engagement is still relatively limited, given that one study used a qualitative approach to describe student experience. These findings are therefore more appropriately understood as an indication of the existence of a cognitive engagement mechanism, rather than as quantitative evidence for its improvement.

Affective Engagement: Limited Evidence

Affective engagement is the dimension with the most limited evidence among the three. Interest, enjoyment, enthusiasm, and positive experiences do appear in students' experiences of using technology, but they are not yet the main outcomes that are explicitly measured through student engagement instruments. This condition has led to the lack of an adequate basis for concluding that digital technology consistently increases affective engagement. Positive experiences with technology have the potential to be a supportive condition for engagement, but this relationship still needs further research to be ascertained. Future research needs to pay more attention to the affective dimension, given that students' interest and emotional experiences can affect the sustainability of their engagement in physical education learning. This relationship, however, needs to be tested using instruments that explicitly measure affective engagement.

The Central Role of the Teacher

Although technology is an important part of learning strategies, teachers still hold a central position in determining how they are used (Wohlfart & Wagner, 2023). Teachers are responsible for choosing technology that suits learning objectives, regulating when and how devices are used, providing direction, and ensuring that technology does not degrade the quality of learning interactions.

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Teachers' digital competencies in this context are not limited to the ability to operate devices or applications. These competencies also include pedagogical abilities to determine when technology is really needed, what functions the technology should perform, and how it can be integrated with physical activities. Technology and teachers should therefore not be positioned as two components that replace each other. Technology serves to expand teachers' pedagogical abilities, while teachers remain the ones who determine the design and quality of students' learning experiences.

The role of teachers is also crucial in controlling potential obstacles, such as distractions, excessive use of devices, and limitations of digital competence. Effective technology integration ultimately requires a balance between technical competence and pedagogical competence of teachers.

Maintaining the Balance Between Technology and Physical Activity

One of the important findings of this review is the need to maintain a balance between the use of technology and physical activity. Physical education has different characteristics from subjects that mostly take place in a sedentary manner, so the use of technology in it needs to carefully consider active learning time. Technology becomes relevant when the pedagogical value it generates is greater than the time spent operating the device. Flipped learning is one real example: technology is used outside of the main activity time, so that face-to-face time can be used more to move around.

On the other hand, excessive use of devices during learning risks reducing activity time and actually increasing distractions. The principle of integrating technology in physical education is therefore not a matter of increasing the use of technology, but placing it in the learning part that does need digital support. Technology, in other words, should serve to strengthen physical activity and the learning process, not replace the physical activity that is the main characteristic of physical education.

Motivation Is Not Equivalent to Student Engagement

Another important conceptual implication of this review is the need to make a clear distinction between motivation and student engagement. In the physical education technology literature, there is not a few studies that make motivation, acceptance of technology, usability, satisfaction, or intention to use technology as the main outcomes.

These variables do provide valuable information about students' experiences, but they do not necessarily reflect their involvement during the learning process. Students may be highly motivated to use an app, but may not necessarily show active participation, attention, reflection, or emotional involvement during learning.

This difference has important implications for how the results are interpreted. Findings in the form of increased motivation alone should not be directly interpreted as an increase in student engagement. Future research needs to use explicit engagement indicators, as well as clearly distinguish between the psychological factors that drive engagement and the manifestation of engagement itself.

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Implications for Physical Education Practice

Based on the synthesis that has been described, there are several practical implications that can be considered in high school physical education learning.

1. Technology can be used before a learning session through flipped learning to deliver basic materials, movement demonstrations, or other supporting information. This strategy provides more face-to-face time for physical practice and activity.
2. Videos and apps can function as a means of feedback, allowing students to record, observe, and evaluate their own movements so that learning becomes more active and reflective.
3. Tracking tools can be used to support self-monitoring, where the data generated becomes material for students to understand their activities and performance developments.
4. Teachers need to set clear limits on the use of devices, so that technology does not become a source of distraction and does not reduce active learning time.
5. The choice of technology should be based on learning objectives, not simply because it is available or considered modern. Its use should provide a clear pedagogical function and be relevant to the needs of students.

The main principle of integrating technology in physical education is therefore not "the more technology the better", but rather "technology is used when it provides a clear pedagogical value to the learning process and student engagement."

LIMITATIONS

As a narrative review, this study has several limitations that need to be considered in interpreting the results. First, literature searches are only conducted through the Scopus database. Although the scope is quite broad and multidisciplinary, it is possible that relevant research indexed in other databases is not also identified. Second, the search strategy is based on three main concepts, namely digital technology, physical education, and secondary school, without including the term engagement as a mandatory component. This choice is intended to avoid the loss of articles that use terms such as participation, involvement, or on-task behavior, but as a consequence, the search results become broader and require a stricter screening process.

Third, only two studies ultimately met all the inclusion criteria. This makes the available evidence base very limited and heterogeneous, so the results of this review cannot be used to generalize that all forms of digital technology consistently increase student engagement. Fourth, the screening process is carried out by one reviewer, so that there is a possibility of subjectivity in making decisions regarding the feasibility of the study. The criteria for inclusion, exclusion, and operational definition of engagement are used as an effort to maintain the consistency of the selection process.

Fifth, one of the included studies used a qualitative approach that described students' experiences and perceptions, instead of using special quantitative instruments to measure engagement. The interpretation of cognitive and affective engagement in this review therefore needs to be done carefully. Sixth, there were differences in research design and engagement indicators between the two included studies, so the findings could not be

directly compared as an equivalent measure of effectiveness. The results of this review are more appropriately used to identify patterns of technology integration and mechanisms that have the potential to support engagement, rather than to determine the most universally effective technology or strategy.

CONCLUSION

This narrative review shows that empirical evidence on the integration of digital technology and student engagement in secondary school physical education learning is still relatively limited. Of the 78 articles identified through Scopus, only two studies ultimately met all inclusion criteria, with differences in research design, technological forms, pedagogical strategies, and engagement indicators also confirming the heterogeneity of the available evidence.

The synthesis of the second study shows that digital technology has the potential to support student engagement if integrated through pedagogical strategies with clear learning functions. Flipped learning, for example, shows strong potential in supporting behavioral engagement through increased opportunities for physical activity and skill practice. Meanwhile, the use of videos, apps, and tracking tools is more related to cognitive engagement through feedback, self-monitoring, individualization, and reflection. Evidence on affective engagement, on the other hand, is still limited because this dimension has not been widely measured explicitly in existing research.

The findings of this review also confirm that the contribution of technology to engagement does not only depend on the type of technology used, but also on the way in which it is integrated into the learning process. Pedagogical and digital competence of teachers, availability of infrastructure, privacy protection, distraction control, and maintenance of physical activity time are factors that need to be considered in its implementation.

On that basis, digital technology is more appropriately positioned as a pedagogical tool that strengthens the learning process and student engagement, rather than as a learning goal itself. Further research needs to use stronger designs, larger samples, and validated and multidimensional student engagement instruments. Simultaneous measurement of behavioral, cognitive, and affective engagement is also needed to gain a more comprehensive understanding of the mechanisms that link the integration of digital technology with student engagement in secondary school physical education learning.

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CONFLICT OF INTEREST

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