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The Implementation of Digital Media in Integrated Learning in Schools: A Systematic Literature Review From 2020 To 2025

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Abstract

The integration of technology in modern education demands the adaptation of dynamic pedagogical strategies, one of which is through an integrated learning approach. However, the implementation of digital media in unifying various disciplines in school environments still faces challenges regarding complexity and infrastructure readiness. This study aims to analyze implementation trends, the variety of technology types, and the effectiveness of using digital learning media in integrated learning in schools. The method used is a Systematic Literature Review (SLR) by reviewing 38 selected articles published between 2020–2025. Data collection was conducted through indexed databases with strict selection using the PRISMA protocol. The results show that media usage trends have evolved from simple multimedia to advanced technologies such as Artificial Intelligence (AI), Virtual Reality (VR), and Learning Management Systems (LMS). The implementation of digital media in integrated learning models, such as STEM and Project-Based Learning (PBL), has been proven to significantly increase cognitive engagement, facilitate the understanding of abstract concepts, and support differentiated learning. In conclusion, digital media is not merely a supplementary tool but a primary catalyst that enables the creation of an integrated learning ecosystem that is adaptive, collaborative, and relevant to 21st-century skill needs. Synergy between teachers' technological readiness (TPACK) and school infrastructure support is required for the sustainability of this implementation.

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1. INTRODUCTION

In the 21st century, global education is undergoing a significant shift—from learning that is divided into separate subjects toward a more holistic and interconnected approach. Integrated learning models such as STEM (Science, Technology, Engineering, and Mathematics), STEAM, and Project-Based Learning have become priorities in many national curricula, as they are believed to better prepare students with critical thinking and complex problem-solving skills. Nevertheless, combining multiple disciplines into a single learning theme is not without challenges. Students often struggle to process the cognitive complexity, while teachers face pedagogical difficulties in designing and implementing integrated instruction (Khalid et al., 2024; Satar et al., 2024). Within this context, the integration of technology is no longer optional; it has become essential for helping learners visualize and understand abstract, cross-disciplinary concepts that are difficult to grasp through traditional teaching methods.

The years between 2020 and 2025 represent a period of rapid and unprecedented digital transformation in education. This transformation began with emergency responses to the

pandemic, which normalized blended learning practices, and continued with the growing adoption of advanced technologies such as Artificial Intelligence (AI) and Virtual Reality (VR) between 2023 and 2025 (Chance, 2025; Soelistiono, 2023). The wide range of digital learning media offers substantial potential for building an adaptive and integrated learning ecosystem. Empirical studies indicate that the strategic use of appropriate digital tools can help reduce gaps in students' understanding by simultaneously linking concepts from science, social studies, and language learning (Afifa & Astuti, 2024; Sunaryati et al., 2024).

Despite the strong potential for synergy between digital media and integrated learning, the existing body of literature remains largely fragmented. Many prior literature reviews focus primarily on the effectiveness of digital media within a single subject area, or they discuss integrated learning without explicitly addressing the role of technology in supporting it. Furthermore, limited attention has been given to the rapid shift in technology trends over the past five years—from passive presentation tools toward personalized and intelligent learning systems. The absence of a comprehensive mapping of media types, implementation strategies, and their specific impacts on integrated learning at the K–12 level has created a critical gap in informing future curriculum development. In addition, teachers' limited readiness to integrate content, pedagogy, and technology within the TPACK framework continues to be a widely debated issue (Rosa et al., 2025).

Based on these considerations, the present study is urgently needed to provide a holistic overview of technology implementation in integrated learning. Accordingly, this study seeks to address the following research questions:

1. What trends have characterized the development of digital learning media used in integrated learning in schools between 2020 and 2025?
2. What implementation strategies have been employed to utilize digital learning media in supporting interdisciplinary integration?
3. What impacts does the use of digital learning media have on students' learning outcomes and skill development within integrated learning environments?

Accordingly, this Systematic Literature Review (SLR) aims to examine, analyze, and synthesize empirical evidence related to trends, implementation strategies, and the effectiveness of digital learning media in integrated learning contexts. The findings of this review are expected to contribute a strategic framework that can inform educators and educational technology developers in designing integrated learning ecosystems that are effective, relevant, and sustainable.

2. METHOD

This study employs a Systematic Literature Review (SLR) approach, adopting the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework to ensure a transparent, systematic, and replicable article selection process. The SLR method was selected to synthesize up-to-date empirical evidence (state of the art) on the implementation of digital learning media in integrated learning contexts, thereby addressing the research questions formulated in this study.

Data collection was conducted using Publish or Perish (PoP) software by retrieving articles from two major academic databases, namely Google Scholar and Scopus. These databases were chosen due to their broad citation coverage and the high relevance of their indexed publications to the field of educational technology. The search strategy was designed using Boolean operator

logic to refine and filter relevant studies. The keywords used in the search included: "digital learning media" OR "educational technology" OR "digital learning" AND "integrated learning" AND "school" OR "education".

To ensure the quality, rigor, and relevance of the selected studies, explicit inclusion and exclusion criteria were applied during the screening process. These criteria were used to systematically assess the eligibility of each article. The inclusion and exclusion criteria applied in this review are presented in the following table.

Tabel 1. Inclusion and Exclusion Criteria

Criteria	**Inclusion (Accepted)**	**Exclusion (Rejected)**
Time Range	Articles published between 2020 and 2025	Articles published before 2020
Participants	School students (Elementary, Junior High, and Senior High levels)	University students or lecturers
Topic	Digital media in integrated learning	Non-digital (print-based) media or single-subject, non-integrated learning
Article Type	Research articles (accredited journals or conference proceedings) with full-text availability	Opinion articles, book reviews, or abstract-only publications
Language	Indonesian and English	Languages other than Indonesian and English

After the inclusion and exclusion criteria were applied, the article selection process followed the PRISMA framework and was conducted through four main stages: identification, screening, eligibility assessment, and final inclusion.

1. Identification
   An initial search was performed across indexed academic databases, specifically Google Scholar and Scopus, using validated search strings. At this stage, a total of 300 articles (n = 300) were identified as potentially relevant to the keywords "digital learning media" and "integrated learning." All retrieved records were compiled into an initial inventory without automatic duplication removal.
2. Screening
   The identified articles were subsequently screened based on the relevance of their titles and abstracts. During this stage, 235 articles were excluded (n = 235) due to duplication, misalignment with the research focus, or publication outside the 2020–2025 timeframe. As a result, 65 articles were retained and deemed suitable for further evaluation.
3. Eligibility
   A total of 65 full-text articles were retrieved and reviewed in depth to determine their eligibility based on the predefined inclusion criteria. At this stage, 27 articles were excluded (n = 27) for the following reasons: (1) a lack of relevance to the research scope, specifically studies conducted at the higher education level or involving university students (n = 15); and (2) an overly general focus on thematic or integrated learning without explicitly addressing the use of digital learning media (n = 12).
4. Inclusion
   Following the rigorous screening and eligibility assessment process, 38 articles (n = 38) were finally selected as meeting all inclusion criteria. Data from these selected studies were

subsequently extracted and analyzed using qualitative synthesis techniques to address the research questions posed in this systematic literature review.

The following figure illustrates the PRISMA flow diagram used in the article selection process for this study.

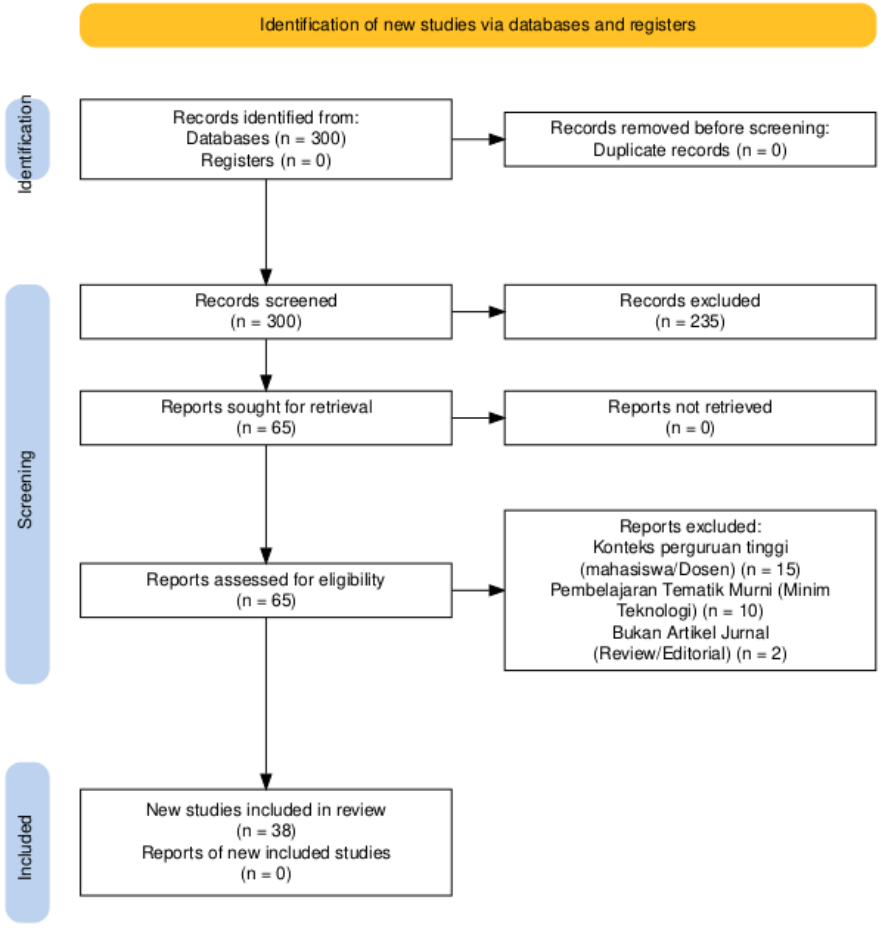

Figure 1. PRISMA flow

3. RESULTS AND DISCUSSION

Based on the results of the systematic search conducted using the PRISMA framework, 38 articles were identified as relevant to the implementation of digital learning media in integrated learning at the school level between 2020 and 2025. An in-depth analysis of these selected studies revealed findings that can be organized into three main themes: trends in digital learning media development, implementation strategies within the curriculum, and the impact of digital media on learning effectiveness..

Table 2. Article search results

No.	Author(s) (Year)	Article Title	Research Results / Findings
1	(Sunaryati et al., 2024)	*Enhancing Elementary School Students' Engagement through Digital-Based Integrated Learning*	The findings indicate that the integration of digital platforms in integrated learning significantly improves elementary school students' affective and cognitive engagement compared to conventional learning methods.
2	(Nuraeni et al., 2023)	*Analysis of the Use of Animated Videos as Integrated Learning Media*	The results show that the use of animated videos as integrated learning media effectively enhances elementary students'

		on Elementary Students' Learning Motivation	learning motivation by presenting content in a visual, engaging manner that aligns with learners' characteristics.
3	(Elan et al., 2025)	*Development of Instrumental Values in Moodle-Based Integrated Learning Worksheets in Elementary Schools*	The study reveals that Moodle-based integrated learning worksheets are valid and feasible for integrating character values into Civic Education and Social Studies subjects at the elementary school level.
4	(Nuraini & Kusaeri, 2025)	*Systematic Literature Review: The Impact of Digital Learning Media on Differentiated Learning*	The findings indicate that digital learning media play a crucial role in supporting the success of integrated differentiated learning by providing adaptable instructional content tailored to students' needs.
5	(Khalid et al., 2024)	*A Systematic Review: Digital Learning in STEM Education*	The study demonstrates that digital learning technologies facilitate the integration of STEM disciplines and assist students in understanding complex relationships among science, technology, engineering, and mathematics concepts.
6	(Amalia et al., 2024)	*Differentiated Learning Integrated with Social-Emotional Awareness and Digital Learning Media*	The results show that integrated learning combining digital media and social-emotional awareness has a positive impact on students' learning outcomes and emotional well-being.
7	(Tondeur et al., 2024)	*The DTALE Model: Designing Digital and Physical Spaces for Integrated Learning Environments*	The findings indicate that learning environment designs integrating physical and digital spaces support more flexible, collaborative, and student-centered integrated learning.
8	(Tarigan et al., 2021)	*The Effect of Interactive Digital Learning Modules on Students' Learning Activity and Autonomy*	The study shows that interactive digital learning modules increase students' learning activity and autonomy in integrated learning contexts.
9	(Afifa & Astuti, 2024)	*The Effect of Digital Learning Media on Motivation and Learning Outcomes in IPAS*	The findings indicate that digital learning media in the IPAS subject effectively improve elementary school students' learning motivation and integrated conceptual understanding.
10	(Hodam et al., 2020)	*Bringing Earth Observation to Schools with Digital Integrated Learning Environments*	The study shows that the use of digital earth observation data in integrated learning environments enhances students' scientific literacy and environmental awareness.
11	(Baziukė et al., 2025)	*How E-Learning Platforms Are Addressing Project-Based Learning*	The findings reveal that modern e-learning platforms effectively support Project-Based Learning as an integrated learning approach by facilitating collaboration and monitoring students' learning progress.

12	(Rosa et al., 2025)	*Innovative Teaching in the Digital Age: Applying the TPACK Model*	The study shows that teachers applying the TPACK model are able to create innovative integrated learning that enhances student engagement and learning enthusiasm.
13	(Devi & Rusdinal, 2023)	*Validation of Digital Learning Media to Improve Basic Literacy Skills*	The findings indicate that the developed digital learning media are valid and effective in improving students' basic literacy skills through an integrated learning approach.
14	(Chance, 2025)	*The Combined Impact of AI and VR on Interdisciplinary Learning*	The results show that the integration of Artificial Intelligence and Virtual Reality creates simulation-based learning experiences that strengthen interdisciplinary learning.
15	(Tasheva & Aripova, 2025)	*Modern Science and Education: Innovative Approaches*	The study indicates that innovative approaches in modern science education require the integration of digital technology to support holistic interdisciplinary learning.
16	(Hrynevych et al., 2021)	*Use of Digital Tools as a Component of the STEM Education Ecosystem*	The findings show that digital tools are essential components of the STEM education ecosystem, enabling integrated project-based learning.
17	(Astutik & Yuwana, 2021)	*Development of Non-Fiction Text Digital Learning Media for Narrative Writing Skills*	The study indicates that non-fiction text-based digital learning media effectively improve students' narrative writing skills in integrated learning settings.
18	(Militansina, 2023)	*Islamic Story Book-Based Digital Storytelling for CLIL*	The findings show that Islamic storybook-based digital storytelling effectively enhances language mastery and content learning in an integrated CLIL context.
19	(Yun & Crippen, 2024)	*Educational Technology in Inquiry-Based Elementary Science Education: A Systematic Review*	The study indicates that educational technology supports inquiry-based science learning integrated with other subject areas at the elementary level.
20	(Nugraha et al., 2020)	*Application of Content and Language Integrated Learning in Bilingual Programs*	The findings show that the implementation of CLIL in elementary schools successfully integrates language learning and subject content with the support of visual and digital media.
21	(Axelrod & Kahn, 2024)	*Multimodal Making of Digital Comics in Language Arts*	The study reveals that multimodal digital comic creation supports interdisciplinary learning between arts and language while enhancing students' digital literacy.
22	(Rusdi et al., 2025)	*The Effect of Digital Learning Media on Elementary Students' Learning Motivation*	The findings indicate that the use of digital learning media has a significant positive effect on elementary school students' learning motivation.
23	(Wardana et al., 2022)	*Integration of Digital and Non-Digital Learning Media to Advance Life Skills*	The study shows that integrating digital and non-digital learning media effectively

			develops students' life skills through integrated learning.
24	(Iskandar et al., 2024)	*Implementation of Integrated Learning to Enhance Elementary Students' Creativity*	The findings indicate that integrated learning supported by creative digital media significantly enhances elementary school students' creativity.
25	(Soelistiono, 2023)	*Educational Technology Innovation: AI-Integrated Learning System Design*	The study shows that Artificial Intelligence–based integrated learning systems support adaptive learning pathways within integrated curricula.
26	(Satar et al., 2024)	*Integrated Learning: Nature and Strategies of Integrated Learning in Elementary Schools*	The findings indicate that the success of integrated learning in elementary schools strongly depends on teachers' ability to integrate relevant technological media.
27	(Fransiska et al., 2024)	*Students' Cognitive Development in the Use of Digital Learning Media*	The study shows that digital learning media support students' cognitive development, particularly in the transition from concrete to abstract thinking in integrated learning.
28	(Cahyanto & Afifulloh, 2020)	*Component Display Theory (CDT)-Based E-Modules*	The findings indicate that CDT-based e-modules effectively present integrated learning materials systematically and support students' independent learning.
29	(Eugenijus, 2023)	*Integrating Blended Learning and STEM Education*	The study shows that the implementation of blended learning in STEM education enhances students' interdisciplinary problem-solving skills.
30	(Lu et al., 2021)	*Digital Learning and Its Impact on the Education System*	The findings indicate that integrated digital learning systems have a positive impact on the efficiency and reach of the education system.
31	(Ni'mah & Rahmawati, 2023)	*Educational Technology in Islamic Education: A Systematic Literature Review*	The study shows that the integration of educational technology supports integrated learning that combines religious and general knowledge.
32	(Saseendran & Thomas, 2025)	*Integration of Design Thinking and Educational Technology in Science Education*	The findings indicate that integrating Design Thinking and educational technology in science education fosters systemic thinking and students' sustainability competencies.
33	(Fan & Chen, 2023)	*Cooperative Learning in a CLIL Context with Technology Support*	The study shows that technology-supported cooperative learning in a CLIL context enhances interaction and learning outcomes in both language and content areas.
34	(Mageira et al., 2022)	*Educational AI Chatbots for Content and Language Integrated Learning*	The findings indicate that Artificial Intelligence–based chatbots function effectively as personalized learning partners in CLIL environments.
35	(Al-Gindy et al., 2020)	*Virtual Reality: Development of an*	The study shows that Virtual Reality–based integrated learning environments

		Integrated Learning Environment	enhance memory retention and understanding of abstract concepts.
36	(Mahyudin & Hermansyah, 2025)	*Enhancing Historical Thinking Skills through Digital Learning Modules*	The findings indicate that integrated digital learning modules effectively improve students' historical and analytical thinking skills.
37	(Yadav, 2024)	*Digital Learning and Interdisciplinary Learning*	The study shows that digital learning promotes interdisciplinary learning practices among both students and teachers.
38	(Billert et al., 2022)	*Vocational Training with Microlearning and 360° Video*	The findings indicate that the use of 360-degree video in microlearning effectively supports integrated, work-process-based learning in vocational education.

An in-depth analysis of the articles presented in the table above yielded findings that can be classified into three main aspects: trends in technological development, curriculum implementation strategies, and the impact of digital media on learning effectiveness. The following section elaborates on each of these aspects.

a. Trends in the Development of Digital Learning Media (2020–2025)

The results of data extraction indicate a notable shift in the types of digital technologies adopted in school settings over the review period. During the early phase (2020–2021), technology use was predominantly centered on multimedia presentation tools and video conferencing platforms, which functioned primarily as emergency responses to the sudden transition to remote learning during the COVID-19 pandemic. In contrast, the period from 2022 to 2025 reflects a clear transition toward more immersive, interactive, and intelligent technologies that support deeper learning integration.

From a quantitative perspective, the types of digital learning media discussed in the reviewed literature can be grouped into several categories:

- **Platforms and Learning Management Systems (LMS) :** continue to serve as the backbone of digital learning infrastructure, particularly in supporting blended learning environments. Studies by Elan et al. (2025) and Baziukė et al. (2025) emphasize that platforms such as Moodle and other modern e-learning systems are no longer used merely as repositories for instructional materials. Instead, they function as collaborative learning spaces that facilitate communication, coordination, and the management of Project-Based Learning (PBL) activities across integrated subject areas.
- **Visual Media and Interactive Multimedia :** Animated videos, digital comics, and digital storytelling emerge as the most frequently used media at the elementary school level. Empirical findings reported by Nuraini and Kusaeri (2025) as well as Militansina et al. (2023) indicate that narrative-based visual media are particularly effective in supporting integrated (thematic) learning and Content and Language Integrated Learning (CLIL). Such media help learners connect abstract concepts across disciplines by presenting content in concrete, engaging, and contextually meaningful formats.
- **Immersive Technologies (VR/AR and Metaverse):** Recent studies published between 2024 and 2025 demonstrate a marked increase in the adoption of immersive technologies, including Virtual Reality (VR) and Augmented Reality (AR). Research by Chance (2025) and Al-Gindy et al. (2020) suggests that VR plays a significant role in interdisciplinary education by enabling students to experience simulated environments that cannot be

physically accessed in conventional classroom settings, such as outer space exploration or medical and scientific simulations.

- **Artificial Intelligence (AI) :** The integration of Artificial Intelligence began to dominate scholarly discourse toward the end of the review period. Studies by Soelistiono (2023) and Mageira et al. (2022) reveal that AI-based systems—such as intelligent tutoring systems and educational chatbots—are increasingly employed to personalize learning pathways within complex and integrated curricula. These systems support adaptive feedback, individualized pacing, and differentiated instruction across multiple subject areas.

Overall, this shift reflects a fundamental change in how schools conceptualize educational technology. Rather than functioning solely as presentation or delivery tools, digital technologies are increasingly viewed as comprehensive learning environments capable of simulating real-world contexts and supporting deep, interdisciplinary learning.

b. Implementation Strategies in Integrated Learning

The implementation of digital media in integrated learning is not conducted in an ad hoc manner but is guided by deliberate and well-planned pedagogical strategies. Based on the synthesis of the reviewed literature, three main strategic models have been identified as being commonly applied in school contexts:

- **Integration within the STEM/STEAM Model :** The most frequently reported strategy involves the use of digital tools as integrative connectors across disciplines within STEM and STEAM education. Studies by Khalid et al. (2024) and Hrynevych et al. (2021) explain that digital tools—such as coding platforms, data-logging applications, and engineering simulation software—enable students to observe mathematical and scientific relationships in real time. Within this model, technology functions primarily as an inquiry-oriented tool, allowing students to actively explore and construct knowledge rather than passively receiving information.
- **Digital Differentiation Approach :** Recent studies by Nuraini and Kusaeri (2025) as well as Amalia et al. (2024) emphasize the use of digital media to support differentiated instruction in integrated classrooms. In heterogeneous learning environments, teachers employ adaptive digital applications capable of adjusting content complexity and learning pace according to students' individual abilities. This approach addresses a long-standing challenge in integrated learning, where uniform instructional strategies often fail to accommodate diverse learner needs.
- **Hybrid (Physical–Digital) Integration :** The DTALE model discussed by Tondeur et al. (2024) offers a novel perspective on the design of learning spaces in integrated learning environments. Rather than replacing physical experiences, this strategy seeks to enrich them through purposeful digital integration. For instance, students engage in direct nature observations outside the classroom (physical learning) and subsequently process and analyze the collected data using earth observation tools or digital mapping applications in the classroom (digital learning), as illustrated by Hodam et al. (2020). This hybrid approach has been shown to effectively balance the development of digital technical skills with authentic, sensory-based learning experiences.

c. Effectiveness and Impact of Implementation

An analysis of empirical findings from the 38 reviewed articles indicates consistently positive effects of digital media implementation in integrated learning, although the

magnitude and nature of these impacts vary according to educational level and the type of technology employed.

- **Increased Engagement and Motivation.** Nearly all studies, including those by Sunaryati et al. (2024) and Rusdi et al. (2025), report significant improvements in students' learning motivation. Interactive digital media—such as game-based learning environments and animated instructional videos—have been shown to increase elementary school students' time-on-task. Engaging visual representations help make integrated learning content, which is often perceived as cognitively demanding, more enjoyable and easier for students to comprehend.
- **Strengthening Interdisciplinary Conceptual Understanding.** One of the key findings across the reviewed studies is the capacity of digital technology to visualize relationships among concepts from different disciplines. Fransiska et al. (2024) report that digital media significantly support learners at the concrete operational stage, particularly at the elementary school level, by making abstract concepts more accessible and comprehensible. At higher educational levels, Yadav (2024) highlights that access to global digital resources encourages students to engage in independent, interdisciplinary thinking by linking local issues to broader global phenomena.
- **Development of 21st-Century Skills (4C).** The implementation of digital media in integrated learning environments—especially through technology-supported Project-Based Learning (PBL)—has been shown to directly foster the development of 21st-century skills, including creativity, collaboration, communication, and critical thinking. Studies by Iskandar et al. (2024) and Axelrod and Kahn (2024) demonstrate that when students are tasked with producing digital artifacts, such as digital comics or social awareness videos, they are naturally required to collaborate, critically evaluate content, and creatively design their outputs within an interdisciplinary framework.
- **Teacher Readiness Challenges (TPACK).** Despite the generally positive impacts reported, the literature also identifies substantial challenges related to teacher readiness. Research by Rosa et al. (2025) and Satar et al. (2024) underscores that the effectiveness of digital media integration is highly contingent upon teachers' levels of Technological Pedagogical Content Knowledge (TPACK). Limited competence in integrating content knowledge, pedagogical strategies, and technological tools often constrains the optimal use of digital media in integrated learning settings. A case study by Elan et al. (Elan et al., 2025) also highlights the technical and infrastructure constraints that remain barriers in some elementary schools.

Overall, the findings of this review confirm that digital learning media have evolved from being merely supplementary tools to becoming integral components of integrated learning ecosystems. The effectiveness of their implementation is no longer determined by *whether* technology is used, but rather by *how* it is meaningfully aligned with curriculum objectives, pedagogical approaches, and students' characteristics.

4. CONCLUSION

This systematic review confirms that the period from 2020 to 2025 represents a critical phase in the evolution of primary and secondary education, during which digital learning media have shifted from supplementary resources to fundamental components of integrated learning architectures. The synthesis of existing literature demonstrates that the adoption of advanced

technologies—ranging from learning management systems to artificial intelligence and virtual reality—plays a crucial role in addressing the complexity of interdisciplinary integration by making abstract concepts more concrete, contextual, and meaningful for students.

The findings further indicate that successful technology integration not only enhances student motivation but also significantly promotes critical thinking and collaboration skills, particularly when supported by innovative pedagogical models such as STEM education and project-based learning. Nevertheless, this review also highlights that technological advancement alone is insufficient to ensure effective learning outcomes if it is not accompanied by strong pedagogical readiness among teachers. Persistent disparities in teachers' digital competencies, along with unequal access to technological infrastructure, remain substantial barriers to optimizing integrated learning ecosystems.

Consequently, the implications of these findings suggest a necessary shift in educational policy and practice—from an emphasis on hardware procurement toward a more strategic investment in developing teachers' capacities to design adaptive and hybrid learning environments. Such a shift is essential to ensure the long-term sustainability and impact of educational innovation.

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