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From Language Literacy to Digital Literacy: Technology Strategies for Improving Learning Quality and Educational Management

Hegar Harini[1*], Ahmad Jauhari Hamid Ripki[2], Ahmad Durul Napis[3], Nurhasanah[4], Arbiana Putri[5]

[1,2,3,4,5]*STKIP Kusuma Negara, Indonesia*

A R T I C L E I N F O

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A B S T R A C T

Digital transformation in education requires the integration of literacy competencies, instructional strategies, and institutional management. This study aims to examine the transformation from language literacy to digital literacy and identify technology strategies that support learning quality and educational management. Using a narrative literature review, this study synthesizes 30 primary sources published between 2006 and 2026, comprising 25 journal articles and five institutional sources. The findings identify five interconnected themes: literacy transformation, technology-enhanced learning, teachers' digital competence, learning quality, and educational leadership and management. The synthesis indicates that technology integration requires appropriate pedagogical strategies, competent educators, and sustainable institutional support. This study proposes the Integrated Digital Literacy and Educational Quality Framework, which connects literacy foundations, technology-enabled pedagogy, teachers' digital competence, and educational management. The framework provides a conceptual foundation for developing inclusive digital education strategies, although its proposed relationships require further empirical validation.

A B S T R A K

Transformasi digital dalam pendidikan membutuhkan integrasi antara kemampuan literasi, strategi pembelajaran, dan manajemen lembaga pendidikan. Penelitian ini bertujuan menganalisis transformasi literasi bahasa menuju literasi digital serta mengidentifikasi strategi teknologi yang mendukung peningkatan mutu pembelajaran dan manajemen pendidikan. Penelitian menggunakan pendekatan narrative literature review dengan menyintesis 30 sumber utama yang diterbitkan pada periode 2006–2026, terdiri atas 25 artikel jurnal dan lima sumber kelembagaan. Hasil kajian mengidentifikasi lima tema yang saling berkaitan, yaitu transformasi literasi, pembelajaran berbasis teknologi, kompetensi digital guru, mutu pembelajaran, serta kepemimpinan dan manajemen pendidikan. Sintesis menunjukkan bahwa integrasi teknologi membutuhkan strategi pedagogis yang tepat, kompetensi pendidik, dan dukungan kelembagaan berkelanjutan. Penelitian ini mengusulkan Integrated Digital Literacy and Educational Quality Framework yang menghubungkan fondasi literasi, pedagogi berbasis teknologi, kompetensi digital guru, dan manajemen pendidikan. Kerangka tersebut memberikan landasan konseptual bagi pengembangan strategi pendidikan digital yang inklusif, meskipun hubungan yang diusulkan masih memerlukan pengujian empiris lebih lanjut.

1. INTRODUCTION

The rapid development of digital technology has significantly transformed how people access information, communicate, and learn. These changes have also influenced education, particularly as learning processes are no longer confined to printed textbooks and face-to-face classroom interactions. Students can now access various sources of knowledge through digital devices, learning platforms, educational videos, and artificial intelligence-based applications. However, easier access to information does not necessarily translate into the ability to understand and critically evaluate it. UNESCO (2023) emphasizes that the use of technology in education should consider learning quality, equitable access, and institutional readiness. Meanwhile, OECD

** Corresponding author, email address: hegar@stkipkusumanegara.ac.id*

(2023) explains that digital transformation in education requires more than the provision of technological devices; it also involves developing an ecosystem that supports learning and educational management. This situation suggests that the main challenge facing education is no longer simply introducing technology, but ensuring that technology genuinely contributes to learning processes and educational quality.

Within these developments, language literacy remains essential as the foundation of students' ability to understand and acquire knowledge. Reading, writing, listening, and communication skills enable individuals to process information and express ideas systematically. However, digital environments have expanded the forms and sources of information that students must understand. Information is no longer communicated exclusively through written texts but also through images, audio, videos, and various forms of interactive communication. Ng (2012) explains that young people's familiarity with technology does not automatically indicate that they possess adequate digital literacy. The ability to operate digital devices must be accompanied by the skills to understand information, evaluate sources, and use technology responsibly. Therefore, language literacy and digital literacy should not be viewed as two competencies that replace one another. Language literacy provides the foundation for understanding and communicating information, while digital literacy extends these abilities within an increasingly complex technological environment.

The integration of technology into language learning demonstrates its potential to enhance students' learning experiences. Sung et al. (2015), through a meta-analysis of mobile device use in language learning, found that technology can positively contribute to learning outcomes. Wu & Chen (2020) also explain that digital storytelling can be used to develop learning activities that combine narratives, multimedia, and student participation. More recently, Yu & Zeng (2026) examined the application of digital storytelling in English language learning and highlighted its potential to support language skills and student engagement. These findings suggest that technology can broaden instructional approaches, shifting learning from primarily receiving information toward more interactive and creative activities. Nevertheless, the success of technology integration still depends on the alignment of instructional strategies with learning objectives, subject matter, and students' needs. Therefore, technology integration should be understood as part of pedagogical development rather than merely replacing conventional learning media.

Successful technology integration is also closely associated with teachers' ability to design and implement effective learning activities. Mishra & Koehler (2006), through the Technological Pedagogical Content Knowledge (TPACK) framework, explain that effective technology integration requires the combination of technological, pedagogical, and content knowledge. This perspective suggests that teachers need more than the ability to operate applications; they must also understand when, why, and how technology should be used to support learning. Scherer et al. (2019) demonstrate that teachers' acceptance of technology is influenced by their perceptions of its usefulness and ease of use. Meanwhile, Claro et al. (2024) emphasize the importance of understanding teachers' digital competence through multiple dimensions related to professional practice and teaching. These findings indicate that teachers' digital competence is an important element connecting technological availability with the quality of students' learning experiences. Without adequate pedagogical competence, the use of digital devices may simply transfer conventional learning activities to electronic platforms without producing meaningful changes.

However, improving learning quality through technology is not solely the responsibility of teachers. Educational institutions also play an important role in creating environments that support the planned and sustainable use of technology. Infrastructure availability, internet access, policies governing device use, teacher training, and evaluation systems are all components of educational management decisions. OECD (2023) emphasizes the importance of developing a digital education ecosystem that incorporates resources, governance, and learning support systems. Within the context of educational leadership, Nagel et al. (2026) discuss the relationship between digitalization and school leadership, while Asriadi & Andriani (2026) examine the development of digital leadership from technological readiness to organizational outcomes. These perspectives suggest that digital transformation requires institutional leadership and management support rather than relying exclusively on individual teacher initiatives. Therefore, technology strategies in education should connect classroom innovation with institutional policies, human resource development, and educational management capacity.

Although research on educational technology continues to expand, the relationship between digital literacy, learning quality, and educational management still presents several issues that require a more comprehensive understanding. Børte et al. (2023) highlight the importance of teachers' readiness to use technol-

ogy for formative assessment, while Cheah et al. (2023) emphasize the need to consider technology-supported learning practices that promote equitable educational opportunities. Meanwhile, UNESCO (2023) cautions that the benefits of educational technology cannot be separated from issues of accessibility, evidence quality, and implementation conditions. These different perspectives indicate that improvements in educational quality cannot be assessed solely through the frequency or intensity of digital device use. Educational quality also involves students' ability to understand information, their engagement in learning, assessment quality, and equitable access to educational services. Thus, the increasing use of technology does not necessarily indicate improvements in learning quality unless it is accompanied by pedagogical changes and adequate management support. This situation highlights the need to understand the relationships among literacy competencies, instructional strategies, and institutional management within an integrated discussion.

Based on these developments in the literature, there is a need to connect several perspectives that have frequently been examined through different research focuses. Studies on technology-supported language learning tend to emphasize instructional media and learning outcomes, whereas research on teachers' digital competence focuses more on their readiness and ability to integrate technology into teaching. Meanwhile, studies on digital leadership and educational management emphasize institutional policies, infrastructure, and organizational change. These three perspectives are conceptually related, but their connections require a more systematic synthesis to explain how technology can support learning quality while strengthening educational management. In this context, the research gap addressed in this study is not simply a lack of research on educational technology, but rather the need for a synthesis that connects the transformation of language literacy, the development of digital competence, pedagogical strategies, and educational management capacity. Such integration is important to ensure that digital transformation is understood not merely as a change in technological devices or instructional media, but as a process of developing human capabilities and educational organizations.

In response to these issues, this study aims to analyze developments in the literature concerning the transformation from language literacy to digital literacy and to identify technology strategies that have the potential to improve learning quality and educational management. The study adopts a narrative literature review approach to synthesize conceptual and empirical findings related to technology-supported language learning, teachers' digital competence, pedagogical strategies, digital leadership, and educational governance. Through this synthesis, the study seeks to develop the Integrated Digital Literacy and Educational Quality Framework as a conceptual framework explaining the interrelationships among students' literacy competencies, technology integration in learning, teachers' professional competence, and educational management support. The contribution of this study lies in bringing together instructional and managerial perspectives to understand digital transformation in education. The proposed framework is expected to provide a foundation for future research and serve as a reference for educators, educational leaders, and policymakers in designing more focused, inclusive, and quality-oriented technology strategies.

2. THEORETICAL FRAMEWORK AND HYPOTHESES

2.1 Transformation from Language Literacy to Digital Literacy

Language literacy is a fundamental competency that enables individuals to understand, process, and communicate information through reading, writing, listening, and speaking. In education, these skills provide the foundation for students to acquire knowledge, develop critical thinking, and participate in learning activities. However, technological developments have transformed the forms of information and the ways people interact with knowledge. Information that was previously delivered primarily through printed texts is now available in various digital formats, including videos, images, audio, and interactive media. These changes have expanded literacy requirements, as students must not only understand information but also assess the credibility of sources and use information responsibly. Ng (2012) explains that the ability to operate technology does not automatically indicate digital literacy proficiency. Therefore, the transformation from language literacy to digital literacy does not mean replacing reading and writing skills, but rather extending their application within an increasingly complex information environment.

Digital literacy encompasses the ability to use technology to access, evaluate, manage, create, and communicate information. In educational contexts, these competencies relate to how students understand learning resources, collaborate through digital platforms, and produce work that integrates text and multimedia. The Digital Competence of Educators framework, or DigCompEdu, developed by the European Com-

mission, Joint Research Centre (2017), emphasizes the use of digital resources, teaching and learning, assessment, and the development of students' digital competence. Although this framework is specifically designed for educators, its dimensions demonstrate that digital literacy is closely connected to pedagogical practices and the development of learning competencies. UNESCO (2018) also positions technological competence as part of teachers' professional development and educational quality improvement. Together, these frameworks indicate that digital literacy should be understood as a competency that integrates technical, cognitive, and pedagogical dimensions with responsible technology use.

The relationship between language literacy and digital literacy becomes increasingly apparent when students use technology to read, write, discuss, and communicate ideas. For example, reading digital articles requires both reading comprehension and the ability to evaluate information reliability. Similarly, producing educational videos or digital stories requires the ability to construct narratives, select relevant information, and communicate messages effectively. Wu & Chen (2020) demonstrate that digital storytelling is an educational approach that combines storytelling skills with multimedia technology. This approach provides opportunities for students to develop language competencies through more creative and interactive activities. Therefore, language literacy and digital literacy are complementary. Language literacy provides the foundation for comprehension and communication, while digital literacy expands how these competencies are applied throughout the learning process.

2.2 Technology Strategies for Improving Learning Quality

The use of technology in education has developed through various approaches, ranging from multimedia integration to the implementation of digital learning platforms. In language learning, technology enables students to access materials more flexibly, practice independently, and interact with learning resources beyond the classroom. Sung et al. (2015), through a meta-analysis of mobile device use in language learning, demonstrate that mobile-assisted language learning can positively contribute to learning outcomes. These findings suggest that digital devices have the potential to support learning when implemented through strategies appropriate to students' needs. However, technological effectiveness cannot be separated from learning objectives, subject matter characteristics, and how teachers manage learning activities. Thus, technology should be positioned as a means of strengthening the learning process rather than becoming the primary objective of learning itself.

One increasingly adopted strategy in language education is digital storytelling, an approach that combines storytelling activities with text, images, audio, and video. Wu & Chen (2020) identify various applications of digital storytelling in education, while Yu & Zeng (2026) discuss its potential in English language learning and teaching. This approach provides students with opportunities to construct stories, develop ideas, and communicate messages through digital media. Such activities involve not only language skills but also creativity, communication, and technological competence. In addition, Thompson & von Gillern (2020) examine the use of digital games in English vocabulary learning. Their research broadens the understanding of how technology can create more diverse learning experiences. Nevertheless, the benefits of technology should be evaluated based on its contribution to learning processes and outcomes rather than solely on the attractiveness of the media being used.

Improving learning quality also involves using technology to support assessment and feedback. Børte et al. (2023) explain that technology integration in formative assessment requires teacher readiness, organizational support, and alignment with instructional practices. Technology can help educators collect information about students' learning progress, but such information still requires pedagogical interpretation before it can be used to improve instruction. Cheah et al. (2023) also emphasize the importance of equitable learning opportunities in technology-supported educational practices. These perspectives suggest that learning quality should not be measured exclusively through academic achievement but also through interaction quality, assessment, participation, and access to learning resources. Therefore, quality-oriented technology strategies should consider pedagogical effectiveness while ensuring that technology integration does not widen inequalities in learning opportunities.

2.3 Teachers' Digital Competence and Technology Integration in Learning

Teachers play an important role in determining how technology is used to support learning activities. The availability of devices and applications does not necessarily result in effective learning when teachers lack the ability to integrate them with instructional content and pedagogical strategies. Mishra & Koehler (2006)

introduced the Technological Pedagogical Content Knowledge (TPACK) framework, which explains the relationships among technological, pedagogical, and content knowledge. This framework emphasizes that technology integration should be aligned with subject matter characteristics and instructional approaches. In language learning, for example, selecting digital applications should consider the specific skills being developed, such as reading, writing, speaking, or listening. Thus, teachers' digital competence involves not only the ability to operate technological devices but also the capacity to make pedagogical decisions regarding their use.

Beyond competence, teachers' acceptance of technology also influences its successful integration into learning. Scherer et al. (2019) employed a meta-analytic approach to explain teachers' acceptance of educational technology based on the Technology Acceptance Model (TAM). This model identifies perceived usefulness and perceived ease of use as important factors in understanding technology acceptance. Scherer & Teo (2019) also examined factors associated with teachers' intentions to integrate technology into educational practices. Both studies indicate that technology use is determined not only by the availability of facilities but also by educators' beliefs, perceptions, and readiness. Therefore, educational digitalization policies should consider how teachers perceive the benefits of technology and receive support for its implementation. Digital transformation is unlikely to be sustainable if teachers are positioned merely as technology users without being involved in the development of learning practices.

Developing teachers' digital competence requires continuous professional learning. Tondeur et al. (2019) emphasize the importance of teacher educators in preparing future teachers to integrate technology into instructional practices. Meanwhile, Claro et al. (2024) examine teachers' digital competence through a synthesis of quantitative research and highlight the importance of understanding this competence as multidimensional. Nagel et al. (2023) also focus on educators' professional capacity to develop digital competence. These findings suggest that technology training should not be limited to mastering applications but should also include instructional planning, collaboration, reflection, and evaluation of technology use. Therefore, developing teachers' digital competence is part of improving the quality of educational human resources and requires sustained institutional support.

2.4 Digital Leadership and Educational Management

Digital transformation in education cannot be separated from educational institutions' ability to manage change. Technology integration requires decisions concerning infrastructure procurement, human resource development, information management, and evaluation of learning processes. OECD (2023) explains that a digital education ecosystem consists of various interconnected elements, including technology, resources, policies, and governance. This perspective suggests that educational digitalization is not merely an activity involving the provision of devices but a process of developing systems that enable technology to be used effectively. In this context, educational management is responsible for ensuring that technology integration aligns with learning needs and institutional objectives. Therefore, successful digital transformation requires alignment between instructional strategies and organizational capacity to manage resources and educational change.

Digital leadership is one of the elements that can support this alignment. Nagel et al. (2026) examine developments in research on digitalization and school leadership, while Asriadi & Andriani (2026) discuss the relationship between digital readiness, leadership practices, and educational organizational outcomes. This literature provides a basis for understanding the role of educational leaders in establishing a digital vision, encouraging teachers' competence development, and creating an organizational environment that supports innovation. Digital leadership also involves the ability to identify technological needs, manage change, and coordinate stakeholders involved in educational processes. However, the relationship between digital leadership and improved learning outcomes should be interpreted cautiously because organizational changes do not always produce direct effects on student learning. Thus, digital leadership is more appropriately understood as an enabling condition that supports the focused and sustainable implementation of technology strategies.

In educational management practices, technology strategies must also consider equitable access, data protection, and the sustainability of digital systems. UNESCO (2023) cautions that educational technology offers benefits but also presents risks associated with unequal access, the quality of evidence, and users' interests. Miao & Holmes (2023) similarly emphasize the importance of a human-centered approach to the use of artificial intelligence in education and research. These perspectives suggest that educational management

decisions should not be based solely on emerging technological trends. Educational institutions need to consider the suitability of technology for students' needs, teachers' capabilities, infrastructure readiness, and ethical principles and information security. Therefore, technology-based educational management should prioritize learning quality, students' interests, and institutional responsibility in decision-making processes.

2.5 Integration of Digital Literacy, Technology Strategies, and Educational Quality

Studies on language literacy, digital competence, instructional strategies, and educational management reveal complementary conceptual relationships. Language literacy provides fundamental skills for understanding and communicating information, while digital literacy extends these competencies within technological environments. Technology-supported instructional strategies offer approaches for applying literacy skills through more diverse learning activities. Meanwhile, teachers' competence determines how appropriately technology is aligned with pedagogical objectives, while educational management provides organizational support that enables innovation to be implemented sustainably. Ng (2012), Mishra & Koehler (2006), and OECD (2023) offer different yet complementary perspectives for understanding the relationships among individual competencies, instructional practices, and educational ecosystems. Based on this synthesis, improving educational quality through technology should be understood as the result of interactions among multiple components rather than an automatic consequence of using digital devices.

The integration of these perspectives can be explained through the relationships among literacy readiness, pedagogical strategies, educators' competence, and institutional support. At the student level, language and digital literacy enable individuals to understand and use information during learning. At the instructional level, technology can be used to develop activities that support communication, collaboration, creativity, and assessment. At the educator level, digital competence and pedagogical skills influence how technology is selected and implemented. Meanwhile, at the organizational level, educational leadership and management provide policies, facilities, training, and evaluation. The TPACK framework developed by Mishra & Koehler (2006), the digital competence approach in DigCompEdu (European Commission, Joint Research Centre, 2017), and the digital education ecosystem perspective presented by OECD (2023) can serve as theoretical foundations for understanding these relationships. Thus, learning quality and educational management effectiveness are two dimensions that should be considered simultaneously in digital educational transformation.

Based on this integration, the present study proposes the Integrated Digital Literacy and Educational Quality Framework as a conceptual framework for understanding technology strategies aimed at improving learning quality and educational management. The framework positions language literacy and digital literacy as foundational competencies supporting learning activities, while technology strategies and teachers' digital competence are understood as components that help translate these competencies into pedagogical practices. Digital leadership and educational management are positioned as organizational conditions supporting technology implementation through policies, human resource development, and infrastructure provision. The expected outcomes include improved learning processes, stronger assessment practices, broader learning opportunities, and more effective educational management. However, the relationships proposed in this framework remain conceptual and cannot yet be considered empirically established causal relationships. Therefore, the framework serves as a foundation for literature synthesis and provides direction for future research on digital transformation in education.

3. RESEARCH METHOD

3.1 Research Design

This study adopts a narrative literature review approach to examine the transformation from language literacy to digital literacy and the strategies for using technology to improve learning quality and educational management. This approach was selected because the study aims to integrate various theoretical perspectives and empirical findings that differ in their focus, methods, and educational contexts. Snyder (2019) explains that literature reviews can be used to identify developments in knowledge, compare research findings, and develop a conceptual understanding of a phenomenon. Meanwhile, Green et al. (2006) emphasize that a narrative literature review allows researchers to develop interpretative discussions that explain the relationships among ideas presented in the literature. This review focuses on five main themes: the transformation from language literacy to digital literacy, technology strategies in learning, teachers' digital competence, educational leadership and management, and the integration of these components to improve educational quality.

A total of 30 primary sources were designated as the synthesis corpus, consisting of 25 journal articles and five institutional sources. The literature covers publications from 2006 to 2026. Earlier studies with significant theoretical contributions were retained, while more recent publications were included to understand developments in digital education practices and policies.

3.2 Literature Sources and Search Strategy

The literature search was designed to use Google Scholar, Scopus, ScienceDirect, SpringerLink, Taylor & Francis Online, and the official websites of international educational organizations, particularly UNESCO, OECD, and the European Commission. These sources were selected to identify studies relevant to digital literacy, technology-supported language learning, teachers' competence, and educational management. The keywords used in the search strategy included digital literacy, language literacy, technology-enhanced language learning, digital storytelling, mobile-assisted language learning, teacher digital competence, educational technology, digital leadership, educational management, and educational quality. These keywords could be combined using the Boolean operators AND and OR to broaden or narrow the search scope. The search strategy primarily targeted publications from 2015 to 2026, with exceptions for foundational studies of theoretical relevance. For example, Mishra & Koehler (2006) and Ng (2012) were retained because they provide conceptual foundations for technology integration in learning and the development of digital literacy.

3.3 Literature Selection Criteria

Literature selection was based on the relevance of each source to the research objectives, the clarity of its bibliographic information, and its contribution to the development of the conceptual synthesis. Priority was given to journal articles examining the relationships among literacy, technology use, instructional practices, educators' competence, and educational management. In addition to journal articles, reports and competency frameworks published by international organizations were included to strengthen the discussion of digital education policies and governance.

Table 1. Literature Selection Criteria

Aspect	Inclusion Criteria	Exclusion Criteria
Publication period	2015–2026; foundational sources published before 2015 were permitted	Older publications without relevant theoretical contributions
Source type	Journal articles, official reports, and institutional competency frameworks	Personal blogs, opinions without scientific foundations, and untraceable sources
Research focus	Language literacy, digital literacy, educational technology, teachers' competence, or educational management	Technology-related studies without a clear connection to education
Context	Formal education, educator development, and educational governance	Studies outside educational contexts without conceptual relevance
Publication language	Indonesian and English	Publications that could not be adequately reviewed
Contribution	Relevant empirical findings, conceptual frameworks, or policy recommendations	Publications with insufficient information or limited contributions

Source: Criteria developed by the authors based on the research objectives.

3.4 Literature Selection Procedure

The literature selection procedure consisted of four stages: identification, initial screening, eligibility assessment, and final inclusion. During the identification stage, 120 publications were identified through the literature search. Following the examination of publication titles and the removal of duplicate or potentially overlapping records, 95 publications remained for further screening. These publications were then evaluated based on their abstracts and relevance to the research objectives. At this stage, 37 publications were excluded because they did not sufficiently address the research focus, leaving 58 publications for a more detailed eligibility assessment. The full-text assessment resulted in the exclusion of another 28 publications that did not adequately meet the established inclusion criteria. Consequently, 30 primary publications were included in the final narrative synthesis, representing 25% of the initially identified records. The selection procedure is illustrated in Figure 1, which presents the progression from initial identification to final inclusion.

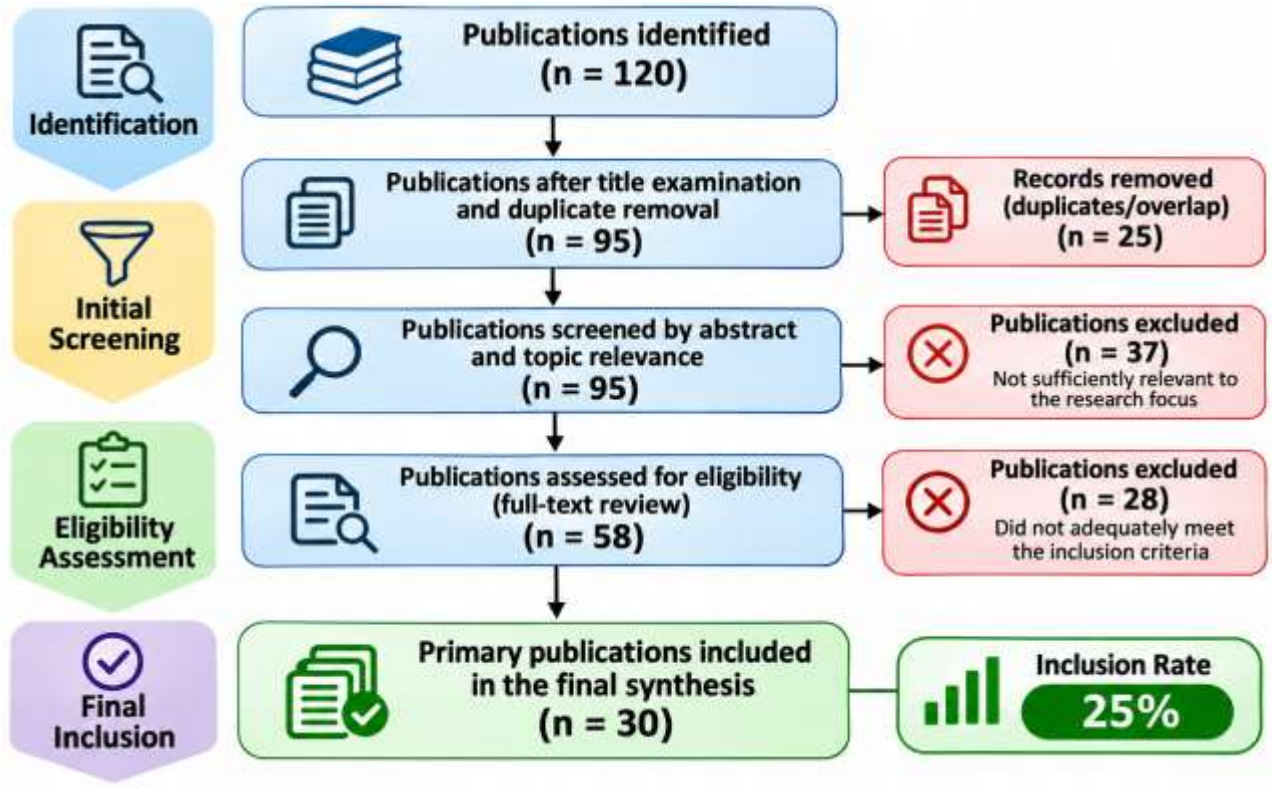


Figure 1. Literature Selection Process
Source: Authors' literature selection (2026).

3.5 Literature Analysis and Synthesis Techniques

The 30 selected publications were analyzed using a thematic synthesis approach. Each study was examined based on its research focus, methodology, key findings, and contribution to digital transformation in education. The findings were grouped into five themes covering language literacy, teachers' digital competence, learning quality, educational leadership, and digital education policies. This classification helped identify similarities, differences, and relationships across studies, as summarized in Table 2. The synthesis involved three steps: classifying findings into dominant themes, comparing relationships across studies, and integrating the results into the Integrated Digital Literacy and Educational Quality Framework. The framework connects students' literacy competencies, teachers' technological capabilities, and institutional management with learning quality and educational effectiveness. The review followed relevant narrative review quality principles discussed by Baethge et al. (2019). As no primary data or statistical testing were involved, the proposed relationships were interpreted as theoretical propositions rather than established causal effects.

Table 2. Thematic Synthesis Framework

Theme	Analytical Focus	Number of Sources
Transformation of language literacy and digital learning	Literacy competencies and technology integration in language learning	8
Teachers' digital competence	TPACK, technology acceptance, and professional development	7
Learning quality	Digital assessment, equitable access, and learning experiences	3
Educational leadership and management	Digital leadership, institutional policies, and organizational change	7
Digital education policies and competency frameworks	Digital ecosystems, competency standards, and responsible technology use	5
Total	**Primary literature corpus**	**30**

Source: Authors' thematic classification of the 30 primary publications.

4. DATA ANALYSIS AND DISCUSSION

4.1 Mapping and Development of the Literature on Digital Literacy in Education

A review of 30 primary sources indicates that the development of digital literacy in education is associated with changes in how students acquire knowledge, the use of technology in learning, the development of teachers' competence, and the strengthening of educational institutional management. The reviewed literature comprises 25 journal articles and five institutional sources published between 2006 and 2026. These sources represent various types of research, including empirical studies, meta-analyses, literature reviews, conceptual framework development, and educational policy reports. Such diversity provides an opportunity to understand digital educational transformation from both instructional and organizational perspectives.

Based on their primary focus, the literature was classified into five themes. The first theme includes eight publications addressing the transformation of language literacy and digital learning. The second consists of seven publications examining teachers' digital competence and technology integration. The third comprises three publications focusing on learning quality, assessment, and equitable learning opportunities. The fourth includes seven publications discussing digital leadership and educational management. The fifth consists of five institutional sources addressing policies, digital education ecosystems, and technological competency frameworks. This classification was used to identify the primary contribution of each source, although several publications are relevant to more than one theme.

Table 3. Thematic Mapping and Synthesis of 30 Publications

No.	Author(s) (Year)	Focus and Approach	Main Contribution	Theme
1	Sung et al. (2015)	Meta-analysis of mobile-assisted language learning	Mobile technology has the potential to improve language learning outcomes	T1
2	Yu & Zeng (2026)	Systematic review of digital storytelling in English language learning	Digital storytelling may support language skills and student engagement	T1
3	Wu & Chen (2020)	Systematic review of educational digital storytelling	Multimedia and digital narratives can be integrated into learning activities	T1
4	Abd Rahman & Bakar (2020)	Systematic review of digital storytelling	Identifies the potential of digital storytelling for developing language skills	T1
5	Thompson & von Gillern (2020)	Meta-analysis of vocabulary learning through digital games	Digital games can serve as an approach to vocabulary instruction	T1
6	Putri et al. (2025)	Systematic review of mobile learning and digital storytelling	Connects multilingual language learning with technology use	T1
7	John & Ukpai (2025)	Systematic review of digital storytelling	Discusses the contribution of digital storytelling to language learning	T1
8	Ng (2012)	Conceptual and educational study of digital literacy	The ability to operate devices does not necessarily indicate digital literacy proficiency	T1
9	Mishra & Koehler (2006)	Development of the TPACK framework	Technology integration requires alignment among technological, pedagogical, and content knowledge	T2
10	Scherer et al. (2019)	Meta-analysis of teachers' technology acceptance	Perceived usefulness and ease of use are associated with technology acceptance	T2
11	Scherer & Teo (2019)	Meta-analysis of technology integration intentions	Identifies factors associated with teachers' intentions to use technology	T2
12	Tondeur et al. (2019)	Study of preservice teacher preparation	Teacher education contributes to readiness for technology integration	T2
13	Claro et al. (2024)	Systematic review of teachers' digital competence	Teachers' digital competence encompasses multiple professional dimensions	T2
14	Nagel et al. (2023)	Study of educators' professional agency	Digital competence development is associated with educators' professional capabilities	T2
15	Knezek et al. (2023)	Development of digital competence strategies and instruments	Emphasizes strategies for developing teachers' competence	T2
16	Børte et al. (2023)	Systematic review of technology-supported formative assessment	Technology-based assessment requires pedagogical readiness and organizational support	T3

17	Cheah et al. (2023)	Mixed-methods systematic review of equitable teaching practices	Technology integration should consider equitable learning opportunities	T3
18	Tadlaoui-Brahmi et al. (2022)	Systematic review of digital citizenship	Digital education includes critical and responsible technology use	T3
19	Nagel et al. (2026)	Scoping review of school leadership and digitalization	Identifies the role of leadership in school digital transformation	T4
20	Asriadi & Andriani (2026)	Systematic review of digital leadership	Connects digital readiness, leadership practices, and organizational outcomes	T4
21	Amelia (2026)	Systematic review of principal leadership	Discusses leadership strategies in digital education	T4
22	Fitriani (2026)	Systematic review of digital leadership and teachers' ICT literacy	School leadership can support the development of teachers' technological competence	T4
23	Susanti et al. (2026)	Systematic review of digital transformational leadership	Positions leadership as part of school management transformation	T4
24	Amin et al. (2025)	Systematic review of leadership and digital transformation	Connects leadership strategies with educational management	T4
25	Kalogeratos et al. (2026)	Systematic review of digital educational leadership and management	Emphasizes the importance of vision, competence, and technology governance	T4
26	OECD (2023)	Policy report on digital education ecosystems	Digital transformation requires governance, resources, and support systems	T5
27	UNESCO (2023)	Global education monitoring report	Technology benefits must be evaluated alongside risks, equity, and evidence quality	T5
28	Miao & Holmes (2023)	Guidelines for AI use in education	AI implementation should consider ethics and human interests	T5
29	UNESCO (2018)	ICT competency framework for teachers	Technological competence should be integrated with pedagogy and professional development	T5
30	European Commission, Joint Research Centre (2017)	DigCompEdu framework	Provides dimensions of digital competence for educators' professional practices	T5

Note: T1 = Language literacy and digital learning; T2 = Teachers' digital competence; T3 = Learning quality; T4 = Educational leadership and management; T5 = Digital education policies and competency frameworks.
Source: Authors' conceptual synthesis based on the 30 primary publications.

This mapping indicates that research on digital educational transformation has developed through several areas of inquiry. Earlier studies established foundations for understanding digital literacy and technology integration in pedagogy, while subsequent literature increasingly addressed instructional strategies, educators' competence, and organizational support. More recent publications have also examined digital leadership and the use of artificial intelligence in education.

4.2 Transformation from Language Literacy to Digital Literacy

The synthesis findings indicate that technological developments have broadened the meaning of literacy in educational contexts. Language literacy remains a fundamental competency for understanding and communicating information, but digital environments require students to develop additional skills. Information is now presented in various formats, including text, images, audio, video, and interactive media. Consequently, reading and writing activities are no longer limited to conventional text comprehension. Students must also be able to evaluate information sources, understand the relationships between text and visual media, and use information ethically. Ng (2012) explains that individuals' familiarity with technology does not automatically indicate adequate digital literacy. This finding reinforces the understanding that digital literacy represents an extension of literacy competencies rather than merely the technical ability to operate digital devices.

The relationship between language literacy and digital literacy can be understood through changes in learning activities. When students read online articles, they use not only language comprehension skills

but also the ability to distinguish credible information from misleading content. Similarly, when preparing multimedia presentations, they need writing skills, argumentation abilities, source selection, and the capacity to communicate ideas through technology. The DigCompEdu framework developed by the European Commission, Joint Research Centre (2017) highlights the importance of digital competence in developing learning activities and students' capabilities. This perspective aligns with UNESCO (2018), which positions technological competence as part of educational development and teachers' professionalism. Thus, language literacy provides the foundation for communication, while digital literacy expands students' capacity to understand and produce knowledge in digital environments.

In language learning, this transformation is reflected in the use of digital media that enable students to participate more actively in learning. Wu & Chen (2020) examined the application of digital storytelling in education and demonstrated how this approach combines narratives with multimedia technology. Yu & Zeng (2026) also discussed the use of digital storytelling in English language learning, including its potential to support language skills and student engagement. Creating digital stories requires students to organize ideas, select vocabulary, develop storylines, and communicate messages through digital media. These activities demonstrate that language competencies can be developed alongside technological skills. However, the educational contribution of such activities still depends on instructional design, students' abilities, and teacher support.

Based on these findings, the transformation from language literacy to digital literacy is more appropriately understood as a process of developing complementary competencies. Language literacy does not lose its relevance as technology advances because information comprehension and communication skills remain fundamental to learning. Instead, digital literacy provides new contexts in which these competencies can be applied. Consequently, developing digital literacy in education should not involve neglecting reading, writing, and critical thinking skills, but rather integrating them into technology-supported learning activities.

4.3 Technology Strategies for Improving Learning Quality

The literature synthesis indicates that technology offers various strategies for enriching learning processes. In language education, these strategies include mobile devices, interactive multimedia, digital games, and digital storytelling. Sung et al. (2015), through a meta-analysis of mobile-assisted language learning, identified a positive contribution of technology use to learning outcomes. This finding suggests that technology can expand learning opportunities by providing more flexible access to materials and diverse learning activities. However, it does not imply that every use of mobile devices will improve learning. Technological effectiveness remains influenced by the alignment of pedagogical strategies, learning objectives, and students' characteristics.

One strategy receiving considerable attention in the literature is digital storytelling. Wu & Chen (2020) explain that this approach combines storytelling activities with various multimedia elements. In language learning, students can use text, images, voice recordings, and videos to communicate ideas. Yu & Zeng (2026) discuss the potential of this approach in English language learning, while Abd Rahman & Bakar (2020) examine its application in developing language skills. Based on this synthesis, digital storytelling can be understood as an approach connecting language competencies with creativity and digital communication. Learning activities focus not only on acquiring subject matter but also on constructing, developing, and communicating information. Therefore, technology has the potential to improve the quality of learning experiences when students are given opportunities to apply their knowledge actively.

Another strategy involves using digital games in learning. Thompson & von Gillern (2020) examined English vocabulary learning through digital games and provided insights into the use of interactive media to support language acquisition. This approach demonstrates that technology can provide learning experiences that differ from conventional instructional activities. However, game elements alone cannot serve as indicators of learning success. Digital game implementation still requires clear objectives, appropriate content, and evaluation of students' learning progress. In this context, technology should help teachers develop more meaningful activities rather than simply making learning more attractive.

In addition to delivering instructional content, technology can support assessment and feedback. Børte et al. (2023) demonstrate that technology integration in formative assessment requires teacher readiness and adequate supporting conditions. Technology can facilitate the collection of information about learning progress, but the quality of instructional decisions still depends on teachers' ability to interpret that information. Cheah et al. (2023) also emphasize the importance of equitable learning opportunities in technology-

supported educational practices. These perspectives indicate that improvements in learning quality cannot be assessed solely through the use of applications or devices. Quality also involves assessment practices, student engagement, and equitable opportunities to access learning experiences.

Therefore, technology strategies that support learning quality involve more than simply digitizing instructional materials. Technology should be used to strengthen comprehension, encourage participation, provide feedback, and help teachers adapt instruction to students' needs. Improvements in learning quality do not occur merely because technology is present in classrooms, but because it is applied through appropriate pedagogical decisions and supported by continuous evaluation. This perspective provides a foundation for understanding the importance of teachers' digital competence in educational transformation.

4.4 Teachers' Digital Competence as a Link Between Technology and Learning

The synthesis findings indicate that teachers' digital competence is an important component of technology strategy implementation. Teachers are responsible for selecting instructional media, designing activities, managing interactions, and evaluating learning outcomes. Therefore, the ability to operate digital devices is insufficient to ensure that technology provides educational benefits. Mishra & Koehler (2006), through the TPACK framework, explain that technology integration requires the combination of technological, pedagogical, and content knowledge. This framework suggests that technology use should consider learning objectives and the characteristics of the content being taught. In language education, for example, applications designed to improve speaking skills may not be equally suitable for teaching reading or writing. Thus, teachers' digital competence includes the ability to determine how technology can be appropriately used to support learning objectives.

Beyond competence, teachers' readiness and acceptance of technology also require attention. Scherer et al. (2019) demonstrate that perceptions of usefulness and ease of use are associated with teachers' technology acceptance. Scherer & Teo (2019) also examine factors related to educators' intentions to integrate technology. These findings indicate that policies focused on providing technological devices do not necessarily lead to effective implementation when teachers do not understand the benefits of technology or encounter barriers to its use. This situation highlights the importance of training, mentoring, and technical support tailored to educators' needs. Digital learning transformation requires changes in how teachers understand and use technology, rather than merely increasing the number of available facilities.

The development of teachers' digital competence is also associated with professional learning processes. Tondeur et al. (2019) emphasize the importance of preparing preservice teachers to integrate technology, while Claro et al. (2024) demonstrate that teachers' digital competence should be understood through multiple dimensions. Nagel et al. (2023) examine educators' professional agency in developing digital competence. Together, these perspectives indicate that developing technological capabilities requires more than training in application use. Teachers also need opportunities to collaborate, reflect, evaluate instructional practices, and develop innovations aligned with students' needs. Therefore, digital competence development should become part of a continuous strategy for improving the quality of educators.

In a broader context, teachers' digital competence can be understood as a conceptual link between technological availability and instructional implementation. Digital devices provide resources, but teachers determine how these resources are translated into pedagogical activities. This relationship does not mean that teachers' competence is the only determinant of learning quality. Student readiness, technology access, organizational support, and learning environment characteristics must also be considered. Nevertheless, based on the literature synthesis, teachers' digital competence represents an important enabling condition for implementing technology strategies in a more focused manner that is relevant to learning needs.

4.5 Digital Leadership and Educational Management in Supporting Learning Transformation

Technology integration in education requires organizational support to ensure consistent implementation. The literature synthesis indicates that digital transformation involves not only changes in instructional media but also the development of policies, infrastructure, human resource competencies, and institutional governance. OECD (2023) explains that digital education ecosystems comprise interconnected components, including technological resources, support systems, and management policies. This perspective suggests that educational institutions need clear strategies for identifying technological requirements and aligning them with learning objectives. Without adequate management support, technology use may develop through isolated individual initiatives without producing sustainable institutional change.

Digital leadership is one of the aspects discussed in the literature on educational organizational transformation. Nagel et al. (2026) examine research developments concerning school leadership and digitalization, while Asriadi & Andriani (2026) discuss the relationships among digital readiness, leadership practices, and organizational outcomes. These studies provide a basis for understanding the role of educational leaders in establishing a direction for change, encouraging competence development, and coordinating technological resources. Digital leadership involves not only leaders' ability to use digital devices but also their capacity to establish a vision, manage change, and create an environment that supports innovation. However, improved organizational outcomes cannot automatically be equated with better learning outcomes without considering the instructional processes involved.

In educational management practices, digital strategies must also consider sustainability and equitable access. UNESCO (2023) cautions that technology implementation presents risks associated with the digital divide, the protection of students' interests, and limitations in evidence of effectiveness. Meanwhile, Miao & Holmes (2023) emphasize the need for human-centered artificial intelligence and ethical considerations in education. These perspectives suggest that decisions concerning technology use should not be based solely on emerging innovations or modernization pressures. Educational institutions need to assess benefits, costs, human resource readiness, information security, and the suitability of technology for students' needs. Thus, digital educational management requires a balance among innovation, institutional responsibility, and equitable access to quality educational services.

Based on this synthesis, educational leadership and management can be positioned as organizational components that support successful technology implementation. Teachers' competence and instructional strategies operate at the pedagogical level, while educational management provides the conditions that enable both to develop. Such support may include infrastructure provision, continuous training, technology use policies, and implementation evaluation. The relationship between pedagogical and organizational components indicates that digital transformation should be understood as a process involving multiple levels of educational management. Improving learning quality and strengthening educational management are two interrelated objectives, but each requires distinct evaluation indicators.

4.6 Development of the Integrated Digital Literacy and Educational Quality Framework

Based on the synthesis of the five main themes, this study develops the Integrated Digital Literacy and Educational Quality Framework as a conceptual framework for understanding the relationships among language literacy, digital literacy, technology strategies, teachers' competence, and educational management. The framework integrates the digital literacy perspective proposed by Ng (2012), the TPACK framework developed by Mishra & Koehler (2006), the educators' digital competence framework introduced by the European Commission, Joint Research Centre (2017), and the digital education ecosystem approach presented by OECD (2023). Although these perspectives address different areas, they complement one another in explaining digital educational transformation. Digital literacy provides the foundation for individual competencies, TPACK explains technology integration in pedagogy, DigCompEdu broadens the understanding of educators' competence, and the digital education ecosystem approach situates technological transformation within organizational and governance contexts.

The proposed framework consists of four main components. The first is literacy foundation, which encompasses language literacy and digital literacy as students' fundamental competencies for understanding, evaluating, and communicating information. The second is technology-enabled pedagogy, which includes educational technology, multimedia strategies, digital storytelling, and digital assessment. The third is teacher digital competence, which encompasses technological proficiency, pedagogical knowledge, instructional design capabilities, and professional development. The fourth is digital educational leadership and management, which includes policies, infrastructure, human resource development, leadership, and technology governance. These four components are understood as interconnected elements that support improvements in educational quality.

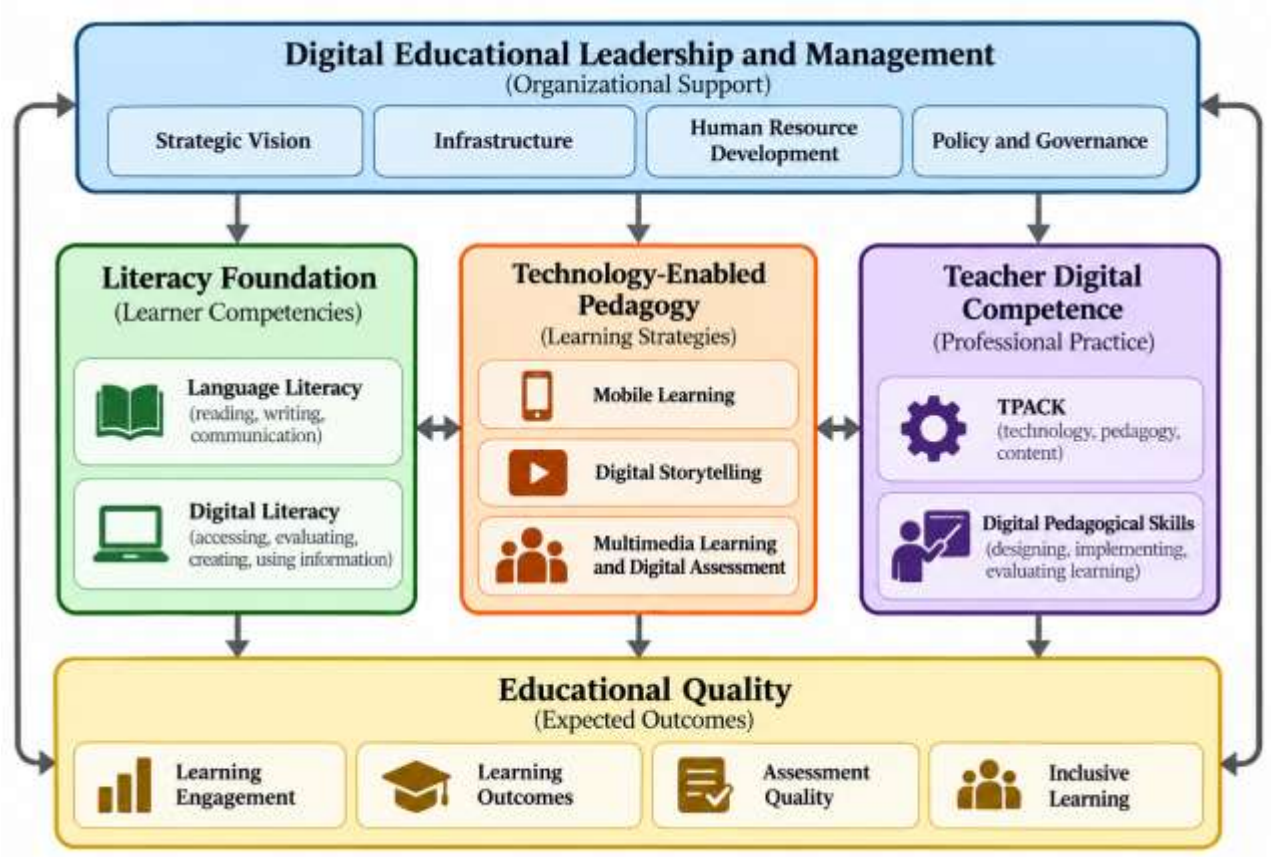


Figure 2. Integrated Digital Literacy and Educational Quality Framework
Source: Authors' conceptual synthesis based on the reviewed literature.

The framework is not intended to suggest that all components have empirically established causal relationships. Instead, the relationships among components represent conceptual propositions developed from similarities and connections identified in the literature. For example, students' digital literacy may support the use of learning resources, but its benefits also depend on instructional design and teachers' capabilities. Similarly, digital leadership may provide organizational conditions that support innovation, but its contribution to learning quality requires further empirical evaluation. Therefore, this framework serves as a tool for understanding digital educational transformation more comprehensively while providing a foundation for future research.

The framework's primary contribution lies in connecting perspectives that are frequently examined at different levels of analysis. Digital literacy research often focuses on individual competencies, educational technology studies emphasize pedagogical strategies, and educational management research addresses leadership and organizational governance. Through this integration, improving educational quality is understood as a process requiring alignment among students' competencies, educators' capabilities, instructional strategies, and institutional support. Thus, digital educational transformation should not be understood merely as technological change, but as a simultaneous process of developing human capabilities and educational organizations.

4.7 Theoretical and Practical Implications and Directions for Future Research

Theoretically, the synthesis findings broaden the understanding of digital educational transformation by connecting language literacy, digital literacy, instructional strategies, teachers' competence, and educational management within a single conceptual framework. This integration provides the perspective that educational quality cannot be explained solely by technological availability or individuals' ability to operate digital devices. Learning quality is also associated with pedagogical alignment, interaction quality, assessment practices, and organizational support. The TPACK framework developed by Mishra & Koehler (2006) provides a foundation for understanding technology integration in learning, while OECD (2023) extends the discussion

to digital education systems and governance. By combining these perspectives, this study positions literacy transformation as part of pedagogical and organizational change in education rather than as an isolated development of technological skills.

Practically, the findings provide implications for teachers, educational leaders, and policymakers. Teachers need to develop the ability to select technology based on learning objectives and integrate it with reading, writing, communication, and critical thinking activities. Digital storytelling, mobile learning, and digital assessment can be considered strategies for supporting learning activities, but their implementation must be adapted to students' characteristics and the availability of facilities. At the organizational level, educational leaders should provide continuous training, adequate infrastructure, and clear technology use policies. Therefore, educational digitalization programs should focus not only on device procurement but also on developing human competencies and improving the quality of learning processes.

This review also highlights the importance of considering the risks and limitations of digital transformation. Differences in access to devices and internet connectivity may influence students' opportunities to obtain equitable learning experiences. In addition, the use of artificial intelligence-based technology introduces new concerns regarding data protection, transparency, and responsible information use. UNESCO (2023) and Miao & Holmes (2023) provide a foundation for understanding the importance of approaches that consider both the benefits and risks of technology. Therefore, educational digitalization strategies should be developed through continuous evaluation to ensure that technological innovation does not neglect inclusion and students' interests.

Future research is encouraged to empirically examine the relationships among the components of the Integrated Digital Literacy and Educational Quality Framework. Quantitative studies could measure students' digital literacy, teachers' digital competence, instructional strategies, digital leadership, and educational quality indicators. Structural Equation Modeling–Partial Least Squares (SEM-PLS) could be considered for examining direct and indirect relationships among variables, provided that the analysis is supported by appropriate theoretical foundations, measurement designs, and data. Qualitative research could also be conducted to understand how teachers and educational leaders manage technological change across different organizational contexts. Furthermore, longitudinal studies could help explain how digital competence and learning quality develop over time.

Overall, the synthesis findings indicate that improving educational quality through technology requires the integration of students' literacy competencies, pedagogical strategies, teachers' digital competence, and educational management support. These four components should not be treated as independent factors because technology implementation occurs within interconnected learning and organizational environments. Through the proposed conceptual framework, this study provides a foundation for understanding how the transformation from language literacy to digital literacy can be incorporated into more comprehensive strategies for improving learning quality and educational management.

5. CONCLUSION, IMPLICATION, SUGGESTION, AND LIMITATIONS

This review demonstrates that the development of green digital marketing in the green economy involves not only the use of digital technologies to promote environmentally friendly products but also companies' ability to establish credible environmental communication and encourage sustainable consumption behavior. The literature synthesis indicates that social media, digital advertising, and e-commerce platforms can expand the reach of sustainability information and enhance consumer engagement. However, the effectiveness of these strategies depends on information clarity, transparency of environmental claims, and consumer trust. The risk of greenwashing may generate skepticism and undermine corporate credibility, while price, quality, product availability, and consumption habits may constrain behavioral change. Based on these findings, this review integrates four key components, namely Green Digital Marketing, Environmental Communication, Green Trust, and Sustainable Consumer Behavior, into a conceptual framework for understanding the relationship between digital marketing strategies and sustainable consumption. Therefore, the success of green digital marketing should not be evaluated solely through increased consumer attention or purchase intentions but should also consider actual changes in consumer behavior that contribute to environmental sustainability.

This review provides theoretical and practical implications for the development of sustainable digital marketing. Theoretically, integrating green digital marketing, environmental communication, green trust,

and sustainable consumer behavior broadens the understanding of the relationship between digital marketing strategies and environmentally responsible consumption decisions. The framework positions communication quality and trust as essential elements in understanding consumer responses while recognizing that sustainable behavior is influenced by psychological and situational conditions. From a practical perspective, companies should develop digital marketing strategies that are not only visually appealing but also communicate environmental information that is clear, specific, and verifiable. The use of social media, educational content, and digital interactions should be supported by business practices consistent with sustainability claims. For governments and other stakeholders, the findings emphasize the importance of consumer education, improved environmental literacy, and oversight of green marketing claims to ensure that the transition toward a green economy is supported by responsible communication.

This review has several limitations that should be considered when interpreting its findings. First, the study employs a narrative literature review approach, meaning that its synthesis is interpretative and does not provide statistical effect estimates comparable to those generated through meta-analysis. Second, the literature scope focuses on publications from 2015 to 2026 identified through Scopus and Google Scholar. Consequently, relevant studies indexed in other databases or published outside this period may not be comprehensively represented. Third, the reviewed studies differ in industry contexts, respondent characteristics, methodological approaches, and measures of consumer behavior, limiting the direct generalizability of the findings across consumer populations. Furthermore, several studies emphasize green purchase intention rather than actual purchasing behavior, resulting in limited evidence regarding changes in sustainable consumption practices. The proposed integrative framework is also conceptual and has not been empirically tested using primary data. Therefore, the relationships among its components should be interpreted as a synthesis of existing literature rather than empirically established causal relationships.

Future research is recommended to empirically examine the relationships among green digital marketing, environmental communication, green trust, and sustainable consumer behavior using quantitative, qualitative, or mixed-methods approaches. Quantitative studies may employ Structural Equation Modeling to investigate the mediating roles of environmental communication and green trust while considering greenwashing as a factor that may undermine consumer trust. Future studies should also account for product prices, quality, availability, environmental literacy, and consumption habits as contextual factors. Beyond measuring purchase intentions, subsequent research should incorporate indicators of actual behavior, including environmentally friendly product purchases, product reuse, reduced excessive consumption, and waste management practices. Empirical research involving Indonesian consumers is particularly important because differences in purchasing power, access to green products, and environmental literacy may generate varying responses to sustainable digital marketing strategies. Accordingly, future studies are expected to strengthen the empirical evidence and provide more contextually relevant recommendations for companies seeking to support the transition toward a green economy.

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