

Digital-Based Indonesian Language Learning in Higher Education: A Review of Trends, Challenges, and Emerging Technologies

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ARTICLE HISTORY

Received : 2025-12-11

Revised : 2026-05-20

Accepted : 2026-05-24

KEYWORDS

Digital language learning

Language education

Bahasa Indonesia

Higher education

ICT integration

Digital literacy



ABSTRACT

Digital transformation has significantly influenced Indonesian language learning in higher education through the integration of ICT, digital platforms, and artificial intelligence (AI). However, existing studies remain fragmented, often focusing on specific technologies or isolated pedagogical practices without providing a comprehensive understanding of how digital learning is implemented in Indonesian language education. This gap highlights the need for a systematic review that synthesizes current evidence, identifies dominant trends, and examines emerging challenges in the context of rapid digital transformation. This study employed a Systematic Literature Review (SLR) guided by the PRISMA protocol to analyze empirical studies published between 2020 and 2026. Data were collected from Scopus and Google Scholar databases using predefined inclusion and exclusion criteria. From 300 initial records, 23 eligible studies were selected and analyzed through thematic coding and cross-study synthesis. The findings reveal five interconnected themes: digital learning strategies, ICT integration, language-specific pedagogy, digital literacy, and AI-based learning technologies. The review indicates that digital technologies tend to support engagement and language learning when combined with student-centered instructional design and adequate digital competence. Digital literacy also emerged as both a facilitator of learning participation and a source of inequality related to access and technological skills. In addition, AI-based tools provide opportunities for interactive and personalized learning while raising concerns regarding learner dependency and pedagogical control. This study proposes a holistic framework integrating pedagogy, technology, digital literacy, learner readiness, and AI in Indonesian language learning. The review is limited to higher education studies indexed in Scopus and Google Scholar. Future research should investigate longitudinal impacts of AI-supported language learning and integrated digital pedagogical models.

1. Introduction

Digital technology is no longer an external support in language education. It has become part of the way students read, write, interact, think, and construct meaning in higher education. In recent years, digital platforms, online interaction, and artificial intelligence (AI) have changed language learning from a mostly teacher-directed process into a more flexible, interactive, and student-centered learning experience (Amirudin, 2026; Riadi, 2024). This shift is closely related to constructivist and socio-cultural views of learning, which see knowledge as something built through active participation, collaboration, and mediated interaction. In digital learning spaces, students do not only receive information. They search

for it, evaluate it, discuss it, and use it to produce meaning. These practices also reflect connectivism and self-regulated learning because learners must manage digital resources, join online discourse, and develop independent learning strategies.

In Indonesian higher education, this transformation has a specific and strategic meaning. Bahasa Indonesia is not only a national language or a medium of academic communication. It also carries cultural identity, critical literacy, and social meaning. Therefore, Indonesian language learning in universities should not be reduced to technical language mastery. It must also develop students' ability to communicate ethically, critically, and meaningfully in digital contexts. After the COVID-19 pandemic, Indonesian

universities expanded online and blended learning through Learning Management Systems (LMS), web-based learning, social media, digital games, and AI-supported applications (Atmojo, 2021; Lubis, 2021; Yasa, 2022). These digital approaches are often linked to the development of 21st-century skills, especially critical thinking, collaboration, creativity, and communication (Budiman, 2023; Kurniaman, 2025). However, the rapid growth of digital learning also raises an important question: how can Indonesian language learning remain pedagogically meaningful, culturally grounded, and academically rigorous in a technology-rich environment?

Several studies show that digital learning technologies have encouraged the use of blended learning, inquiry-based learning, and game-based learning to improve learner autonomy and engagement (Dewantara, 2021; Djihadah, 2023; Rahmatika, 2025). Digital tools can support constructivist and constructionist learning because they allow students to co-construct knowledge through shared artefacts, online dialogue, and collaborative learning activities (An et al., 2022; Girvan & Savage, 2019; Rojprasert et al., 2020). Reviews of technology-enhanced learning also indicate that Web 2.0 tools, such as discussion forums, wikis, blogs, and collaborative documents, can strengthen community building, peer discussion, learner publication, and cooperative learning within constructivist pedagogy (Lamtara, 2023; Tchoshanov, 2021). Empirical studies further show that synchronous online projects and blended platforms, including social media groups and learning management systems, can increase connectedness and collaborative “learning by making,” which reflects constructionist principles of meaningful production shared with peers (An et al., 2022; Rojprasert et al., 2020). From a socio-cultural perspective, these mediated interactions can expand communication and enable peer or teacher scaffolding during joint activity (Levin et al., 2025; Tchoshanov, 2021). Even so, the literature still shows a conceptual gap. Studies on virtual worlds and blended courses often report social presence, discussion, and artefact-sharing, but they do not always explain how learners’ zones of proximal development are operationalized in digital language learning (Girvan & Savage, 2019; Rojprasert et al., 2020).

Other studies explain digital learning through the Technology Acceptance Model (TAM) and the Technological Pedagogical Content Knowledge (TPACK) framework. TAM explains technology adoption through users’ perceptions, especially perceived usefulness and perceived ease of use, which influence attitudes and behavioral intention toward educational technologies (Al-Marroof et al., 2020; Jang et al., 2021; Prasajo et al., 2020). Educational studies show that these perceptions depend not only on access to tools but also on teachers’ knowledge and competence, which shape TAM beliefs and intentions in online teaching, Web 2.0 adoption, and the use of

emerging AR/VR and AI learning tools (Jang et al., 2021; Khong et al., 2023; Prasajo et al., 2020; Yim & Wegerif, 2024). TPACK complements this explanation by emphasizing the need to align technology, pedagogy, and subject content (Al-Marroof et al., 2020; Khong et al., 2023; Yim & Wegerif, 2024). Studies combining TAM and TPACK show that stronger TPACK is associated with higher perceived usefulness, ease of use, and intention to adopt technology in online teaching and IoT-supported learning contexts (Almaiah et al., 2022; Khong et al., 2023; Wijayati et al., 2024). These findings confirm that effective digital integration depends on user perceptions, digital competence, pedagogical-content-technology alignment, training, and institutional support (Jang et al., 2021; Khong et al., 2023).

Yet, the existing literature still remains fragmented. Many studies emphasize the positive effects of digital technology on flexibility and engagement, while giving less attention to persistent problems such as digital inequality, uneven infrastructure, limited teacher readiness, and disparities in digital literacy (Fuad, 2026). These issues matter because language learning depends on interaction, feedback, discourse management, and meaningful communication. These processes cannot be replaced by technology alone. The emergence of AI and generative AI adds further concerns, including learner dependency, reduced critical engagement, academic integrity risks, and the weakening of authentic language production and cultural meaning-making (Juanda, 2024; Safitri, 2025).

This study is positioned within that unresolved scholarly space. Previous studies on digital learning in higher education often focus on isolated technologies or individual instructional strategies, such as LMS implementation, digital literacy, web-based learning, or game-based learning, without explaining how pedagogy, digital literacy, learner readiness, ICT integration, and AI interact in Indonesian language learning contexts (Ahsin, 2025; Cahyo, 2025; Rahmatika, 2025).

Scholarship on educational technology and AI in language learning also tends to draw from broad digital education or non-Indonesian settings. It commonly highlights benefits such as engagement and feedback, while also noting concerns about superficial integration and learner overreliance on tools, including automated writing support (Aljafen, 2021; Assalamah et al., 2024). In Indonesia, theoretical discussions of technology integration often focus on EFL teacher preparation and TPACK-based readiness, especially issues of limited ICT and language competence and the need to align technology, pedagogy, and content, rather than on Indonesian-language courses in higher education (Eddraoui et al., 2023; Othman, 2024). Evidence on university-level Indonesian language learning is still limited. One mixed-method study in a Scientific Indonesian Language course found improved student outcomes with AI, but it also reported mixed impacts

and called for deeper analysis of implementation factors beyond short-term achievement gains (Sugianti & Rosidah, 2024). As a result, dominant pedagogical patterns, locally grounded design principles, and persistent implementation barriers remain under-synthesized, even though Indonesian higher education needs context-sensitive instructional models (Irwansyah et al., 2019) and generative AI may embed cultural bias that affects Indonesian languacultures over time (Wandera, 2024). The novelty of this study lies in its attempt to integrate constructivism, socio-cultural theory, connectivism, self-regulated learning, TAM, and TPACK into one analytical framework for reviewing digital-based Indonesian language learning in higher education.

This study is significant because it views digital-based Indonesian language learning as a pedagogical, cultural, and institutional issue, not just technology use. It systematically reviews empirical studies from 2020 to 2026 by examining pedagogical strategies, ICT and AI use, digital literacy, learner readiness, and key integration challenges. The findings can help lecturers, curriculum developers, researchers, and institutions design more inclusive and sustainable digital language learning practices. In conclusion, digital-based Indonesian language learning in higher education has entered a more complex phase. It involves pedagogy, learner readiness, digital literacy, institutional support, and cultural sensitivity. This review implies that future digital language learning models should place pedagogy before technology while protecting the social, cultural, and critical functions of Bahasa Indonesia.

2. Method

2.1 Research Design

This study employed a Systematic Literature Review (SLR) to examine digital-based Indonesian language learning strategies in higher education. The SLR approach was selected because it provides a structured, transparent, and replicable procedure for identifying, evaluating, and synthesizing existing empirical evidence. Compared with traditional narrative reviews, SLR enables a more rigorous mapping of research trends, theoretical developments, instructional practices, and emerging issues within a specific field. In this study, the SLR design was particularly appropriate for synthesizing fragmented research concerning digital learning, ICT integration, digital literacy, and artificial intelligence in Indonesian language education. The review process was guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework to ensure methodological transparency and consistency throughout the identification, screening, eligibility, and inclusion stages.

2.2 Search Strategy

The literature search was conducted using two major academic databases: Scopus and Google Scholar, with Google Scholar searches facilitated through the Publish or Perish application. Scopus was selected because it indexes high-quality peer-reviewed international publications and provides strong coverage of educational and language-learning research. Google Scholar was additionally included to broaden the search scope and capture potentially relevant studies from regional journals, conference proceedings, and emerging publications that may not yet be indexed in Scopus, particularly within Indonesian educational contexts. The combination of these databases was intended to balance international visibility and contextual relevance. However, the researchers acknowledge that limiting the search to two databases may have excluded some relevant studies indexed elsewhere, representing a limitation of the review.

The search process applied a structured Boolean search strategy to improve consistency and retrieval accuracy. The following search string was used:

("Indonesian language" OR "Bahasa Indonesia")
AND ("digital learning" OR "online learning" OR "e-learning" OR "technology")
AND ("higher education" OR "university" OR "college" OR "tertiary education")

Additional keyword combinations and backward reference searches were also conducted to identify potentially relevant studies that may have been missed during the initial search process. These supplementary strategies helped broaden the search coverage and strengthen the comprehensiveness of the review. The search was limited to publications published between 2020 and 2026, as this period represents the rapid acceleration of digital learning implementation during and after the COVID-19 pandemic.

It also reflects the growing use of AI-supported learning technologies, online learning environments, and broader post-pandemic digital transformation in higher education. By restricting the timeframe, the review focused on recent and relevant studies that capture contemporary pedagogical and technological developments. This limitation also ensured that the selected literature was closely aligned with current higher education contexts and the evolving practices of digital learning.

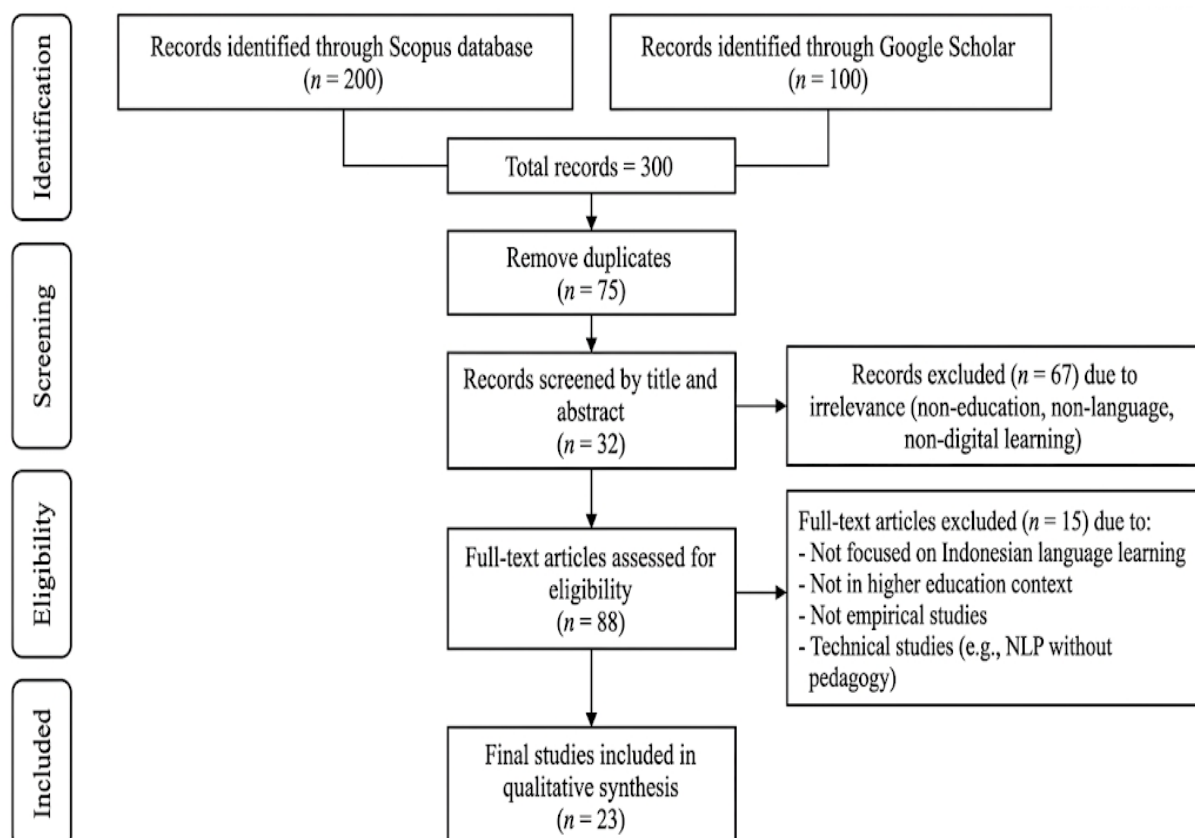
2.3 Inclusion and Exclusion Criteria

To ensure the relevance and quality of the selected studies, explicit inclusion and exclusion criteria were established, as presented in Table 1.

Table 1. Inclusion and Exclusion Criteria

Criteria	Inclusion	Exclusion
Publication Type	Empirical studies (qualitative, quantitative, mixed-methods)	Editorials, opinion papers, conceptual studies
Language Focus	Indonesian language learning or transferable language learning contexts	Studies unrelated to language learning
Educational Level	Higher education (university, college, tertiary education)	Primary or secondary education
Topic	Digital-based learning (ICT, LMS, e-learning, AI)	Traditional/non-digital learning
Methodology	Clear research design with data	No empirical data
Time Frame	2020–2026	Before 2020
Scope	Learning strategies, tools, or outcomes	Purely technical studies (e.g., NLP without pedagogy)
Duplication	Unique records	Duplicate articles

2.4 Screening and Selection Process

**Figure 1.** PRISMA flow diagram of the study selection process

The screening and selection procedures followed the PRISMA framework systematically to ensure transparency and replicability throughout the review process. In the identification stage, 300 records were retrieved from Scopus and Google Scholar searches. After removing 75 duplicate records, 225 articles remained for preliminary screening. During the screening stage, titles and abstracts were reviewed to determine their relevance to digital language learning, higher education, and Indonesian language education contexts. At this stage, 125 records were excluded because they were unrelated to language learning, higher education, or digital pedagogy themes.

The remaining 100 articles proceeded to the eligibility stage, where full-text assessments were conducted using the predefined inclusion and exclusion criteria. Articles were excluded if they lacked empirical data, focused primarily on technical system development without pedagogical discussion, addressed non-higher education contexts, or failed to discuss digital learning implementation meaningfully. Following full-text assessment, 77 studies were excluded for these reasons. Ultimately, 23 studies met all eligibility criteria and were included in the final qualitative synthesis.

To strengthen methodological rigor, a quality appraisal process was also conducted during the eligibility stage. Each study was evaluated based on research clarity, methodological transparency, data adequacy, and relevance to the review objectives. Studies with insufficient methodological explanation or unclear empirical procedures were excluded to maintain the credibility of the synthesis.

2.5 Data Extraction and Thematic Analysis

Data extraction was carried out systematically using a structured coding form developed by the researchers to ensure consistency across all reviewed studies. The information extracted from each article covered several key aspects, including publication details, research objectives, educational context, types of digital technologies used, pedagogical approaches, methodological design, major findings, and reported challenges or practical implications. Once the extraction process was completed, the collected data were examined through thematic analysis. This procedure enabled the researchers to identify recurring patterns, compare similarities and differences among the studies, and reveal conceptual relationships across the dataset. As a result, the analysis provided a clearer understanding of how digital technologies have been applied in educational settings and what issues commonly emerge in their implementation.

The thematic analysis followed four stages: familiarization, initial coding, category development, and theme refinement. During the familiarization stage, all included studies were read repeatedly to gain a comprehensive understanding of the data. Initial open coding was then conducted to identify recurring concepts related to instructional strategies, digital technologies, learner outcomes, digital literacy, and AI integration. Similar codes were subsequently grouped into broader analytical categories through an iterative comparison process. Finally, the categories were refined into five dominant themes representing the major dimensions of digital-based Indonesian language learning in higher education: (1) digital learning strategies, (2) ICT and technology integration, (3) language-specific learning, (4) digital literacy and learning outcomes, and (5) artificial intelligence and emerging technologies.

To enhance the trustworthiness of the review and maintain analytical consistency, the coding and categorization process was conducted iteratively through repeated reading, comparison, and refinement of the extracted findings. Each theme was reviewed several times to reduce the possibility of subjective interpretation and to ensure that the coding decisions remained closely aligned with the evidence presented in the original studies. Cross-checking procedures were also applied during the coding stage to verify the consistency between the identified themes, the categorized data, and the reported findings of the reviewed literature. Through this thematic synthesis approach, the researchers were able not only to summarize the findings descriptively but also to examine broader conceptual relationships, recurring pedagogical patterns, and emerging issues across the selected studies. This process provided a more systematic basis for interpreting how digital-based Indonesian language learning has been studied and understood in recent empirical research..

3. Result

3.1 Overview of Selected Studies

This systematic review analyzed 23 empirical studies published between 2020 and 2026 that investigate digital-based language learning in higher education. The selected studies vary in methodological approaches, including experimental, qualitative, quantitative, and mixed-method designs, reflecting the diversity of research perspectives in digital pedagogy.

To provide a structured overview, Table 2 presents the characteristics of the selected studies, including research focus, technological tools, methodology, and key findings.

Table 2. Characteristics of Selected Studies (n = 23)

No	Author (Year)	Focus / Strategy	Technology Tools	Method	Key Findings
1	Ahsin (2025)	Web-based learning writing	Web-based media	Experimental	Improves students' news writing skills
2	Amirudin (2026)	Digital pedagogy	Digital platforms	Qualitative	Enhances character formation and engagement
3	Arono (2025)	TPACK metacognitive listening +	Digital tools	Experimental	Improves critical listening skills
4	Dewantara (2021)	Blended learning	Moodle	Case study	Promotes autonomy
5	Djihadah (2023)	Inquiry-based learning	ICT tools	Experimental	Enhances engagement
6	Riadi (2024)	Blended learning inquiry	LMS	Mixed-method	Improves cognitive presence
7	Budiman (2023)	Digital literacy	Online platforms	Survey	Supports learning success
8	Atmojo (2021)	Online learning system	SIPDA	Quantitative	Effective during pandemic
9	Lubis (2021)	Digital materials	E-learning	Development	Improves effectiveness
10	Mutmainah (2023)	E-learning	LMS	Experimental	Improves outcomes
11	Yasa (2022)	Social media learning	Social media + LMS	Mixed-method	Improves interaction
12	Kurniaman (2025)	ICT literacy needs	ICT tools	Survey	Indicates literacy gap
13	Cahyo (2025)	Listening (BIPA)	Digital media	Experimental	Improves comprehension
14	Indrariyani (2025)	Online interaction	Platforms	Discourse	Teacher role crucial
15	Rahmatika (2025)	Game-based learning	Digital games	Survey	Boosts motivation
16	Suharto (2022)	Writing skills	Digital tools	Experimental	Improves writing quality
17	Isnah (2022)	Digital literacy	Digital tools	Quantitative	Strong correlation with ability
18	Asia (2025)	Tech literacy	Digital tools	Quantitative	Improves motivation
19	Mahmudah (2026)	Digital proficiency	Platforms	Quantitative	Builds positive attitudes
20	Zulfadhli (2024)	Academic writing	Online tools	Mixed-method	Supports literacy
21	Juanda (2024)	AI vs students	ChatGPT	Comparative	Challenges comprehension
22	Safitri (2025)	GenAI learning	AI tools	Experimental	Improves reading
23	Nuemaihom (2025)	AI metaverse	AI + virtual env.	Mixed-method	Enhances communication

3.2 Thematic Analysis of Digital-Based Learning

The thematic analysis of the 23 selected studies identified five dominant and interconnected themes that characterize the current development of digital-based Indonesian language learning in higher education. These themes reflect the major pedagogical, technological, and instructional trends emerging from recent empirical research published between 2020 and

2026. The categorization was developed through thematic coding and cross-study comparison, allowing recurring concepts, instructional patterns, and technological orientations to be systematically grouped into broader analytical dimensions. Collectively, the themes demonstrate that digital language learning in higher education extends beyond the use of technology itself and increasingly involves the interaction between pedagogy, learner competence, digital infrastructure, and emerging technological innovation.

Table 3. Thematic Categorization of Studies

Theme	Description	Studies
Digital Learning Strategies	Pedagogical models (blended, inquiry, game-based)	Ahsin ; Dewantara ; Djihadah ; Riadi ; Rahmatika
ICT & Technology Integration	LMS, platforms, digital tools	Atmojo ; Lubis ; Mutmainah ; Yasa
Language-Specific Learning	Indonesian/BIPA skill development	Cahyo ; Suharto ; Indrariansi
Digital Literacy & Outcomes	Literacy, motivation, attitudes	Budiman ; Isnah ; Asia ; Mahmudah ; Zulfadhli
AI & Emerging Technology	AI, GenAI, metaverse	Juanda ; Safitri ; Nuemaihom

As shown in Table 3, the reviewed studies demonstrate that digital-based Indonesian language learning is multidimensional and shaped by the interaction between pedagogical approaches, technological integration, learner competence, and emerging innovations. The themes also reveal a noticeable shift from technology-oriented discussions toward more pedagogically informed perspectives emphasizing interaction, learner autonomy, digital literacy, and

meaningful communication practices. Furthermore, the emergence of AI-related studies indicates that Indonesian language education is increasingly entering a new phase of digital transformation in which personalization, automation, and immersive technologies are becoming more influential in shaping learning experiences. These thematic findings provide the analytical foundation for the following discussion of each theme in greater detail.

3.2.1 Digital Learning Strategies in Language Education

The thematic analysis demonstrates that digital learning strategies in Indonesian language education have increasingly shifted toward student-centered and interactive pedagogical approaches. Across the selected studies, researchers consistently emphasize that digital learning is no longer limited to technology-mediated content delivery, but increasingly focuses on learner engagement, autonomy, collaboration, and higher-order thinking. The findings indicate that blended learning, inquiry-based learning, web-based instruction, and game-based learning have become dominant instructional models in higher education language learning contexts. These approaches reflect broader pedagogical transitions from passive learning toward more participatory and flexible digital learning environments, a pattern widely discussed in international research on technology-enhanced language learning and digital pedagogy.

One of the most frequently discussed strategies is blended learning, which combines face-to-face instruction with online learning activities. [Dewantara \(2021\)](#) found that Moodle-supported blended learning promotes learner autonomy by allowing students to access learning materials independently and manage their own learning pace. Similarly, [Riadi \(2024\)](#) reported that blended inquiry learning strengthens students' cognitive presence and participation in digital environments through collaborative and reflective learning activities. These findings align with broader higher education studies demonstrating that blended learning environments not only increase flexibility but also encourage active engagement and self-directed learning by providing learners with greater control over the timing and pace of study ([Andreiko & Skarloupina, 2019](#); [Duarte, 2013](#)). In addition, [Galani \(2025\)](#) reported that integrating gamified digital tools into blended language learning environments significantly improved learners' motivation, engagement, and autonomous learning behaviors.

Inquiry-based learning also emerged as an important digital pedagogical strategy. [Djihadah \(2023\)](#) demonstrated that ICT-supported inquiry learning encourages students to participate actively in problem-solving, exploration, and discussion activities. Through digital interaction and collaborative tasks, learners become more involved in constructing meaning rather than simply receiving information from instructors. This finding strongly reflects constructivist perspectives emphasizing that meaningful learning occurs when students actively engage with content, peers, and authentic learning experiences in technology-mediated environments. [Emmerson \(2019\)](#) further argues that socio-constructivist approaches are highly compatible with digital language learning because synchronous and asynchronous technologies facilitate collaborative interaction, negotiation of meaning, and knowledge construction within online environments.

In addition to inquiry-based approaches, web-based learning environments were found to support students' independent learning capacity and language performance. [Ahsin \(2025\)](#) reported that web-based media significantly improved students' news writing skills by providing flexible access to digital resources and opportunities for repeated practice. The accessibility of online learning materials allows students to revisit content, receive feedback, and develop writing proficiency beyond classroom limitations. Similar findings were identified by [Mat et al. \(2025\)](#), whose systematic review of web-based learning in ESL and EFL contexts revealed that cloud-based applications, learning management systems, collaborative writing platforms, and automated writing evaluation tools contribute positively to writing performance, learner engagement, and motivation. [Erdawati et al. \(2025\)](#) also found that web wiki-based collaborative writing improved students' scientific writing quality, self-regulation, and self-efficacy through continuous peer interaction and reflective learning practices. These findings collectively indicate that web-based learning environments can facilitate self-regulated learning processes, particularly in language production activities requiring continuous practice and feedback.

Game-based learning further contributes to enhancing motivation and engagement in digital language learning. [Rahmatika \(2025\)](#) found that digital game-based language learning increases students' participation and enthusiasm, particularly in Indonesian language learning contexts requiring interaction and communicative practice. The use of digital games creates more enjoyable and immersive learning experiences, reduces anxiety, and encourages active involvement in language tasks. These findings are consistent with broader international literature demonstrating that game-based learning positively influences motivation, participation, and communicative competence in second and foreign

language learning contexts ([Li et al., 2010](#); [Bai, 2024](#); [Surbakti, 2025](#)). [Miloserdova and Morozov \(2024\)](#) specifically reported that game mechanics generate high levels of learner engagement and communication practice by gradually immersing students in meaningful language activities. Similarly, [Grab \(2025\)](#) found that gamification elements such as points, badges, and leaderboards significantly increased intrinsic and extrinsic motivation while making language learning more interactive and rewarding.

Another important finding concerns the integration of pedagogical and technological knowledge through TPACK-oriented approaches. [Arono \(2025\)](#) demonstrated that TPACK-based metacognitive listening strategies improve students' critical listening skills by aligning technology use with instructional objectives and pedagogical practices. This finding highlights that the effectiveness of digital learning depends not solely on technological availability but also on how teachers integrate pedagogy, content, and technology meaningfully. [Tseng et al. \(2020\)](#), in a critical review of TPACK research in language teaching, similarly found that many educators continue to rely on teacher-centered instructional approaches despite having access to digital technologies. This suggests that technological integration alone does not automatically transform pedagogy. [Li and Hedi \(2025\)](#) further argued that tensions between traditional teacher identities and expectations for digital innovation often influence teachers' willingness and ability to implement technology-rich instruction effectively.

The findings also reveal a broader pedagogical trend in which digital learning strategies increasingly emphasize interaction, collaboration, and learner-centered participation rather than teacher-dominated instruction. Several studies indicate that digital tools function most effectively when they facilitate discussion, reflection, communication, and collaborative problem-solving. In this sense, technology operates as a mediational tool supporting social interaction and knowledge construction rather than merely serving as a platform for material distribution. [Lantolf and Xi \(2023\)](#) argue from a sociocultural perspective that mediated interaction and the Zone of Proximal Development remain central to language development in digital environments. Similarly, [Hoerudin \(2025\)](#) proposed an integrative interaction model grounded in digital ecology and sociocultural theory, emphasizing that sustainable digital language learning depends on meaningful interaction among learners, teachers, technologies, and learning environments.

The reviewed studies further demonstrate that digital learning strategies are increasingly associated with the development of learner autonomy and self-regulated learning. Flexible access to online materials, collaborative digital activities, and continuous feedback mechanisms enable learners to monitor

progress, regulate learning strategies, and engage more independently with language learning tasks. However, the findings also suggest that autonomy does not emerge automatically from technology use alone. Students still require instructional guidance, scaffolding, and structured learning support to effectively manage digital learning processes. This indicates that successful digital language learning depends not only on technological access but also on pedagogically informed support systems that help learners develop self-regulation and critical engagement.

Overall, the analysis suggests that the effectiveness of digital learning strategies lies not in the technology itself, but in how pedagogical models are designed to foster interaction, autonomy, collaboration, and higher-order thinking. While most studies report positive outcomes related to engagement, motivation, writing quality, and participation, the findings consistently indicate that technology alone does not guarantee successful learning outcomes. Effective digital language learning requires meaningful instructional design, pedagogical readiness, and the integration of technology with sound educational principles. Consequently, digital learning strategies in Indonesian language education are evolving toward more interactive, flexible, and student-centered models while simultaneously reinforcing the continuing importance of teacher facilitation and pedagogical quality.

3.2.2. *Integration of ICT and Digital Platforms*

The integration of ICT tools, including Learning Management Systems (LMS), social media, digital platforms, and institutional online systems, has become a central component of digital-based language learning in higher education. Across the reviewed studies, ICT is consistently positioned not merely as a technological support system, but as a facilitator of flexible, interactive, and student-centered learning environments. The findings indicate that digital platforms increasingly function as spaces for communication, collaboration, material distribution, assessment, and learner engagement, reflecting broader transformations in technology-enhanced language education.

Online learning systems and institutional digital platforms were widely reported to support learning continuity and improve academic outcomes, particularly during the transition to online learning environments following the COVID-19 pandemic. [Atmojo \(2021\)](#) found that institutional online systems effectively maintained instructional continuity during emergency remote learning, while [Mutmainah \(2023\)](#) reported that LMS-based learning improved students' academic performance through structured access to materials and sustained online interaction. Similar findings are reported in broader ICT and higher education literature. [Herniawati et al. \(2025\)](#)

emphasized that LMS implementation positively influences student motivation, participation, and learning engagement when supported by appropriate institutional readiness and platform usability.

The findings further indicate that LMS environments support more organized and accessible learning experiences. [Salahuddin et al. \(2020\)](#) argued that LMS implementation in language education provides instructional guidance, facilitates communication, and saves time for both teachers and learners. Through centralized digital platforms, students are able to access materials repeatedly, monitor assignments, participate in discussions, and receive continuous feedback. These features contribute to greater flexibility and learner participation, particularly in language learning contexts requiring sustained interaction and practice.

Beyond institutional platforms, digital teaching materials were also identified as an important factor supporting learning effectiveness. [Lubis \(2021\)](#) reported that digital teaching materials improve accessibility and support diverse learning needs by enabling students to access instructional content beyond classroom limitations. This finding aligns with broader discussions on inclusive digital education emphasizing that accessibility should be treated as a fundamental principle in technology-enhanced learning environments rather than an optional feature. In this sense, digital learning materials contribute not only to instructional efficiency but also to more equitable learning participation across diverse student populations.

The reviewed studies additionally reveal the growing role of social media integration in language learning environments. [Yasa \(2022\)](#) found that social media-assisted learning encourages interaction, collaboration, and participation among students, creating more dynamic learning experiences. Similar perspectives are highlighted by [Mondahl and Razmerita \(2014\)](#), who argue that social media platforms facilitate collaborative learning through communication, knowledge sharing, and peer interaction. [Huot and Such \(2025\)](#) further noted that social media environments provide opportunities for digitally native learners to engage more actively in language learning activities because of their interactive features, accessibility, and familiarity among students. These findings suggest that social media platforms can support informal and participatory dimensions of language learning when integrated with clear pedagogical objectives.

However, the effectiveness of ICT integration remains strongly dependent on students' and teachers' digital literacy and technological competence. [Kurniaman \(2025\)](#) identified significant ICT literacy gaps among students, indicating that not all learners benefit equally from digital learning platforms. Similar concerns are raised by [Lucas et al. \(2022\)](#), who found

that higher education students often demonstrate weaknesses in areas such as digital problem-solving, content creation, and online safety despite frequent exposure to technology. This suggests that technological access alone does not guarantee meaningful participation in digital learning environments. [Santoso \(2025\)](#) further emphasized that disparities in digital literacy can contribute to unequal learning experiences and reduced educational quality, particularly for students with limited technological support and digital competence.

The findings also indicate that ICT integration should not be understood solely as a technical process of adopting digital tools. Instead, successful implementation depends on pedagogically purposeful design, institutional readiness, accessibility, and ongoing learner support. Several studies demonstrate that digital platforms become more effective when they facilitate communication, collaboration, reflection, and meaningful interaction rather than functioning merely as repositories for instructional materials. In this sense, ICT operates as a mediational tool supporting social learning processes and learner participation rather than simply delivering information.

Overall, the reviewed studies demonstrate that ICT integration plays a crucial role in shaping digital language learning environments in higher education. LMS platforms, digital teaching materials, institutional systems, and social media collectively contribute to increased accessibility, interaction, flexibility, and learner engagement. Nevertheless, the findings consistently show that the effectiveness of ICT integration is influenced by moderating factors such as platform usability, digital competence, institutional preparedness, and pedagogically informed implementation. Consequently, ICT-based innovations in Indonesian language learning should be supported by inclusive instructional design, continuous digital literacy development, and accessibility-oriented practices to ensure that digital platforms enhance rather than reproduce educational inequalities.

3.2.3. Indonesian Language Learning in Digital Contexts

The implementation of digital technology in Indonesian language learning highlights the importance of pedagogical design, instructional support, and teacher facilitation in technology-mediated learning environments. Across the reviewed studies, researchers consistently emphasize that technology alone does not automatically produce effective learning outcomes without meaningful pedagogical integration. In digital language learning contexts, technology increases not only instructional flexibility but also the complexity of pedagogical design, requiring teachers to manage interaction, learning activities, and discourse more carefully within online environments ([Jalkanen, 2015](#); [Wang, 2015](#)). Consequently, the effectiveness of digital-based

Indonesian language learning depends heavily on how technology is aligned with instructional objectives, learner needs, and communication practices.

In Indonesian higher education contexts, digital language learning increasingly operates through online and technology-mediated environments, including BIPA (*Bahasa Indonesia bagi Penutur Asing*) programs that connect learners and Indonesian language tutors across geographical boundaries. [Maulana et al. \(2020\)](#) described a web-based BIPA platform designed to connect international learners with Indonesian language tutors remotely, demonstrating how digital infrastructure expands access to Indonesian language learning globally. Similarly, [Zira et al. \(2024\)](#) argued that digital applications provide significant opportunities for improving the accessibility and effectiveness of BIPA learning for foreign learners. These findings indicate that digital technology plays a strategic role in extending Indonesian language education beyond conventional classroom limitations and supporting broader international participation in Indonesian language learning.

Digital media has also been shown to support the development of specific language skills, particularly listening and writing. [Cahyo \(2025\)](#) found that digital media improves listening comprehension in BIPA learning contexts, while [Suharto \(2022\)](#) reported that digital writing tools enhance students' academic writing quality. Supporting these findings, [Praheto et al. \(2020\)](#) demonstrated that interactive multimedia is more effective in supporting Indonesian language skill development compared to conventional instructional media. Interactive digital environments allow students to engage more actively with listening, writing, and communication tasks through multimedia-based learning experiences. In addition, [Werdistira \(2023\)](#) showed that digital literacy-based listening and writing materials delivered through accessible tools such as Google Forms can support online language learning activities effectively. These findings collectively suggest that digital tools can facilitate language-skill development when integrated with clearly defined pedagogical objectives and interactive learning tasks.

The integration of technology in BIPA learning further demonstrates how digital tools support flexible and accessible language instruction. [Inthase et al. \(2024\)](#) reported that technology-integrated BIPA programs for Thai learners enabled learning activities to occur "anytime and anywhere" through platforms such as Zoom, Google Meet, and digital content applications. Such flexibility expands communication practice and learner participation across educational contexts. However, effective technology integration in BIPA learning requires a balance between digital media use and interactive communicative teaching. Unequal internet access, technological limitations, and overdependence on translation applications still affect the quality of digital language learning experiences.

Another important finding concerns the quality of online interaction and discourse management in digital learning environments. [Indrariyani \(2025\)](#) emphasized that teacher management of discourse patterns and interaction significantly influences the effectiveness of online Indonesian language learning. This finding suggests that teachers remain central actors in facilitating meaningful communication and ensuring active participation in digital environments. [Maddix \(2012\)](#) similarly identified online discussion forums as one of the most important components of social learning in digital education because they create opportunities for interaction, reflection, and collaborative meaning-making. Within task-based online learning environments, [Wang \(2015\)](#) further argued that teachers must actively motivate learners, monitor participation, and provide instructional support throughout digital learning activities. These findings indicate that teacher facilitation remains a critical pedagogical function even in technology-rich learning environments.

The reviewed studies also reveal that collaborative and facilitative discourse strategies contribute positively to student engagement and interaction. Online learning environments that encourage discussion, negotiation of meaning, and collaborative communication tend to generate more active participation and extended learner responses. In contrast, highly directive and teacher-dominated approaches may limit interaction and reduce opportunities for meaningful communication. These findings reinforce socio-cultural perspectives emphasizing that language development occurs through mediated interaction and social participation rather than through isolated exposure to digital content alone.

At a broader instructional level, the effectiveness of digital Indonesian language learning depends on pedagogically informed learning design rather than the availability of technology itself. Similarly, [Wardhana et al. \(2024\)](#) argued that teachers play an essential role in selecting and implementing digital media creatively according to students' characteristics and instructional needs. This perspective aligns with [Jalkanen's \(2015\)](#) argument that technology-rich language learning environments increase the complexity and unpredictability of pedagogical design, requiring educators to engage critically with instructional planning rather than relying on technology as an automatic solution.

Overall, the reviewed studies confirm that digital-based Indonesian language learning requires a balanced integration of technology, pedagogy, interaction, and teacher facilitation. Digital platforms and media provide important opportunities for improving access, flexibility, communication, and language-skill development in both Indonesian language and BIPA contexts. However, successful implementation depends on meaningful instructional

design, sustained interaction, pedagogical support, and active teacher involvement. Consequently, the effectiveness of digital Indonesian language learning is shaped not only by technological innovation but also by how educators create learning experiences that promote engagement, collaboration, and authentic language use in digitally mediated environments.

3.2.4. Digital Literacy and Learning Outcomes

Digital literacy emerges as one of the most significant factors influencing learning success in higher education, particularly within technology-mediated learning environments. Across the reviewed studies, digital literacy is consistently associated with students' ability to access, evaluate, manage, and utilize digital information effectively for academic purposes. The findings indicate that digital literacy extends beyond basic technical skills and includes broader competencies related to communication, information management, critical evaluation, collaboration, and self-directed learning. [Mokhtari \(2023\)](#) emphasized that digital literacy should not be understood merely as computer proficiency, but rather as a multidimensional competence essential for effective learning participation in contemporary higher education contexts. This perspective strongly aligns with the findings of [Budiman \(2023\)](#) and [Isnah \(2022\)](#), which position digital literacy as a key determinant of successful engagement in digital language learning environments.

The reviewed studies consistently demonstrate a positive relationship between digital literacy and academic performance. [Budiman \(2023\)](#) found that digital literacy supports learning success by enabling students to engage more effectively with online learning platforms and digital learning materials. Similarly, [Isnah \(2022\)](#) reported a strong correlation between digital literacy and language ability, suggesting that students with higher digital competence tend to achieve better learning outcomes.

The relationship between digital literacy and learning outcomes is also closely connected to self-directed and autonomous learning processes. [Jang \(2023\)](#) found that digital literacy competence influences academic achievement indirectly through self-directed learning ability, indicating that students with stronger digital literacy are more capable of regulating their own learning processes. This finding reinforces the growing importance of self-regulated learning in online and blended educational environments, where students are increasingly required to manage learning activities independently. In this sense, digital literacy functions not only as a technical competence but also as a facilitator of autonomous engagement, self-management, and sustained participation in digital learning contexts.

In language-learning-oriented higher education contexts, digital literacy also contributes to participation-related outcomes such as communication,

confidence, motivation, and engagement. Asia (2025) reported that technology literacy positively influences students' motivation and participation in language learning activities, while Mahmudah (2026) found that digital proficiency contributes to the development of positive attitudes toward language learning. These findings indicate that digitally competent learners tend to demonstrate greater confidence and willingness to participate in digital learning activities. Moreover, communication competence associated with digital literacy supports learners' readiness to engage actively in collaborative and interaction-based language learning environments.

Digital literacy additionally plays an important role in supporting academic writing and literacy development through access to digital academic resources and technology-supported writing tools. Zulfadhli (2024) highlighted that digital academic resources contribute positively to students' literacy development, particularly in academic writing contexts. Similarly, Ramadhan et al. (2024) explained that digital tools such as grammar checkers, plagiarism detectors, citation managers, and collaborative writing platforms help students produce more structured and academically appropriate writing. These tools provide opportunities for continuous revision, feedback, and collaborative learning, demonstrating how digital literacy can support language production and academic communication practices in higher education.

However, the findings also reveal that digital literacy is distributed unevenly among students, creating disparities in participation and learning outcomes. Kurniaman (2025) identified significant gaps in students' ICT literacy levels, indicating that not all learners benefit equally from digital learning environments. Similar concerns are raised by Arasuraja (2026), who argued that post-pandemic digital learning environments continue to expose substantial inequalities in digital literacy and educational participation. Guo and Wan (2022) further demonstrated that the digital divide in online learning is shaped by differences in technological access, internet quality, adaptability to digital learning, and offline learning support. These findings suggest that technological access alone does not guarantee equitable learning opportunities when students possess unequal levels of digital competence and institutional support.

The reviewed studies further indicate that the influence of digital literacy on learning outcomes may be moderated by broader structural and contextual factors. Biswas (2025) argued that socioeconomic status, infrastructure availability, and teacher readiness significantly affect students' ability to benefit from digital learning environments. Students from resource-limited contexts may experience greater challenges in accessing digital technologies, participating in online learning, and developing advanced digital competencies. Consequently, digital literacy should

not be viewed solely as an individual skill but also as a socially and institutionally conditioned capability shaped by educational infrastructure and support systems.

Overall, digital literacy functions as both a facilitator of academic success and a potential source of educational inequality in higher education. On one hand, digital literacy supports academic achievement, self-directed learning, communication, motivation, and participation in digital learning activities. On the other hand, unequal access to technology, varying levels of digital competence, and differences in institutional support can widen participation gaps and learning disparities. These findings therefore highlight the importance of institutional strategies that strengthen digital literacy development while simultaneously addressing structural barriers related to access, infrastructure, and educational support. Consequently, higher education institutions should position digital literacy not merely as an individual learner attribute, but as a critical educational responsibility necessary for inclusive and equitable participation in digital learning environments.

3.2.5. Artificial Intelligence and Emerging Technologies

The integration of artificial intelligence (AI) and emerging technologies represents one of the most significant developments in contemporary digital language learning. Across the reviewed studies, AI is increasingly positioned as a tool capable of extending learning support, personalizing instruction, and facilitating more adaptive and interactive language-learning experiences. In higher education contexts, AI technologies such as ChatGPT, generative AI systems, virtual environments, and metaverse platforms are reshaping how learners access information, practice language skills, and engage with instructional content. These developments reflect broader transformations in technology-enhanced education in which AI is viewed as a potentially transformative resource for supporting learning processes while simultaneously requiring critical pedagogical oversight.

The reviewed studies indicate that AI tools such as ChatGPT significantly influence students' comprehension processes and learning behaviors. Juanda (2024) reported that AI-assisted interaction changes how students engage with language content by providing immediate access to explanations, information, and language support. Similar findings are discussed by Pickard-Jones et al. (2024), who argued that ChatGPT can enhance and deepen learning experiences by supporting clarification, feedback, and exploratory learning activities. Students often view AI chatbots as useful because they provide quick information and responsive explanations that support comprehension-based learning. As a result, AI technologies are increasingly used in higher education as tools for instructional assistance and learner support.

Beyond comprehension support, AI-mediated learning activities also demonstrate potential for promoting higher-order thinking and argumentation skills. Nusivera et al. (2025) found that integrating ChatGPT into language-learning activities improved students' argumentation, critical thinking, and complex comprehension skills. Through dialogic interaction with AI systems, learners were encouraged to justify opinions, compare perspectives, and engage with alternative viewpoints. These findings suggest that AI can function not only as an information provider but also as a conversational partner capable of stimulating analytical and evaluative thinking when integrated within pedagogically meaningful tasks. In this sense, AI-supported learning may contribute to more reflective and cognitively engaging language-learning experiences.

Generative AI technologies also appear to influence learners' motivation and engagement positively, particularly in reading-oriented activities. Safitri (2025) reported that AI-supported learning environments improve students' reading motivation and participation through adaptive and interactive learning experiences. Similar findings were identified by Leong et al. (2024), who found that generative AI-driven personalization positively affects learners' motivation by tailoring learning materials to students' contexts and interests. Yilmaz and Aydin (2025) further demonstrated that AI-generated reading materials significantly improved reading motivation among EFL learners compared to traditional textbook materials. Jiang et al. (2025) additionally reported that generative AI tools positively influence autonomous motivation in language learning contexts. These findings collectively indicate that AI personalization may support students' willingness to participate more actively in digital learning activities.

In addition to text-based AI interaction, immersive technologies such as metaverse and virtual reality (VR) environments are increasingly explored as tools for enhancing communication and intercultural competence. Nuemaihom (2025) found that AI-driven metaverse environments improve students' communication skills by creating immersive and interactive learning contexts that simulate authentic communication situations. Supporting this finding, Valizadeh and Moghaddam (2025) reported that metaverse-based language learning significantly improved learners' intercultural communicative competence, including communication ability and cultural understanding. Similarly, Dizon and Tang (2024) argued that immersive virtual learning environments promote authentic language use, learner autonomy, and experiential learning through real-time interaction. These findings suggest that immersive technologies provide opportunities for more contextualized and communication-oriented language-learning experiences beyond conventional classroom interaction.

Despite these opportunities, the reviewed studies also identify important pedagogical and ethical concerns regarding AI integration in language education. Several researchers caution that excessive dependence on AI systems may reduce learners' critical engagement, independent thinking, and active cognitive processing. Gulich and Chetveryk (2025) identified risks associated with AI integration, including overreliance on technology, diminished critical thinking, inaccuracies in generated content, and privacy-related concerns. Similarly, Elzerman (2025) argued that excessive AI dependence may contribute to "cognitive offloading," in which learners rely increasingly on AI-generated responses rather than developing their own analytical and problem-solving abilities. These concerns are particularly relevant in language education contexts where sustained cognitive engagement and authentic language production are central components of skill development.

The findings further suggest that the educational effectiveness of AI depends heavily on how technologies are integrated into pedagogical practices. AI tools become more beneficial when they function as scaffolding mechanisms that support learners' exploration, reflection, and communication rather than replacing learners' active cognitive participation. Consequently, educators remain essential in guiding students' use of AI technologies, designing meaningful learning tasks, and ensuring that AI use promotes rather than diminishes critical engagement. Responsible AI integration therefore requires pedagogically grounded instructional design, ethical awareness, and continuous teacher facilitation.

Overall, the reviewed studies indicate that AI and emerging technologies represent a dual-edged development in digital language education. On one hand, AI-based tools provide opportunities for personalized learning, interactive communication, increased motivation, and immersive language practice. On the other hand, these technologies introduce challenges related to dependency, critical thinking, ethical use, and learner autonomy. The findings therefore support a cautious but optimistic perspective in which AI is viewed as a supportive educational resource rather than a replacement for human-centered pedagogy. Ultimately, the educational value of AI in Indonesian language learning depends on how effectively educators integrate these technologies within instructional frameworks that preserve learner agency, meaningful interaction, and critical language-learning processes.

4. Discussion

This systematic review highlights that digital-based Indonesian language learning in higher education is not shaped by technology alone. It is shaped by the interaction among digital learning strategies, ICT integration, language-specific pedagogy, digital literacy, and artificial intelligence.

Across the 23 selected studies, the main pattern is clear. Digital technology supports learning outcomes only when lecturers use it through meaningful instructional design and when students and educators have adequate digital competence. This finding supports broader concerns that the benefits of educational technology are not automatic and are not equally distributed across learning contexts (Singh & Budh, 2025). Therefore, digital transformation in higher education should be understood as a pedagogical, institutional, and social process, not merely as the adoption of new platforms or tools.

The first key finding shows that student-centered digital pedagogy plays a central role in improving engagement, autonomy, and higher-order thinking in Indonesian language learning. Blended learning, inquiry-based learning, and game-based learning emerged as dominant strategies because they create more interactive and participatory learning environments (Dewantara, 2021; Djihadah, 2023; Rahmatika, 2025). These strategies gain stronger pedagogical value when supported by digital platforms that provide flexible access to learning materials, collaborative interaction, and reflective learning opportunities (Ahsin, 2025; Arono, 2025; Riadi, 2024). This pattern confirms that digital learning becomes effective when technology supports task design, active participation, and meaningful learner engagement (Dellatola et al., 2020; Sulindra et al., 2024). In this sense, learners are not positioned as passive receivers of information. They become active participants who construct meaning, interact with peers, regulate their learning, and produce language through purposeful activities.

The second key finding concerns ICT integration. LMS platforms, digital teaching materials, and social media support flexible and accessible learning experiences in Indonesian language education (Atmojo, 2021; Lubis, 2021; Mutmainah, 2023; Yasa, 2022). However, the value of ICT depends on how educators integrate it into the learning process. Digital platforms become meaningful when they support discussion, collaboration, reflection, feedback, and communicative participation. They become less effective when they function only as storage spaces for learning materials. This finding aligns with sociocultural perspectives on technology-mediated learning, which argue that digital tools should be evaluated based on how they support pedagogical goals, not merely based on whether they are used (Compernelle, 2016). Thus, ICT integration in Indonesian language learning reflects a broader shift from technology use as delivery to technology use as mediation for interaction and meaning-making.

The third key finding relates to Indonesian language-specific learning contexts, especially BIPA learning. The reviewed studies show that digital tools can support listening, writing, and online discourse management, but these tools do not automatically create meaningful language learning outcomes (Cahyo,

2025; Suharto, 2022; Indrariansi, 2025). Effective digital language learning still depends on teacher facilitation, learning design, and structured interaction. Teachers need to guide communication, manage discourse, provide feedback, and design authentic language tasks. This finding strengthens socio-cultural views of language learning, which emphasize interaction, scaffolding, and mediated participation. Even in highly digital learning environments, educators remain central as facilitators of communication, designers of learning experiences, and supporters of students' language development.

The fourth key finding supports constructivist and socio-cultural learning theories. Constructivist theory explains that learners build knowledge through meaningful tasks, authentic experiences, and reflection. Socio-cultural theory explains that learning develops through interaction and mediation. The findings of this review reflect both theories. Inquiry-based learning, collaborative digital activities, and online interaction encourage students to engage in active meaning-making rather than depend only on teacher explanation. Sulindra et al. (2024) similarly argued that constructivist approaches in digital language learning require authentic tasks and meaningful contexts that support participation and knowledge transfer. The strong emphasis on collaboration and communication through ICT platforms also supports socio-cultural assumptions that learning occurs through mediated interaction within learning communities. Therefore, the effectiveness of digital Indonesian language learning depends less on technological sophistication and more on the ability of technology to support authentic interaction, collaboration, and learner agency.

The fifth key finding highlights the importance of TPACK-informed instruction. The integration of technological, pedagogical, and content knowledge emerged as a critical factor in improving the quality of digital instruction (Arono, 2025). This finding confirms that technology alone cannot improve learning outcomes. Educators need to embed digital tools into instructional design that matches language-learning objectives and student needs. Ramdhanianty and Zolkafil (2024) also emphasized that TPACK-oriented approaches support interactive and contextualized language learning because they help teachers align technology, pedagogy, and language content. This explains why some technology-rich learning environments still fail to produce meaningful outcomes. When technology lacks pedagogical direction, it may only reproduce traditional teacher-centered instruction in digital form. Therefore, lecturers need both technical competence and pedagogical judgment to design effective digital language learning.

The sixth key finding shows that digital literacy functions as a foundational competence in technology-mediated learning. Students with stronger digital literacy tend to show better academic outcomes,

stronger learning autonomy, and more active participation in digital learning activities (Budiman, 2023; Isnah, 2022; Asia, 2025; Mahmudah, 2026; Zulfadhli, 2024). These findings support self-regulated learning theory because students need to plan, monitor, evaluate, and adjust their own learning in digital environments. Research on digital literacy and self-regulated learning also shows that digital competence and technology use are closely related to students' ability to regulate learning effectively (Gunawan, 2026). However, this review also shows that digital literacy is unevenly distributed. Digital literacy gaps remain a serious concern (Kurniaman, 2025). Bertha et al. (2025) further argued that digital inequality affects opportunities for language-skill development and may exclude marginalized learners from meaningful participation in digital education. Thus, digital transformation must include digital literacy development, infrastructure support, and policies that reduce inequality.

The seventh key finding concerns AI and emerging technologies. AI-supported tools such as ChatGPT, generative AI systems, and immersive virtual environments offer new opportunities for personalized learning, adaptive feedback, and interactive communication (Juanda, 2024; Safitri, 2025; Nuemaihom, 2025). These technologies may improve motivation, engagement, and comprehension when they support learners through responsive and individualized experiences. However, AI integration also raises serious pedagogical and ethical concerns. Excessive dependence on AI may reduce cognitive autonomy, weaken critical thinking, and limit linguistic creativity (Cong et al., 2025). This concern is important in language education because students need sustained cognitive engagement, interpretation, and authentic language production. Therefore, AI should function as a learning scaffold, not as a replacement for students' thinking or teachers' pedagogical role. Human-AI interaction in language learning requires new pedagogical interpretation that protects learner agency, academic integrity, and critical engagement.

Several gaps remain in the existing literature. First, many studies are still fragmented and tool-oriented. They often examine specific platforms or instructional practices without explaining how pedagogy, technology, digital literacy, and learner readiness interact within an integrated learning ecosystem. This reflects a broader gap in digital language-learning research, where sociocultural, constructivist, and self-regulatory dimensions remain insufficiently connected (Lantolf & Xi, 2023). Second, research on Indonesian language learning in diverse higher education contexts is still limited. Third, few studies explain how digital literacy can be systematically embedded into Indonesian language curricula. Fourth, research on AI in language education remains emerging, especially regarding its long-term effects on language proficiency,

learner autonomy, critical thinking, academic integrity, and pedagogical control.

The novelty of this study lies in its holistic synthesis of digital-based Indonesian language learning through five interconnected dimensions: digital learning strategies, ICT integration, language-specific pedagogy, digital literacy, and AI-based learning technologies. Unlike studies that discuss digital learning in isolated ways, this review connects pedagogy, technology, learner competence, institutional readiness, and AI innovation in one analytical framework. It also highlights digital literacy as both an enabling factor and a source of inequality in digital learning participation.

The findings imply that lecturers need to design learner-centered digital instruction that promotes interaction, autonomy, collaboration, and higher-order thinking. TPACK-based professional development is also necessary because effective digital pedagogy requires teachers to align technology with language-learning objectives and instructional strategies (Rani, 2026). Institutions should strengthen infrastructure, accessibility, learner support, and digital literacy programs. They should also address the access divide, use divide, and design divide that affect technology-enhanced learning (Aswani, 2026). At the policy level, digital education policies should support innovation while protecting academic integrity, learner autonomy, critical thinking, and digital inclusion.

Future research should develop integrated models of Indonesian language learning that combine pedagogy, technology, digital literacy, learner readiness, and teacher support. Longitudinal studies are needed to examine the long-term impact of AI on language proficiency, cognitive engagement, learner autonomy, and critical thinking. Further studies should also explore TPACK-oriented teacher training, ethical AI use, learner dependency, and digital inequality in higher education. Future studies should examine BIPA programs, rural universities, eastern Indonesian campuses, multilingual classrooms, and AI-assisted Indonesian academic writing to capture more diverse learning contexts and technology-use practices

5. Conclusions

This systematic review shows that the effectiveness of digital-based Indonesian language learning in higher education depends not only on technology adoption, but also on how digital technologies are pedagogically integrated to support interaction, learner autonomy, critical engagement, and meaningful language use. Across the 23 reviewed studies, five interconnected dimensions shaped current practices: digital learning strategies, ICT integration, language-specific pedagogy, digital literacy, and emerging AI technologies. Student-centered approaches, including blended, inquiry-based, and game-based learning, were more effective when

supported by interactive digital environments, structured instructional design, and active teacher facilitation. The review also confirms the relevance of constructivist, socio-cultural, self-regulated learning, and TPACK perspectives in explaining how technology supports knowledge construction, communication, and participation.

Digital literacy emerged as a foundational competence for effective participation in technology-mediated learning, while also revealing inequalities in access, infrastructure, and digital competence. The growing use of AI offers personalized, adaptive, and immersive language learning opportunities, but it also raises concerns about learner dependency, critical thinking, and cognitive autonomy. The novelty of this study lies in its holistic synthesis of five dimensions into a unified framework connecting pedagogy, technology, learner readiness, and innovation in Indonesian language learning. The findings highlight the need for learner-centered design, teacher readiness, stronger infrastructure, digital literacy support, and ethical technology integration. Since this review is limited to Scopus and Google Scholar studies published between 2020 and 2026, future research should examine AI-supported language learning longitudinally, develop integrated pedagogical models, and address digital inequality across diverse higher education contexts.

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