

AI Literacy EFL Classrooms: Preparing Learners for Human–AI Collaboration

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ABSTRACT

The rapid emergence of generative artificial intelligence (AI) has transformed educational practices across disciplines, including English as a Foreign Language (EFL) education. While AI-powered tools offer substantial support for language learning through writing assistance, feedback generation, language practice, and personalized learning experiences, concerns have emerged regarding students' dependence on AI-generated content, critical evaluation of information, and ethical use of digital technologies. These developments suggest that effective AI integration in language education requires more than technological access and operational skills. This article examines the role of AI literacy in preparing EFL learners for meaningful human–AI collaboration. Employing a qualitative library research design, the study synthesizes recent scholarship on AI literacy, digital literacy, human-centred AI, and AI-assisted language learning. The analysis indicates that AI literacy in EFL contexts encompasses four interconnected dimensions: operational understanding, critical evaluation, ethical awareness, and collaborative competence. Together, these dimensions enable learners to engage with AI systems as reflective users rather than passive consumers of generated content. The study further argues that the educational value of AI depends on learners' ability to exercise human judgment when interpreting, modifying, and applying AI-generated outputs. Consequently, AI literacy should be integrated into EFL curricula as a foundational competency that supports responsible technology use, critical language learning practices, and sustainable human–AI collaboration in contemporary educational environments.

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INTRODUCTION

The rapid advancement of artificial intelligence (AI) has become one of the most significant developments influencing contemporary education. Recent breakthroughs in generative AI, particularly large language models capable of producing human-like texts and interactive responses, have transformed how knowledge is accessed, created, and communicated (Dwivedi et al., 2023; Kasneci et al., 2023). Unlike earlier educational technologies that primarily supported information retrieval, generative AI systems can generate explanations, feedback, summaries, and written texts in response to user prompts (Tlili et al., 2023). Consequently, AI is increasingly viewed as an educational partner whose influence extends across teaching, learning, and assessment practices.

The growing presence of AI has generated widespread discussion among educators, researchers, and policymakers. International organizations have highlighted both the opportunities and challenges associated with AI integration, emphasizing the need for human-centred and responsible implementation in educational settings (UNESCO, 2021, 2023). As AI technologies become more accessible, attention has shifted from questions of adoption to questions concerning the competencies learners require to engage with AI effectively and responsibly.

These developments are particularly relevant to English as a Foreign Language (EFL) education. Generative AI systems can provide writing assistance, language explanations, conversational interaction, and personalized feedback, thereby expanding opportunities for language learning beyond traditional classroom settings (Kohnke et al., 2023; Yan, 2023). Such technologies may support learner autonomy and individualized learning, especially in contexts where opportunities for authentic English interaction are limited.

At the same time, concerns have emerged regarding the educational implications of AI-generated content. Generative AI systems may produce inaccurate information, fabricated references, or contextually inappropriate responses while presenting them in linguistically convincing forms (Kasneci et al., 2023; Tlili et al., 2023). Consequently, learners require the ability to evaluate AI-generated outputs critically rather than accept them uncritically. These concerns are particularly important in language learning, where effective communication depends not only on linguistic accuracy but also on contextual appropriateness and critical judgment.

The integration of AI into language education also raises broader questions concerning learner agency and cognitive engagement. Writing and language learning involve processes of idea development, reflection, and meaning-making rather than the mere production of correct linguistic forms (Hyland, 2019). Excessive dependence on AI-generated content may reduce opportunities for active learning if learners rely on technological outputs without engaging critically with them. Thus, the educational value of AI depends largely on how learners interact with and utilize AI-generated information.

These concerns have contributed to growing scholarly interest in AI literacy. Generally, AI literacy refers to the knowledge, skills, and dispositions required to understand, evaluate, and interact effectively with AI systems (Long & Magerko, 2020; Ng et al., 2021). Contemporary perspectives view AI literacy as a multidimensional construct encompassing technical understanding, critical awareness, ethical responsibility, and informed participation in AI-mediated environments (Ng et al., 2021; Kong et al., 2023). Such perspectives recognize that effective AI use requires more than operational competence.

The importance of AI literacy can also be understood within broader discussions of digital competence. While traditional digital literacy focuses on accessing and evaluating information through digital technologies (Falloon, 2020), AI-mediated environments require learners to

engage with systems that actively generate content and influence decision-making. Consequently, learners need competencies that enable them to interpret, evaluate, and utilize AI-generated outputs responsibly.

Within EFL education, the significance of AI literacy is amplified because language serves as the primary medium through which learners interact with AI systems. Students formulate prompts, interpret responses, evaluate generated texts, and negotiate meaning through language-based interactions. Therefore, language learning and AI literacy are becoming increasingly interconnected, making AI literacy a relevant competency for contemporary language education.

The Indonesian educational context provides a particularly relevant setting for examining these developments. National educational reforms have emphasized digital transformation and the development of future-oriented competencies among learners (Kemendikbudristek, 2022). At the same time, the growing availability of AI-powered applications has increased students' exposure to AI technologies in both formal and informal learning environments. These developments create opportunities for innovation while simultaneously highlighting the need for responsible AI use.

Recent scholarship increasingly argues that the future of AI in education should be framed in terms of collaboration rather than replacement (Luckin, 2018; Raisch & Krakowski, 2021). While AI systems can provide efficiency, feedback, and information-processing capabilities, human learners contribute contextual understanding, creativity, ethical reasoning, and critical judgment. Effective learning therefore depends on productive interaction between human and artificial intelligence rather than on technological substitution.

Against this backdrop, the present study examines the role of AI literacy in preparing EFL learners for human–AI collaboration. Drawing on contemporary scholarship in AI literacy, language education, and human-centred AI, the study identifies key dimensions of AI literacy relevant to EFL contexts and explores their pedagogical implications. Through a qualitative conceptual review, the article proposes a framework that explains how AI literacy can support meaningful and responsible human–AI collaboration in contemporary EFL classrooms.

LITERATURE REVIEW

Conceptualizing AI Literacy in Education

The rapid integration of artificial intelligence into educational environments has generated increasing interest in the concept of AI literacy. Although AI literacy has emerged relatively recently as a field of inquiry, it reflects a broader educational concern regarding the competencies individuals require to participate effectively in technologically mediated societies. As AI systems become increasingly embedded in everyday activities, educational institutions are challenged to prepare learners not only to use these technologies but also to understand, evaluate, and interact with them responsibly.

One of the most influential conceptualizations of AI literacy was proposed by Long and Magerko (2020), who defined it as a collection of competencies that enable individuals to critically evaluate AI technologies, communicate effectively with AI systems, and understand the broader social implications of AI. This definition marked an important shift away from purely technical understandings of technology literacy by emphasizing critical engagement and informed participation. Rather than treating AI as a specialized domain reserved for computer scientists, the framework positions AI literacy as a competency relevant to all learners operating in increasingly AI-mediated environments.

Subsequent scholarship has expanded this perspective. Ng et al. (2021) conceptualized AI literacy as a multidimensional construct encompassing technical knowledge, critical evaluation, ethical awareness, and practical application. This broader understanding reflects recognition that AI technologies influence not only how information is processed but also how decisions are made, knowledge is constructed, and social interactions are mediated. Consequently, effective AI engagement requires learners to understand both the capabilities and limitations of intelligent systems.

The growing importance of AI literacy can also be understood within wider discussions of digital competence. Traditional approaches to digital literacy have generally focused on accessing, evaluating, and communicating information through digital technologies (Falloon, 2020). However, generative AI introduces new challenges because learners increasingly interact with systems that actively produce content rather than merely deliver information. As a result, learners must develop the capacity to evaluate algorithmically generated outputs, recognize potential biases, and make informed judgments regarding the reliability and appropriateness of AI-generated content.

Recent studies further suggest that AI literacy should be viewed as a future-oriented educational competency. According to Kong et al. (2023), AI literacy empowers learners to engage productively with intelligent technologies while maintaining critical awareness of their societal implications. Similarly, UNESCO (2023) argues that AI literacy is becoming essential for participation in contemporary societies because individuals increasingly encounter AI systems in educational, professional, and social contexts. From this perspective, AI literacy extends beyond operational competence and becomes a foundation for responsible citizenship in the age of artificial intelligence.

Taken together, these perspectives suggest that AI literacy is best understood as a multidimensional educational competency that combines technical understanding, critical reflection, ethical responsibility, and informed participation. Such an understanding is particularly relevant to EFL education, where learners increasingly interact with AI through language-based communication and knowledge-construction activities.

Human–AI Collaboration as an Educational Paradigm

The growing presence of AI in educational settings has stimulated new discussions regarding the relationship between human intelligence and machine intelligence. Early debates often portrayed AI either as a technological solution capable of improving educational efficiency or as a potential threat to traditional learning processes. More recent scholarship, however, has moved beyond these polarized perspectives and increasingly conceptualizes AI as a collaborative partner that complements human capabilities rather than replacing them (Luckin, 2018; Raisch & Krakowski, 2021).

This shift is closely associated with the emergence of human-centred approaches to AI. Within these perspectives, the value of AI is not measured solely by its computational power but by its ability to enhance human learning, decision-making, and problem-solving. AI systems possess strengths in processing large quantities of information, identifying patterns, and generating rapid responses. Humans, by contrast, contribute contextual understanding, creativity, ethical reasoning, and critical judgment. Consequently, effective outcomes are often achieved through collaboration rather than substitution.

The concept of collaborative intelligence provides a useful framework for understanding these interactions. Dellermann et al. (2019) define collaborative intelligence as situations in which humans and AI systems work together to achieve outcomes that neither could accomplish independently. Rather than positioning AI as an autonomous actor, collaborative

intelligence emphasizes the complementary nature of human and machine capabilities. Educationally, this perspective shifts attention from technological automation toward the development of competencies that enable learners to engage productively with intelligent systems.

The relevance of this perspective has been increasingly recognized in educational research. Holmes et al. (2022) argue that AI should be designed and implemented in ways that support human learning and agency rather than replace human participation. Similarly, UNESCO (2023) emphasizes that educational applications of AI should remain aligned with human-centred values, including autonomy, transparency, accountability, and ethical responsibility. These principles suggest that educational success depends not merely on technological access but also on learners' ability to interact critically and responsibly with AI systems.

Within EFL education, the notion of human–AI collaboration carries particular significance because language serves as the primary medium through which learners engage with AI technologies. Students communicate with AI systems through prompts, interpret generated responses, evaluate linguistic outputs, and negotiate meaning through dialogue-like interactions. Consequently, successful collaboration depends not only on technological competence but also on learners' linguistic, cognitive, and critical capacities. This relationship highlights the growing importance of AI literacy as a prerequisite for meaningful human–AI collaboration in language learning contexts.

AI-Assisted Language Learning in EFL Contexts

The integration of artificial intelligence into language education has evolved considerably over the past decade. Earlier applications primarily involved intelligent tutoring systems, automated feedback tools, and adaptive learning platforms designed to support individualized instruction. A comprehensive review by Zawacki-Richter et al. (2019) demonstrated that AI technologies have increasingly been employed to facilitate personalization, assessment, and learner support across educational settings. However, the emergence of generative AI has significantly expanded the possibilities for language learning by enabling more sophisticated forms of interaction between learners and technology.

One of the most prominent applications of generative AI in EFL education involves writing support. Recent studies indicate that AI-powered tools can assist learners during various stages of the writing process, including brainstorming, drafting, revising, and editing (Yan, 2023). Through immediate feedback and language modeling, AI systems may help learners overcome linguistic barriers and gain greater confidence in written communication. Similarly, generative AI can provide alternative expressions, vocabulary suggestions, and structural recommendations that support language development.

Beyond writing instruction, AI technologies have also created new opportunities for communicative language practice. Kohnke et al. (2023) note that conversational AI applications can simulate interactive communication and provide learners with additional opportunities to use English beyond classroom settings. Such opportunities are particularly valuable in EFL environments where authentic interaction in English may be limited. Consequently, AI technologies can contribute to learner autonomy by enabling students to engage in self-directed learning and individualized language practice.

Despite these advantages, scholars have also highlighted several pedagogical concerns. Kasneci et al. (2023) argue that large language models may produce inaccurate, biased, or fabricated information while presenting outputs in a highly convincing manner. Such characteristics create risks for learners who may lack the critical skills necessary to evaluate

AI-generated content effectively. In language learning contexts, these concerns extend beyond factual accuracy to include issues of appropriateness, contextual relevance, and communicative effectiveness.

Another concern relates to the potential impact of AI on cognitive engagement. Language learning involves active participation in meaning-making, problem-solving, and knowledge construction. Writing, in particular, serves as a cognitive process through which learners organize ideas, develop arguments, and refine linguistic competence (Hyland, 2019). If AI technologies are used primarily to generate final products rather than support learning processes, opportunities for critical thinking and independent language production may be diminished. Similar concerns have been raised regarding academic integrity and learner dependency in AI-supported educational environments (Cotton et al., 2024).

These opportunities and challenges suggest that successful AI integration requires more than technological access. Learners must possess the competencies necessary to use AI strategically, evaluate outputs critically, and engage with AI systems responsibly. This observation reinforces the importance of AI literacy as a foundational competency for contemporary language education.

Dimensions of AI Literacy for Human–AI Collaboration in EFL Classrooms

The literature reviewed above indicates that AI literacy cannot be reduced to a single skill or competency. Rather, it represents a multidimensional construct encompassing several interrelated dimensions that collectively enable effective engagement with AI technologies. Drawing on the work of Long and Magerko (2020), Ng et al. (2021), UNESCO (2023), and contemporary discussions of human-centred AI, this study identifies four dimensions that are particularly relevant to EFL education: operational literacy, critical literacy, ethical literacy, and collaborative literacy.

Operational literacy refers to learners' ability to access and utilize AI technologies effectively. This dimension includes understanding how AI systems function, formulating effective prompts, interpreting generated outputs, and recognizing the capabilities and limitations of AI tools. Operational competence provides the foundation for learner interaction with AI but does not by itself ensure meaningful or responsible engagement.

Critical literacy involves the capacity to evaluate AI-generated information and make informed judgments regarding its quality, credibility, and relevance. Because generative AI systems may produce convincing yet inaccurate outputs, learners must develop the ability to verify information, identify inconsistencies, and assess the appropriateness of generated content. Within EFL contexts, critical literacy also encompasses evaluating linguistic accuracy, rhetorical effectiveness, and communicative suitability.

Ethical literacy refers to responsible engagement with AI technologies. This dimension includes awareness of academic integrity, transparency, privacy, intellectual ownership, and the broader social implications of AI use. Ethical literacy is particularly important in educational settings because learners increasingly encounter situations in which AI-generated content may influence academic work and decision-making processes.

Finally, collaborative literacy refers to learners' ability to work productively with AI systems while maintaining human agency and oversight. Building on the principles of human–AI collaboration (Luckin, 2018; Raisch & Krakowski, 2021), collaborative literacy positions learners as active participants who evaluate, adapt, and contextualize AI-generated outputs according to specific communicative objectives. Rather than replacing human effort, AI functions as a resource that supports reflection, revision, and learning.

Collectively, these four dimensions provide a conceptual framework for understanding how AI literacy can support meaningful human–AI collaboration in EFL classrooms. They also provide the analytical foundation for examining the pedagogical implications of AI literacy in contemporary language learning environments.

RESEARCH METHOD

Research Design

This study employed a qualitative conceptual review design to examine the role of AI literacy in preparing EFL learners for human–AI collaboration. A conceptual review synthesizes and critically interprets existing scholarship to develop theoretical understanding and identify conceptual relationships within an emerging field (Snyder, 2019). This approach was considered appropriate because research on AI literacy, human–AI collaboration, and AI-assisted language learning remains fragmented across multiple disciplines.

Data Sources and Literature Selection

The review drew upon scholarly literature related to AI literacy, artificial intelligence in education, human–AI collaboration, digital literacy, and AI-assisted language learning. Relevant publications were identified through searches of Scopus, Web of Science, ERIC, ScienceDirect, and Google Scholar using keywords such as *AI literacy*, *generative AI*, *human–AI collaboration*, *AI in education*, and *EFL*. Priority was given to peer-reviewed publications published between 2020 and 2025, while foundational studies published earlier were also included when relevant.

The selected sources were required to demonstrate clear relevance to AI literacy, educational applications of AI, or language learning. Publications focusing exclusively on technical aspects of AI without educational implications were excluded.

Data Analysis and Framework Development

The selected literature was analyzed using thematic analysis (Braun & Clarke, 2022). The process involved repeated reading of the literature, identification of key concepts, coding of recurring ideas, and grouping related concepts into broader themes. Through this process, four dimensions of AI literacy consistently emerged across the reviewed studies: operational literacy, critical literacy, ethical literacy, and collaborative literacy.

These themes were subsequently synthesized into a conceptual framework explaining how AI literacy supports meaningful human–AI collaboration in EFL classrooms. The framework served as the analytical basis for interpreting the pedagogical implications discussed in the study.

Trustworthiness of the Review

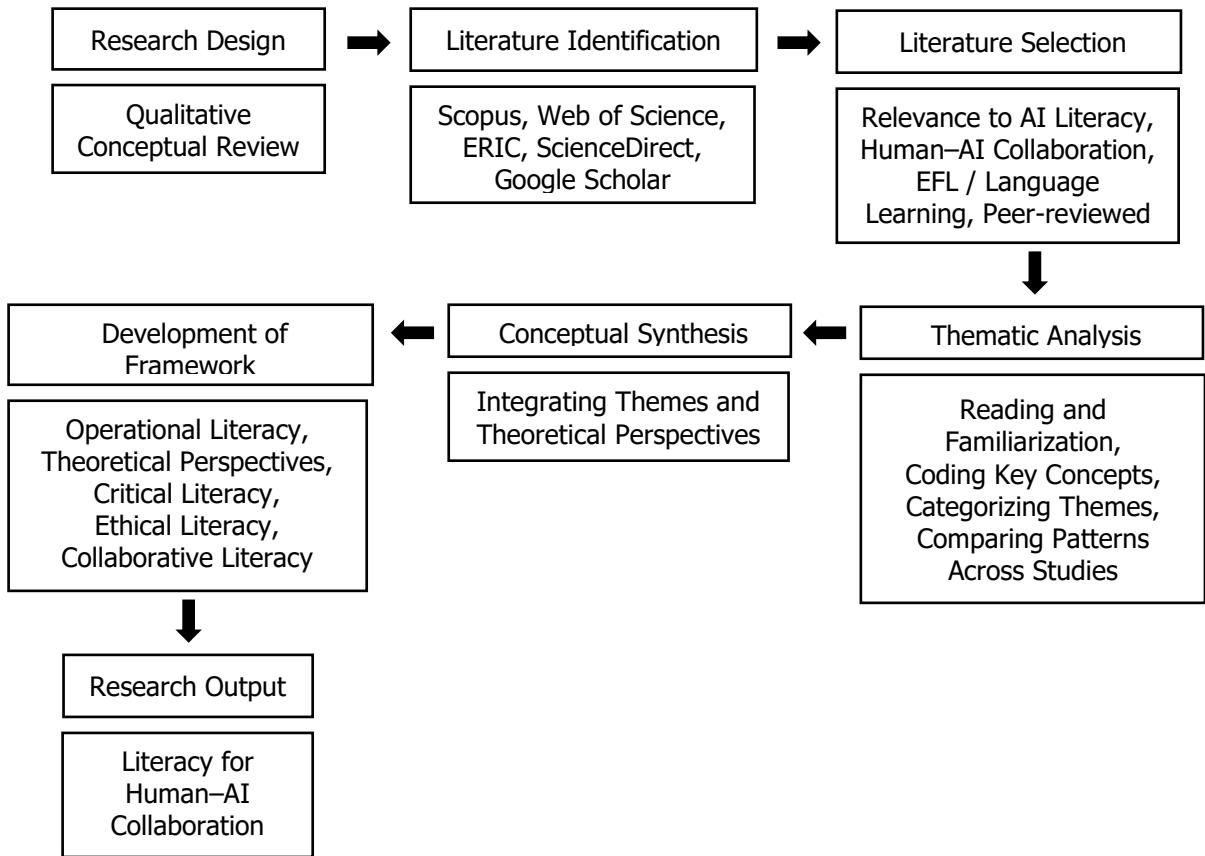
To enhance credibility, the review incorporated literature from multiple scholarly domains, including applied linguistics, educational technology, digital literacy, and artificial intelligence in education. Priority was given to peer-reviewed and widely cited publications. Furthermore, the conceptual framework was developed from recurring themes identified across multiple sources rather than from isolated findings within individual studies.

Research Procedure

To enhance methodological transparency, the overall review procedure is illustrated in Figure 1. The process began with literature identification and selection, followed by thematic analysis and conceptual synthesis. Through iterative comparison of recurring concepts across

the reviewed studies, four dimensions of AI literacy were identified and integrated into a conceptual framework explaining how AI literacy can support effective human–AI collaboration in EFL classrooms.

Figure 1
Research Procedure of the Conceptual Review



FINDINGS AND DISCUSSION

Dimensions of AI Literacy for Human–AI Collaboration

The thematic synthesis of the reviewed literature revealed four interrelated dimensions of AI literacy that are particularly relevant to contemporary EFL education: operational literacy, critical literacy, ethical literacy, and collaborative literacy. Although previous studies have conceptualized AI literacy from different perspectives (Long & Magerko, 2020; Ng et al., 2021; Kong et al., 2023), the analysis indicates that these four dimensions collectively provide a comprehensive framework for understanding how learners can engage effectively with AI technologies in language learning environments. Rather than functioning as isolated competencies, the four dimensions operate in a mutually reinforcing manner and together support meaningful human–AI collaboration.

Operational Literacy

The first dimension emerging from the thematic synthesis is operational literacy. Operational literacy refers to learners' ability to access, navigate, and utilize AI systems effectively. This competency includes understanding the basic functions of AI applications, formulating

effective prompts, interpreting generated outputs, and recognizing the capabilities and limitations of AI technologies (Long & Magerko, 2020).

The reviewed literature consistently indicates that operational literacy serves as the foundational level of AI engagement. Because generative AI systems rely heavily on user input, the quality of learner–AI interaction is often influenced by learners’ ability to communicate their intentions clearly and strategically. In language learning contexts, operational literacy enables learners to employ AI tools for activities such as vocabulary development, writing support, language practice, and information retrieval (Kohnke et al., 2023).

However, the synthesis also suggests that operational competence alone does not guarantee meaningful learning outcomes. Learners may successfully obtain AI-generated responses without fully understanding their accuracy, relevance, or limitations. Consequently, operational literacy should be regarded as a necessary but insufficient condition for responsible AI use in educational settings. More advanced forms of AI literacy are required to transform technological access into educational value.

Critical Literacy

The second dimension identified through the review is critical literacy. Critical literacy refers to learners’ capacity to evaluate AI-generated information, assess the credibility of outputs, identify inaccuracies, and make informed judgments regarding the appropriateness of AI-generated content. This dimension has become increasingly important because generative AI systems are capable of producing linguistically convincing responses regardless of their factual accuracy (Kasneji et al., 2023; Tlili et al., 2023).

The literature indicates that critical literacy plays a central role in preventing uncritical dependence on AI technologies. Learners must develop the ability to verify information, compare multiple sources, and assess whether AI-generated outputs are suitable for specific communicative and academic contexts. In EFL classrooms, critical literacy extends beyond factual verification and includes evaluating linguistic appropriateness, rhetorical effectiveness, and contextual relevance.

The synthesis further reveals that critical literacy contributes directly to learner autonomy. Rather than treating AI as an unquestionable authority, critically literate learners engage actively with AI-generated content and make independent decisions regarding its use. Such engagement supports the development of analytical thinking and reinforces the educational objective of fostering reflective and independent learners.

Ethical Literacy

The third dimension emerging from the thematic analysis is ethical literacy. Ethical literacy refers to learners’ understanding of the responsibilities associated with AI use, including issues related to academic integrity, transparency, privacy, authorship, and responsible participation in digitally mediated environments (UNESCO, 2023).

The reviewed studies suggest that ethical concerns have become increasingly significant following the widespread adoption of generative AI technologies. Because AI systems can generate sophisticated written texts and academic content, learners frequently encounter questions regarding originality, attribution, and appropriate use. Ethical literacy therefore involves recognizing when and how AI-generated content may be incorporated into academic work while maintaining integrity and accountability.

The findings also indicate that ethical literacy contributes to the development of responsible technology users. Unlike operational skills, ethical judgment cannot be delegated

to AI systems. Decisions regarding fairness, transparency, and responsible conduct remain fundamentally human responsibilities. Consequently, ethical literacy serves as a critical safeguard that helps ensure that technological innovation remains aligned with educational values and human-centred principles.

Collaborative Literacy

The fourth dimension identified through the review is collaborative literacy. Among the four dimensions, collaborative literacy emerged as the most distinctive and integrative component of AI literacy. Collaborative literacy refers to learners' ability to work productively with AI systems while maintaining human agency, critical judgment, and decision-making authority (Luckin, 2018; Raisch & Krakowski, 2021).

The thematic synthesis suggests that collaborative literacy extends beyond the ability to use AI effectively. Rather, it involves understanding how human and machine capabilities can complement one another within learning processes. AI systems contribute speed, information-processing capacity, and immediate feedback, whereas human learners contribute contextual understanding, creativity, ethical reasoning, and critical reflection. Meaningful educational outcomes emerge when these complementary strengths are integrated productively.

Within EFL classrooms, collaborative literacy can be observed when learners use AI-generated outputs as resources for exploration, reflection, and revision rather than as final answers. For example, learners may employ AI systems to generate alternative expressions, identify potential weaknesses in written texts, or explore different ways of organizing ideas before making independent decisions regarding their final work. Under such conditions, learning occurs through interaction between human judgment and technological support rather than through technological substitution.

Taken together, the four dimensions identified through the thematic synthesis suggest that AI literacy extends far beyond technical competence. Operational literacy enables access, critical literacy supports evaluation, ethical literacy promotes responsible use, and collaborative literacy facilitates meaningful interaction between human learners and AI systems. Collectively, these dimensions provide a conceptual framework for understanding how EFL learners can engage effectively with AI technologies while maintaining active participation in the learning process.

Pedagogical Implications for EFL Education

The findings of this study suggest that AI literacy should be understood not merely as a technological competency but as a pedagogical competency that enables learners to participate effectively in AI-mediated learning environments. The four dimensions identified through the thematic synthesis—operational literacy, critical literacy, ethical literacy, and collaborative literacy—collectively indicate that successful engagement with AI depends on learners' ability to maintain active intellectual involvement while interacting with increasingly sophisticated technologies. From this perspective, AI literacy functions as a foundation for meaningful human–AI collaboration rather than simply a set of technical skills for operating digital tools.

A central implication of the findings concerns the evolving nature of literacy in contemporary language education. Traditional approaches to digital literacy have focused primarily on learners' ability to access, evaluate, and communicate information through digital technologies (Falloon, 2020). However, the emergence of generative AI has altered the educational landscape by introducing technologies capable of generating content,

providing explanations, and participating in language-based interactions. Consequently, learners are no longer engaging solely with information sources but with systems that actively contribute to knowledge construction. This shift requires educational institutions to expand existing conceptions of literacy and incorporate competencies specifically related to AI-mediated communication and decision-making.

Within EFL classrooms, the significance of AI literacy is amplified because language serves as the principal medium through which learners interact with generative AI systems. Students formulate prompts, interpret responses, evaluate generated texts, and negotiate meaning through language-based exchanges. As a result, language proficiency and AI literacy become increasingly interconnected. Effective interaction with AI requires not only technical competence but also linguistic awareness, communicative sensitivity, and critical judgment. The findings therefore support the view that AI literacy should be integrated into language education rather than treated as a separate technological domain.

The findings further suggest that operational literacy, although necessary, should not be regarded as the ultimate goal of AI-related education. Current discussions surrounding generative AI frequently emphasize practical skills such as prompt construction and efficient interaction with AI systems. While such abilities are undoubtedly valuable, the thematic synthesis indicates that operational competence alone does not guarantee meaningful learning. Learners who can generate sophisticated AI outputs may nevertheless lack the ability to evaluate the quality, accuracy, or appropriateness of those outputs. Consequently, educational efforts should move beyond instrumental technology use and focus on cultivating higher-order forms of engagement with AI.

This observation highlights the importance of critical literacy within AI-enhanced language learning environments. The reviewed literature consistently demonstrates that generative AI systems may produce inaccurate information, fabricated references, or contextually inappropriate responses while maintaining a convincing linguistic style (Kasneci et al., 2023; Tlili et al., 2023). In EFL contexts, learners must therefore evaluate not only the factual accuracy of AI-generated content but also its communicative effectiveness, rhetorical suitability, and cultural appropriateness. Critical literacy enables learners to move beyond passive acceptance of technological outputs and engage in reflective decision-making regarding the use of AI-generated information.

The significance of critical literacy is particularly relevant in relation to language learning objectives. Effective language education seeks not only to develop linguistic accuracy but also to foster analytical thinking, communicative competence, and learner autonomy. When students critically evaluate AI-generated texts, they engage in processes of comparison, reflection, and judgment that contribute to deeper learning. Rather than replacing cognitive effort, AI can become a catalyst for critical engagement when learners possess the skills necessary to interrogate and refine generated outputs.

The findings also underscore the growing importance of ethical literacy in contemporary EFL education. Generative AI has introduced new challenges concerning authorship, originality, transparency, and academic integrity. Because AI systems can generate sophisticated written texts, learners may encounter uncertainty regarding appropriate levels of AI assistance and the ethical boundaries of AI-supported academic work. These concerns suggest that ethical literacy should become an explicit component of language education rather than an implicit expectation.

The integration of ethical literacy into EFL classrooms may involve discussions of responsible AI use, source verification, transparency in AI-assisted writing, and the ethical implications of technological dependence. Such discussions are essential because ethical

decision-making remains a fundamentally human responsibility. While AI systems can provide information and recommendations, they cannot determine what constitutes responsible academic conduct. Consequently, ethical literacy reinforces the human-centred orientation of AI education by emphasizing the continuing importance of human judgment and accountability.

Among the four dimensions identified in this study, collaborative literacy appears to offer the most significant contribution to contemporary discussions of AI in language education. Traditional educational debates frequently frame AI either as a powerful instructional resource or as a potential threat to authentic learning. The concept of collaborative literacy provides an alternative perspective by emphasizing productive interaction between human learners and intelligent technologies. This perspective aligns with theories of collaborative intelligence, which view human and machine capabilities as complementary rather than competing (Dellermann et al., 2019; Raisch & Krakowski, 2021).

Based on this perspective, it can be stated that the educational value of AI lies not in replacing human effort but in augmenting human learning. AI systems can support learners by generating alternative expressions, providing immediate feedback, and offering diverse perspectives on language use. Human learners, however, remain responsible for interpretation, evaluation, creativity, and contextual decision-making. Effective language learning therefore emerges from the interaction between technological support and human agency rather than from technological automation alone.

This understanding has important implications for classroom practice. Teachers may need to redesign learning activities so that AI functions as a learning partner rather than a shortcut to task completion. For example, students might be asked to compare multiple AI-generated responses, identify inaccuracies, evaluate rhetorical effectiveness, or revise AI-generated texts according to specific communicative goals. Such activities encourage learners to engage critically and collaboratively with AI while preserving opportunities for independent thinking and language development.

The findings also have particular relevance for the Indonesian educational context. Recent educational reforms have emphasized the development of critical thinking, creativity, communication skills, and digital competence as essential components of twenty-first-century learning (Kemendikbudristek, 2022). The integration of AI literacy into EFL education aligns closely with these priorities because it combines language learning with the development of critical, ethical, and technological competencies. Rather than introducing AI as an isolated technological innovation, educational institutions may benefit from incorporating AI literacy into broader efforts to prepare learners for participation in digitally mediated societies.

At the curriculum level, the findings suggest that AI literacy should be embedded across learning activities rather than confined to occasional technology-related lessons. EFL curricula may incorporate opportunities for learners to evaluate AI-generated texts, reflect on ethical issues associated with AI use, and develop strategies for productive collaboration with intelligent technologies. Assessment practices may likewise need to evolve to emphasize critical engagement, reflective decision-making, and responsible use of AI-generated resources rather than focusing exclusively on final products.

The findings simply expose that AI literacy represents a crucial educational competency for contemporary language learning. Operational literacy enables access to AI systems, critical literacy supports evaluation, ethical literacy promotes responsible engagement, and collaborative literacy facilitates meaningful interaction between human learners and intelligent technologies. These dimensions collectively contribute to a model of language

education that embraces technological innovation while preserving the human capacities that remain essential to learning.

Ultimately, the future of AI in EFL education should not be understood in terms of technological replacement or technological dependence. Instead, educational efforts should focus on preparing learners to engage with AI critically, ethically, and collaboratively. Such an approach recognizes that while AI technologies will continue to evolve, the enduring goals of language education—communication, critical thinking, creativity, and human understanding—remain fundamentally human endeavours. In this sense, AI literacy serves not only as a technological competency but also as a pedagogical foundation for sustainable human–AI collaboration in EFL classrooms.

CONCLUSION

The rapid integration of generative artificial intelligence into education has created new opportunities and challenges for English as a Foreign Language (EFL) learning. This study has argued that effective engagement with AI requires more than the ability to operate technological tools. Through a qualitative conceptual review, the study identified four interconnected dimensions of AI literacy—operational literacy, critical literacy, ethical literacy, and collaborative literacy—that collectively support meaningful human–AI collaboration in language learning environments. These dimensions highlight the importance of preparing learners not only to use AI but also to evaluate, regulate, and collaborate with it responsibly.

The findings suggest that AI literacy should be regarded as an essential educational competency in contemporary EFL classrooms. While operational literacy enables learners to access and utilize AI systems, critical literacy helps them evaluate AI-generated outputs, ethical literacy promotes responsible technology use, and collaborative literacy facilitates productive interaction between human learners and intelligent technologies. Together, these competencies provide a foundation for maintaining human agency while benefiting from the capabilities of AI.

Based on a pedagogical perspective, the study emphasizes the need to integrate AI literacy into EFL teaching and learning practices. Rather than treating AI as a substitute for human effort, educators should encourage learners to engage with AI critically, ethically, and collaboratively. Such an approach aligns with broader educational goals of fostering communication, critical thinking, creativity, and responsible digital participation. As AI technologies continue to evolve, the ability to collaborate effectively with intelligent systems is likely to become an increasingly important aspect of language education.

Finally, this study contributes a conceptual framework for understanding the relationship between AI literacy and human–AI collaboration in EFL contexts. Future research may extend this work by examining how the proposed dimensions of AI literacy are manifested in actual classrooms and by exploring instructional strategies that support their development among learners and teachers. Through such efforts, EFL education can better respond to the opportunities and complexities of an increasingly AI-mediated world.

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