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DIGITAL TRANSFORMATION IN PHYSICAL EDUCATION: A SYSTEMATIC LITERATURE REVIEW OF AUDIO-VISUAL MEDIA IMPLEMENTATION IN INDONESIA (2015–2025)

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Abstract
Digital transformation in physical education is accelerating globally, yet in developing countries like Indonesia, this process is uniquely shaped by infrastructural challenges and a mobile-first landscape. This study employs a Systematic Literature Review (SLR) following the PRISMA 2020 protocol to analyze the evolution of audio-visual media implementation in Indonesian physical education from 2015 to 2025. Data were sourced from Google Scholar, DOAJ, and SINTA databases, resulting in 42 selected articles that were analyzed using thematic analysis. The results reveal a significant pedagogical shift from the "substitution" level, characterized by passive video consumption during the pandemic, to the "redefinition" level, marked by the development of immersive Augmented Reality and interactive Android applications in the post-pandemic era. While these tools effectively enhance motor skill acquisition for closed skills and boost student engagement through gamification, a persistent digital divide remains a critical barrier in rural areas. The study concludes that Indonesian physical education is undergoing a rapid transition towards mobile-assisted learning, necessitating policies that prioritize infrastructure equity and transform teachers from consumers into creators of digital content.

Keywords: *audio-visual media; digital transformation; physical education; educational technology.*

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INTRODUCTION

The integration of technology in physical education (PE) has shifted from a supplementary administrative tool to a fundamental pedagogical requirement in the 21st century. According to the TPACK framework, effective teaching now requires the seamless intersection of technological, pedagogical, and content knowledge, transforming how movement skills are transferred to students (Roblyer & Hughes, 2023). In the specific context of motor learning, the delivery of information plays a critical role. Mayer's (2020) Cognitive Theory of Multimedia Learning posits that the human brain processes information through dual channels (visual and auditory) implying that audio-visual media is significantly more effective in enhancing skill acquisition compared to verbal instruction alone. This theoretical foundation suggests that digital media, ranging from simple video tutorials to immersive

Augmented Reality (AR), serves as a crucial scaffold for students to construct mental blueprints of complex physical movements (Magill & Anderson, 2021).

However, the implementation of these technologies in Indonesia presents a unique paradox. On one hand, Indonesia exhibits massive digital adoption, with internet penetration reaching 79.5% of the population, dominated by mobile device usage (APJII, 2024). On the other hand, the quality of education remains a challenge, as evidenced by the 2022 PISA results which highlight the urgent need for instructional improvement rather than mere digital consumption (OECD, 2023). This discrepancy is further complicated by the infrastructure gap between urban and rural areas (Badan Pusat Statistik, 2023). Consequently, the digital transformation of physical education in Indonesia is not driven by high-end school laboratories, but rather by a "grassroots" adoption of personal mobile devices and accessible platforms like YouTube and Android applications. This phenomenon forces teachers to adapt strictly to a mobile-first learning environment, often bypassing formal training to overcome facility limitations (World Bank, 2020).

Despite this rapid adoption, current research on digital PE in Indonesia remains fragmented. Previous studies have largely polarized into two categories: emergency remote teaching during the COVID-19 pandemic which focused on basic delivery via WhatsApp or Zoom (Cahyono et al., 2021; Rukmana & Puriana, 2021), and isolated development research on specific tools like Prezi or simple video tutorials (Febrianto & Astuti, 2023; Ladjar et al., 2025). There is a notable scarcity of comprehensive reviews that map the entire evolutionary trajectory of this implementation, from the passive use of instructional videos to the recent integration of interactive Augmented Reality and gamification. Furthermore, the effectiveness of these media in improving actual motor skills versus merely increasing theoretical knowledge remains inconsistent across local literature.

This study aims to bridge this gap by providing a Systematic Literature Review (SLR) of audio-visual media implementation in Indonesian physical education from 2015 to 2025. This specific timeframe was selected to capture the significant shift from pre-pandemic traditional methods, the disruption of the pandemic era, and the post-pandemic acceleration towards immersive technologies

such as Augmented Reality (Kusbiantoro, 2025). By analyzing these trends, this article elucidates how digital transformation is reshaping the pedagogical landscape of physical education in developing countries, offering strategic insights for educators and policymakers in fostering a smart, technology-integrated learning environment.

METOD

This study employs a Systematic Literature Review (SLR) design to identify, evaluate, and interpret available research relevant to a specific research question. The review protocol strictly follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 statement to ensure transparency and reproducibility of the selection process. The primary objective is to map the digital transformation trajectory in Indonesian physical education over the last decade. To achieve comprehensive coverage, the data search was conducted across three major academic databases: Google Scholar, DOAJ (Directory of Open Access Journals), and SINTA (Science and Technology Index). These databases were selected because they host the majority of physical education research published in the Indonesian context.

The literature search was performed in January 2025 using a specific string of keywords combined with Boolean operators to filter relevant documents. The English search string used was: ("Physical Education" OR "PJOK") AND ("Audio-Visual" OR "Video Learning" OR "Augmented Reality" OR "Android Application") AND ("Indonesia"). A similar search string in Bahasa Indonesia was also applied to capture local publications.

To ensure the quality and relevance of the data, specific inclusion and exclusion criteria were established. The inclusion criteria were: (1) peer-reviewed journal articles published between 2015 and 2025; (2) studies conducted within the educational context in Indonesia (elementary to higher education); (3) articles discussing the development or implementation of audio-visual media, including video, multimedia, and Augmented Reality; and (4) empirical studies (quantitative, qualitative, or R&D). Conversely, the exclusion criteria included: (1) articles published before 2015; (2) non-empirical papers such as opinion pieces, editorials,

or book reviews; (3) proceedings or incomplete drafts; and (4) studies focusing on sports coaching outside the school curriculum context.

The selection process involved a multi-stage screening method. First, all identified records were imported into a reference manager to remove duplicates. Second, the titles and abstracts were screened to assess their relevance to the research questions. Third, the remaining articles underwent a full-text assessment to ensure they met the inclusion criteria. A Quality Assessment (QA) was also performed to evaluate the methodological rigor of each study. Articles with unclear methodology or insufficient data were excluded at this stage.

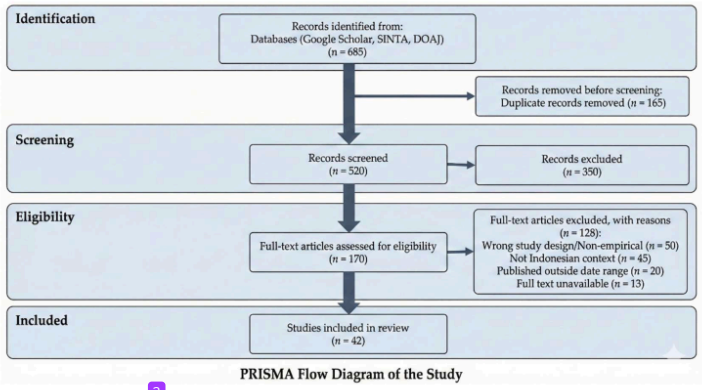

Figure 1. PRISMA Flow Diagram of the Study

The data analysis technique used in this study was Thematic Analysis. The selected articles were coded and categorized based on two main themes: the type of technology used (e.g., passive video vs. interactive AR) and the pedagogical impact (e.g., motor skill acquisition vs. student motivation). This approach allowed the researchers to construct a coherent narrative regarding the shifts in digital adoption over the observed decade.

RESULT AND DISCUSSION

The systematic search and screening process resulted in the final inclusion of 42 articles relevant to the implementation of audio-visual media in Indonesian physical education. The distribution of these studies from 2015 to 2025 reveals a

significant upward trend in research activity. As detailed in Table 1, publication volume remained relatively low between 2015 and 2019 but experienced a sharp spike during the 2020–2022 period. This surge directly correlates with the COVID-19 pandemic, which forced educators to adopt remote teaching technologies. Furthermore, a shift in research methodology is evident. While earlier studies were predominantly descriptive quantitative surveys, the period from 2023 to 2025 shows a dominance of Research and Development (R&D) studies. This indicates that Indonesian educators have transitioned from merely consuming technology to actively developing digital products such as Android applications and Augmented Reality tools.

Table 1. Distribution of Selected Studies based on Year, Educational Level, and Research Design (2015-2025)

Year Range	Elementary School (SD)	Junior High (SMP)	Senior High (SMA)	University	Dominant Research Design
2015–2019	2	3	2	2	Descriptive / Classroom Action Research
2020–2022	4	5	6	4	Survey / Ex-Post Facto (Pandemic Context)
2023–2025	3	4	5	2	**Research & Development (R&D)** / Experimental
Total	**9**	**12**	**13**	**8**	

The Evolution from Passive Consumption to Immersive Interaction

The analysis reveals a distinct evolutionary trajectory in the types of media used over the last decade. In the early phase and during the pandemic emergency (2015–2021), the technology used was largely "substitutive" according to the SAMR model. Teachers utilized WhatsApp and passive video links from YouTube simply to replace face-to-face instruction (Cahyono et al., 2021; Rukmana & Puriana, 2021). However, post-pandemic literature (2022–2025) demonstrates a leap towards "modification" and "redefinition." Recent studies highlight the development of interactive Android-based applications (Julita et al., 2023) and

Augmented Reality (AR) media for specific sports like basketball (Kusbiantoro, 2025).

Nevertheless, this digital transformation is not without disparities. While urban schools in Java successfully implement AR and interactive apps, studies in outer regions often cite infrastructure limitations as a major barrier. For instance, teachers in rural areas still rely heavily on simple offline videos due to unstable internet connections (Wicaksono & Utama, 2022). This suggests that while the technology has evolved, the digital divide remains a critical challenge that influences the choice of media in different geographical contexts.

Table 2. Categorization of Audio-Visual Media Types and Technological Characteristics in Indonesian PE (2015-2025)

Media Category	**Specific Examples from Selected Studies**	**Technological Characteristics**	**Representative Citations**
Passive Video Media	YouTube Tutorials, Recorded Zoom/Google Meet sessions, MP4 Video shared via WhatsApp.	Low Interactivity. One-way communication flow. Relies heavily on internet bandwidth for streaming. Primarily replaces traditional lectures.	Cahyono et al. (2021); Rukmana & Puriana (2021); Irmade (2020)
Interactive Multimedia	Prezi Presentations, E-Modules (Flipbook), PowerPoint with Voiceover.	Medium Interactivity. Student-controlled pace. Combines text, audio, and visual elements. Often accessible offline or via low-bandwidth.	Ladjar et al. (2025); Nasution et al. (2025); Nugraha (2024)
Mobile-Based & Gamified Apps	Android Applications (MIT App Inventor), Kahoot, Digital Board Games (Snakes & Ladders).	High Engagement. Utilizes smartphone portability. Focuses on immediate feedback and competition (gamification) to increase motivation.	Julita et al. (2023); Irawan et al. (2025); Amirunni'am et al. (2024)

Immersive Technology (AR)	Augmented Reality for Basketball, AR-based marker apps.	High Interactivity & Immersion. Overlays virtual objects onto the real world. Requires specific hardware sensors (camera/gyroscope). Provides real-time visual guidance.	Kusbiantoro (2025); Tumaloto et al. (2024); Hidayatullah et al. (2020)

Pedagogical Impact on Motor Skill Acquisition

The effectiveness of audio-visual media varies significantly depending on the type of motor skill being taught. For "Closed Skills" where the environment is predictable, such as swimming or gymnastics, video media with slow-motion features proved highly effective. For example, Wahyudi et al. (2021) and Nasution et al. (2025) found that visual media helped students understand the complex biomechanics of swimming strokes and water rescue techniques without the risk of immediate physical practice. The video serves as a "cognitive scaffold" that allows students to build a mental image of the movement (Magill & Anderson, 2021).

In contrast, for "Open Skills" such as basketball or volleyball games, the impact of media is more focused on tactical understanding rather than technical execution. Hita (2023) noted that digital media significantly improved students' comprehension of basketball tactics. However, the literature also emphasizes that media cannot replace physical repetition. Silvianti and Gazali (2023) highlighted that while interactive media increases interest in volleyball, the actual improvement in passing skills still requires significant field practice. Therefore, audio-visual media in Indonesia acts as a powerful supplementary tool for cognitive preparation but not a complete substitute for physical training.

Student Engagement and Psychological Outcomes

One of the most consistent findings across all reviewed studies is the positive impact of digital media on student motivation and engagement. The integration of gamification elements into physical education has successfully countered the phenomenon of "zoom fatigue" or boredom associated with traditional remote learning. Tools like *Kahoot* for evaluation (Irawan et al., 2025)

and digital board games like "Snakes and Ladders" (Amirunni'am et al., 2024) have transformed theoretical PE lessons into competitive and enjoyable activities.

However, this increased engagement relies heavily on the teacher's digital competence. Studies indicate that when teachers lack the skills to design engaging content, students' interest drops quickly (Maulana & Julianti, 2021). This highlights a critical need for continuous professional development. The enthusiasm of students for mobile-based learning is high, as reported by Sukamto et al. (2021), but it must be matched by the teacher's ability to curate or create high-quality digital content that is pedagogically sound.

CONCLUSION

This systematic literature review confirms that physical education in Indonesia has undergone a fundamental digital transformation from 2015 to 2025. The trajectory of media implementation has shifted from the "substitution" level, characterized by the passive use of YouTube videos and recorded lectures during the pandemic, to the "redefinition" level, marked by the development of immersive Augmented Reality and interactive Android applications in the post-pandemic era. Pedagogically, audio-visual media has proven to be a critical tool for enhancing motor skill acquisition, particularly for closed skills such as swimming and gymnastics, by providing clear cognitive visualization. Furthermore, the integration of gamification elements has significantly improved student engagement and psychological well-being, effectively addressing the issue of learning fatigue in remote settings.

However, the successful implementation of these technologies is not uniform across the archipelago. A significant digital divide remains a primary barrier, where rural schools struggle with infrastructure limitations compared to their urban counterparts. Therefore, this study recommends that policymakers focus not only on procuring hardware but also on improving internet infrastructure in outer regions. For practitioners and teachers, it is crucial to move beyond being consumers of technology to becoming creators. Continuous professional development programs should focus on equipping teachers with skills to design

low-bandwidth, high-impact local content, such as simple offline apps or interactive e-modules, to ensure inclusivity.

This study is limited to the Indonesian context and relies on data from specific databases like Google Scholar and SINTA, which may exclude relevant studies published in other indices. Future research should prioritize longitudinal studies to measure the long-term retention of motor skills acquired through digital media. Additionally, further investigation is needed to explore the effectiveness of "Hybrid Physical Education" models that combine digital preparation with physical practice in diverse geographical settings.

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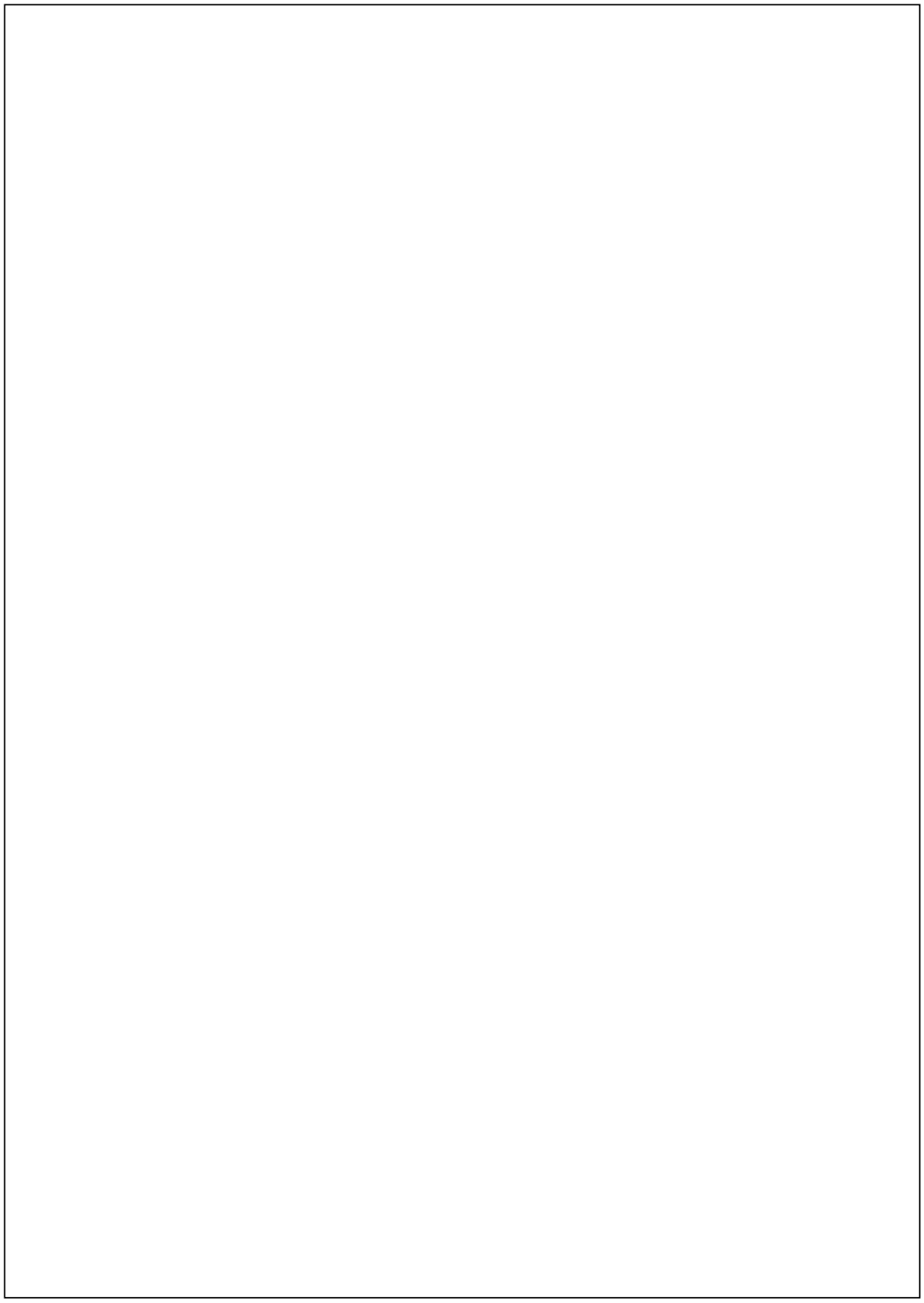

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