

Artificial intelligence-driven innovation in English language education: a thematic literature review and conceptual framework for Indonesian EFL context

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ABSTRACT

The use of Artificial Intelligence (AI) in English as a Foreign Language (EFL) education has expanded rapidly, transforming learning, assessment, teacher professional development, and educational governance. However, existing studies predominantly examine these dimensions independently, leaving a lack of an integrated conceptual framework to explain AI implementation as a comprehensive educational ecosystem. This study aims to synthesize recent research on AI in EFL education, identify emerging themes, and propose the AI-Integrated EFL Innovation Framework (AIEIF). A Thematic Literature Review was conducted on twelve peer-reviewed international articles published between 2024 and 2025. Data were analyzed through open coding, category development, and thematic synthesis to identify recurring conceptual patterns across studies. The analysis generated five interrelated themes: AI-Supported Student Learning, AI for Teacher Professional Development, AI-Based Assessment Innovation, AI Leadership and Educational Governance, and Challenges and Future Directions. The findings indicate that effective AI implementation depends on the integration of adaptive learning, teacher capacity building, data-driven assessment, institutional leadership, and governance while addressing ethical, technological, policy, and cultural considerations. The proposed AIEIF offers a human-centered conceptual framework that advances AI integration in EFL education and provides a foundation for future empirical research, educational policy, and sustainable AI implementation, particularly in the Indonesian context.

Keyword: artificial intelligence; english as a foreign language (efl); ai-integrated efl innovation framework (aieif); educational innovation

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1. INTRODUCTION

The development of Artificial Intelligence (AI) over the past decade has brought about fundamental changes to the global educational landscape. Technological advancements—particularly machine learning, large language models, learning analytics, and generative AI—are no longer viewed merely as tools to support learning but have become an integral part of the transformation of the educational ecosystem (Sposato, 2025). The use of AI spans various aspects of education, ranging from the learning process, assessment, and professional development of educators to institutional governance (Shaan & Ahmad, 2025). This transformation is driven by growing demands for an educational system capable of producing human resources with 21st-century competencies, such as critical thinking, creativity, collaboration, communication, digital literacy, and the ability to engage in lifelong learning (Hattie & Group, 2009). In this context, AI offers opportunities to create more adaptive, personalized, and data-driven learning through the personalization of learning materials, real-time feedback, and the analysis of learning data to support evidence-based decision-making (Syatriana & Dzilarasy, 2025). However, behind these opportunities, the implementation of AI also presents challenges related to ethics, algorithmic transparency, data security, and the changing role of teachers in digital learning environments (Li et al., 2025; Ramendra et al., 2025). Therefore, current research is no

longer focused solely on questions regarding the effectiveness of AI but rather on how this technology can be responsibly integrated to improve the quality of education without neglecting human values.

These changes are becoming increasingly evident in the teaching of English as a Foreign Language (EFL). Until now, EFL instruction has faced various challenges, including limited opportunities for authentic interaction, difficulties in providing prompt feedback to learners, and the need to accommodate diverse learning styles (Hattie & Group, 2009; Werdiningsih et al., 2024). The emergence of AI offers alternative solutions through more adaptive, interactive, and learner-centered instruction. Various recent studies have shown that AI can increase learner engagement, strengthen self-regulation, support personalized learning, and provide faster and more accurate formative assessments (Heikkinen et al., 2025; Marzuki et al., 2023; Ouyang et al., 2024). In addition to enhancing students' learning experiences, the implementation of AI also drives a shift in the teacher's role from an information provider to a learning facilitator, learning experience designer, and developer of digital competencies. Thus, AI not only contributes to improved learning outcomes but also drives a pedagogical transformation that involves students, teachers, assessment, and educational institutions as an interconnected ecosystem.

Although research on AI in EFL education is advancing rapidly, the available literature remains relatively fragmented. Most studies focus on specific aspects, such as improving reading, writing, and speaking skills or AI-based assessment, while research on teacher professional development, educational leadership, and the governance of AI implementation has developed separately. As a result, the conceptual relationships among the various dimensions of AI implementation have not yet been comprehensively mapped. For example, research on adaptive learning generally has not linked the use of learning outcome data to teachers' professional reflection or decision-making at the institutional level. Similarly, studies on educational leadership and AI governance tend to stand alone without explaining their connection to pedagogical innovations in the classroom. This situation indicates that AI implementation is still largely understood from a sectoral perspective, even though digital educational transformation occurs through dynamic interactions among learning, assessment, teacher capacity, institutional policies, and technological support.

These conditions reveal a research gap that requires further attention. First, most previous studies have evaluated the implementation of AI in a specific dimension and thus have not yet produced a conceptual model that integrates student learning, teacher professional development, assessment, educational leadership, and AI governance into a single, comprehensive framework. Second, existing research has focused more on testing the effectiveness of the technology than on explaining the mechanisms underlying the relationships among the components that determine the success of AI implementation. Third, synthesis studies that integrate the latest research findings to produce a conceptual framework relevant to the characteristics of English language education in Indonesia remain very limited. In fact, the Indonesian context—with its diverse geographical conditions, digital infrastructure readiness, human resource capacity, and sociocultural background—requires a different approach to AI implementation than that of developed countries.

In the Indonesian context, the integration of AI is evolving alongside the acceleration of digital transformation in education and the implementation of the Merdeka Curriculum, which emphasizes learner-centered learning, differentiated instruction, and the strengthening of 21st-century competencies (Langoday et al., 2024). This policy opens up broader opportunities for the use of AI to improve the quality of English language learning. However, the implementation of AI in various educational institutions is still predominantly limited to its use as a tool for developing instructional materials, translation, and information retrieval, while its utilization as part of an integrated learning system has not yet been fully optimized. These challenges are not only related to the availability of technology but also concern teacher readiness, school leadership support, institutional policies, digital literacy, and ethical considerations in the use of AI. Therefore, the development of an AI implementation model for EFL education in Indonesia requires a conceptual framework capable of accommodating international theoretical developments while taking local characteristics into account so that technological innovations can truly contribute to improving the quality of learning.

Based on this gap, this study proposes a more integrative perspective through the development of the AI-Integrated EFL Innovation Framework (AIEIF) as a conceptual framework that explains the interrelationships among the dimensions of AI implementation in English language education. This framework was developed using a Thematic Literature Review approach to synthesize the latest research findings, thereby identifying patterns, conceptual relationships, and trends in AI research within the EFL context. Unlike previous studies, which generally examined the implementation of AI in isolation, the AIEIF views student learning, teacher professional development, assessment innovation, educational leadership, institutional governance, and contextual factors as interrelated components that shape an AI-based learning ecosystem.

The development of this framework is based on the understanding that the success of AI implementation is determined not only by the sophistication of the technology but also by the readiness of the educational ecosystem to integrate technology into pedagogical practices in a sustainable manner. AI-based adaptive learning, for example, will only have an optimal impact if it is supported by teachers' competence in

designing meaningful learning experiences, an assessment system capable of generating high-quality learning data, leadership that encourages innovation, and institutional policies that ensure the ethical, transparent, and accountable use of AI. Thus, the implementation of AI is a process of transforming the education system that involves the simultaneous interaction of pedagogical, technological, organizational, and policy aspects.

The novelty of this study lies in the development of the AIEIF as a conceptual model that integrates the five main dimensions of AI implementation: student learning, teacher professional development, assessment innovation, educational leadership and governance, and contextual factors that influence the sustainability of AI implementation.

Through a cross-study thematic synthesis, this framework not only synthesizes existing empirical findings but also clarifies the conceptual relationships among its components, resulting in a more comprehensive model than those presented in previous studies. Within this framework, AI is positioned not as the ultimate goal of educational transformation but rather as a technology that strengthens human capacity through adaptive learning, authentic assessment, continuous teacher professional development, data-driven decision-making, and responsible educational governance.

In addition to contributing to the development of theory regarding the implementation of AI in English language education, this study also offers practical implications for the development of educational policy in Indonesia. AIEIF provides a conceptual foundation for educational institutions, curriculum developers, and policymakers in designing AI implementation strategies that take into account digital infrastructure readiness, educator competencies, ethical considerations, data protection, and the sociocultural characteristics of Indonesian society. By incorporating these contextual factors, the developed framework is expected to be more adaptive to national educational needs without neglecting international developments in theory and practice.

Based on this background and the existing research gaps, this study aims to synthesize the latest findings on the implementation of Artificial Intelligence in English as a Foreign Language (EFL) education, identify the main themes shaping the development of AI research in the EFL context, and develop the AI-Integrated EFL Innovation Framework (AIEIF) as a conceptual model that systematically explains the relationships among the dimensions of AI implementation. Specifically, this study is designed to answer three research questions: (1) How have the main themes of AI implementation in EFL education evolved based on a synthesis of the latest literature? (2) How do the conceptual relationships among these themes shape the English language learning innovation ecosystem? and (3) How can the AIEIF be developed as a relevant conceptual framework to support AI implementation in the context of EFL education in Indonesia?

To achieve these objectives, this study employs a Thematic Literature Review approach, which enables the identification of key themes, the analysis of conceptual relationships among findings, and the development of theoretical constructs based on a synthesis of existing research. This approach was chosen because it not only maps the development of AI research in English language education but also facilitates the development of a new conceptual model that can serve as a foundation for future empirical research and educational policy development. Thus, this study is expected to make a theoretical contribution by enriching perspectives on the implementation of AI in EFL education while also providing a practical contribution as a reference for designing adaptive, sustainable, and quality-oriented strategies for transforming English language learning in the era of artificial intelligence.

2. RESEARCH METHOD

This study employs a Thematic Literature Review (TLR) approach to identify, synthesize, and interpret developments in the implementation of Artificial Intelligence (AI) in English as a Foreign Language (EFL) education. Unlike traditional literature reviews, which are generally descriptive in nature, TLR enables the development of a conceptual synthesis through the identification of patterns, relationships, and themes that consistently emerge across various studies. This approach was chosen because the study aims to build a comprehensive understanding of the interrelationships among various dimensions of AI implementation while simultaneously developing the AI-Integrated EFL Innovation Framework (AIEIF) as a conceptual model. Thus, the study is oriented toward theory building through thematic synthesis rather than measuring the effectiveness of interventions, as in a systematic review or meta-analysis.

The literature review was conducted in four stages: literature identification, article selection, data extraction, and thematic synthesis. The article search was conducted in international scientific databases using a combination of keywords related to Artificial Intelligence, English language education, English as a Foreign Language (EFL), teacher professional development, assessment, educational leadership, and educational innovation. The search focused on articles published between 2024 and 2025 to obtain an up-to-date overview of AI implementation in English language education. Articles were then selected based on four criteria: (1) published in reputable international journals and having undergone a peer-review process; (2) focusing on the

implementation of AI in EFL education; (3) presenting relevant empirical findings or conceptual analyses; and (4) providing sufficient information for thematic analysis. Articles that did not meet these criteria were excluded from the synthesis process. The selection process yielded twelve articles, which were used as the primary data sources.

These articles cover various aspects of AI implementation, including student learning, teacher professional development, AI-based assessment, educational leadership, institutional governance, and implementation challenges across various educational contexts.

Data analysis was conducted using thematic analysis through three coding stages. The open coding stage was used to identify concepts, keywords, and main ideas in each article. Next, codes with related meanings were grouped through axial coding to form conceptual categories. The selective coding stage then integrated these categories into main themes that explain patterns of AI implementation in EFL education. The analysis not only considered commonalities in the findings but also took into account differences in context, perspective, and theoretical implications, resulting in an interpretive and comprehensive synthesis.

The accuracy of the analysis was ensured through an iterative coding process involving repeated readings of all articles and the application of constant comparative analysis to ensure consistency in interpretation and minimize overlap among categories. Each theme was also verified by revisiting the empirical evidence in the source articles so that the relationships among the data, categories, and themes could be transparently accounted for.

The validity of the research was ensured through four criteria of trustworthiness. Credibility was strengthened by applying clear inclusion criteria and selecting relevant articles. Dependability was maintained through systematic documentation of all research stages. Confirmability was achieved by basing all interpretations on evidence found in the source articles, while transferability was enhanced through the presentation of detailed descriptions of the study characteristics and analysis procedures. Through this process, the synthesis yielded five main themes: AI-Supported Student Learning, AI for Teacher Professional Development, AI-Based Assessment Innovation, AI Leadership and Educational Governance, and Challenges and Future Directions. These five themes were then integrated to develop the AI-Integrated EFL Innovation Framework (AIEIF) as a conceptual model that explains the implementation of AI in EFL education as an ecosystem integrating learning, teacher professional development, assessment, educational leadership, and contextual factors. This process is illustrated in Table 1.

Table 1. Cross-Study Thematic Synthesis Matrix

Theme	Supporting Studies	Key Findings from the Literature	Emerging Concepts	Contribution to the AIEIF Framework
Theme 1. AI-Supported Student Learning	Heikkinen et al. (2025); Li et al. (2025); Ramendra et al. (2025); Shafiee Rad (2025); Syatriana and Dzilarsy (2025)	AI improves learner engagement, adaptive learning, personalized instruction, authentic learning experiences, metacognitive awareness, self-regulated learning, and learner autonomy through continuous interaction and feedback.	Student engagement; adaptive learning; learner agency; self-regulated learning; authentic learning; personalized learning	Establishes the pedagogical foundation of the AIEIF by positioning learners as active agents supported by AI-enhanced personalized learning environments.
Theme 2. AI for Teacher Professional Development	Mercer and Pawlak (2024); Arefian et al. (2026); Hajar and Manan (2026); Li and Zeng (2024)	AI promotes professional curiosity, collaborative reflection, digital competence, teacher identity reconstruction, and continuous professional learning through Communities of Practice and reflective dialogue.	Professional curiosity; Community of Practice; teacher identity; AI literacy; reflective practice	Strengthens teacher agency as the driving force for designing, facilitating, and evaluating AI-supported EFL learning.
Theme 3. AI-Based Assessment Innovation	Li et al. (2025); Syatriana and Dzilarsy (2025); Hattie and Yates (2014)	AI transforms assessment through e-portfolios, automated feedback, learning analytics, authentic assessment, and continuous feedback aligned with Visible Learning principles.	AI feedback; e-portfolio; formative assessment; Visible Learning; assessment for learning	Connects learning and teaching through continuous feedback loops that improve learner performance and instructional quality.

Theme	Supporting Studies	Key Findings from the Literature	Emerging Concepts	Contribution to the AIEIF Framework
Theme 4. AI Leadership and Educational Governance	Sposato (2025); Zawacki-Richter et al. (2024)	AI supports evidence-based leadership, institutional digital transformation, educational governance, strategic planning, data-driven decision-making, and quality assurance.	AI leadership; governance; institutional readiness; evidence-based decision-making; educational policy	Provides institutional support and strategic governance that sustain AI implementation beyond classroom practices.
Theme 5. Challenges and Future Directions	Synthesized from all included studies	Successful AI implementation depends on ethical AI use, digital equity, infrastructure availability, teacher readiness, supportive policy, and cultural responsiveness.	AI ethics; digital divide; infrastructure; policy; teacher readiness; cultural adaptation	Functions as contextual and moderating factors influencing all dimensions of the AIEIF and ensuring sustainable implementation.

Table 1 presents the results of the cross-study thematic synthesis conducted across the twelve selected articles. The coding process identified five overarching themes that consistently emerged despite differences in research contexts, methodologies, and AI applications. Rather than representing isolated categories, these themes form an interconnected structure that explains how Artificial Intelligence supports educational transformation from the classroom level to institutional governance. The first three themes primarily address pedagogical innovation through student learning, teacher professional development, and assessment practices, whereas the fourth theme expands the discussion to leadership and educational governance. The fifth theme functions as a cross-cutting contextual dimension by highlighting ethical, technological, organizational, and sociocultural factors that influence the sustainability of AI implementation. Collectively, these five themes constitute the analytical foundation for developing the proposed AI-Integrated EFL Innovation Framework (AIEIF). The following sections discuss each theme in greater depth before integrating them into a unified conceptual framework.

3. RESULTS AND DISCUSSION

A thematic analysis of twelve articles that met the inclusion criteria revealed that the implementation of Artificial Intelligence (AI) in English as a Foreign Language (EFL) education is evolving as an interconnected ecosystem rather than merely as a standalone technological innovation. A cross-study synthesis reveals that AI drives the transformation of learning toward a system that is more adaptive, collaborative, data-driven, and learner-centered. Therefore, the research findings are presented as a conceptual synthesis that connects various findings to explain how AI shapes EFL educational innovation as a whole.

The synthesis process yielded five main themes: AI-Supported Student Learning, AI for Teacher Professional Development, AI-Based Assessment Innovation, AI Leadership and Educational Governance, and Challenges and Future Directions. These five themes represent interrelated dimensions of AI implementation. Student learning is at the core of this transformation through AI-supported personalization and adaptive learning. This transformation further requires the development of teacher competencies, data-driven assessment innovations, and leadership and educational governance support capable of creating a sustainable ecosystem for AI implementation. On the other hand, various challenges—such as ethics, teacher readiness, the digital divide, infrastructure, policy, and cultural adaptation—are factors that influence the success of AI implementation.

Unlike approaches that merely count the frequency of theme occurrences, this study emphasizes the interpretation of relationships among concepts, thereby yielding a more comprehensive understanding of AI implementation in EFL education. Based on this synthesis, the subsequent discussion is organized in stages, beginning with student learning and extending to educational leadership and implementation challenges, serving as the foundation for the development of the AI-Integrated EFL Innovation Framework (AIEIF), which constitutes the study's primary conceptual contribution.

A. *The Implementation of AI in English as a Foreign Language (EFL) Education*

1) AI-Supported Student Learning

The findings of this synthesis indicate that the transformation of students' learning experiences is the most fundamental dimension in the implementation of Artificial Intelligence (AI) in English as a Foreign

Language (EFL) education. Unlike conventional learning, which uses technology merely as a medium for delivering content, AI functions as an adaptive system capable of tailoring content, activities, and feedback based on students' needs and progress. Thus, AI not only enhances learning efficiency but also fosters a learning experience that is more personalized, reflective, and oriented toward the continuous development of competencies.

A synthesis of the studies by Heikkinen et al. (2025), Li et al. (2025), Ramendra et al. (2025), Shafiee Rad (2025), and Syatriana and Dzilarsy (2025) identifies four key characteristics of AI-based learning: personalized learning, self-regulated learning, student engagement, and adaptive feedback. These four aspects complement one another in shaping a learner-centered learning ecosystem. AI enables personalization by tailoring content and difficulty levels based on learning performance, providing dynamic recommendations, and creating learning experiences that are more relevant to individual characteristics. However, the effectiveness of personalization is determined not only by technological capabilities but also by the quality of pedagogical design and learners' ability to use AI reflectively and responsibly.

In addition to supporting personalization, AI enhances self-regulated learning by providing real-time feedback that helps students plan, monitor, and evaluate their learning process. This feature fosters academic independence because learners can identify their weaknesses and adjust their learning strategies without having to wait for teacher evaluations. However, the synthesis indicates that these benefits depend on learners' intrinsic motivation, digital literacy, and metacognitive abilities. AI does not replace the learning process; rather, it serves as a learning partner that strengthens learners' capacity to manage their own learning.

A cross-study analysis also reveals a shift in focus within the AI literature on EFL education. The success of AI implementation is no longer measured solely by improvements in learning outcomes but by the quality of the learning experience, characterized by increased engagement, reflection, autonomy, and the sustainability of the learning process. This shift indicates that AI is increasingly understood as a pedagogical innovation rather than merely as a technological one. However, most research still focuses on students' learning experiences at the individual level and has not yet extensively examined their relationship to teacher competencies, assessment systems, educational leadership, or institutional policies. This gap suggests that the implementation of AI needs to be understood as part of a broader educational ecosystem.

These findings can be explained through the perspective of Self-Regulated Learning (SRL), which positions learners as the primary agents in managing their own learning. Within this framework, AI functions as a cognitive scaffold that supports goal-setting, strategy selection, progress monitoring, and learning reflection through adaptive feedback and the analysis of learning data. These findings are also consistent with the student-centered learning approach, which views AI as a facilitator of learning rather than a substitute for human involvement. Therefore, AI's contribution is reflected not only in improved academic achievement but also in the development of reflection, independent learning, and digital literacy as the foundation for lifelong learning.

In the Indonesian context, the implementation of AI has great potential to expand access to learning resources, increase opportunities to practice English, and provide faster feedback. However, these benefits can only be realized if AI is integrated into learning strategies that foster critical thinking, creativity, collaboration, and problem-solving rather than being used merely to obtain instant answers. Furthermore, the successful implementation of AI also requires teacher readiness, equitable access to digital infrastructure, and the strengthening of students' digital literacy. Thus, AI-Supported Student Learning serves as the foundation for the transformation of EFL education, which must be further supported by teacher professional development, assessment innovation, and educational governance to create a sustainable AI-based learning ecosystem.

2) AI for Teacher Professional Development

A thematic synthesis indicates that the successful implementation of Artificial Intelligence (AI) in English as a Foreign Language (EFL) education depends not only on technological capabilities but also on teachers' capacity to integrate AI into their pedagogical practices. Recent literature demonstrates that AI does not replace the role of teachers but rather transforms them into learning designers, facilitators of reflection, makers of pedagogical decisions, and agents of innovation. Therefore, teacher professional development is a key prerequisite for the effective and sustainable implementation of AI.

A synthesis of the studies by Mercer and Pawlak (2024), Arefian et al. (2026), Hajar and Manan (2026), and Li and Zeng (2024) indicates that professional development in the AI era encompasses strengthening pedagogical competencies, AI literacy, reflective skills, and professional identity. Teachers are expected not only to master technology but also to critically evaluate AI outputs, integrate them into learning strategies, and ensure that their use remains aligned with learning objectives and students' needs. Thus, teacher

professionalism is shifting from technological mastery toward the ability to combine human intelligence and artificial intelligence in creating meaningful learning experiences.

All four studies show that AI is driving a redefinition of the teacher's role from a knowledge transmitter to a learning facilitator and lifelong learner. Mercer and Pawlak emphasize the importance of professional curiosity as a driving force for continuously exploring new approaches, reflecting on teaching practices, and evaluating the effectiveness of AI. Arefian et al. highlight that AI expands opportunities for collaboration through professional communities that enable teachers to share experiences, develop pedagogical innovations, and access best practices. Meanwhile, Hajar and Manan point out that the implementation of AI requires teachers to build an adaptive professional identity without losing sight of humanistic values in education. These findings indicate that teachers' professional transformation occurs not only in technical aspects but also encompasses changes in how they think, learn, and perceive the teaching profession in the digital age.

A cross-study analysis reveals a paradigm shift from technological competence toward pedagogical intelligence. Technical competence is no longer sufficient to address the complexities of AI implementation. Teachers are expected to understand the limitations of algorithms, recognize potential information biases, and make pedagogical decisions that take the learning context into account. The relationship between AI and professional development is also reciprocal. AI provides access to learning resources, accelerates reflection, and supports learning innovation, while the effectiveness of AI depends on teachers' ability to interpret information and translate it into appropriate pedagogical decisions. This suggests that the quality of AI implementation is determined more by teachers' professionalism than by the sophistication of the technology itself.

These findings can be explained through the perspectives of Communities of Practice, Professional Curiosity, and Teacher Identity. AI expands the scope of professional collaboration through learning communities that enable the continuous exchange of knowledge and innovation. At the same time, professional curiosity drives teachers to experiment, critically evaluate the use of AI, and continuously develop their competencies. Meanwhile, the Teacher Identity perspective emphasizes that AI does not diminish the relevance of the teaching profession but rather reinforces the importance of competencies that cannot be replaced by technology, such as empathy, ethical consideration, cultural sensitivity, and the ability to foster motivation for learning.

In the Indonesian context, these findings indicate the need to reorient the teacher professional development system. Training programs should not only focus on mastering AI applications but also on developing AI literacy, reflective thinking skills, a collaborative culture, and an adaptive professional identity. Institutional and policy support that encourages continuous professional learning is a critical factor in enabling teachers to utilize AI ethically, critically, and pedagogically. Thus, AI for Teacher Professional Development serves as a strategic bridge between student-centered learning and broader educational transformation while also laying the foundation for AI-based assessment innovations discussed in the following section.

3) AI-Based Assessment Innovation

A thematic synthesis indicates that Artificial Intelligence (AI)-based transformations in learning and teacher professional development must be supported by innovations in assessment to sustainably improve the quality of learning. Recent literature shows that AI is no longer viewed merely as a tool for automating grading but as a technology that transforms assessment into an integral part of the learning process (assessment for learning). This research synthesis identifies three key mechanisms that strengthen the function of assessment: adaptive feedback, AI-based e-portfolios, and the use of assessment data to support instructional decision-making. These three mechanisms shift the focus of assessment from measuring learning outcomes to supporting the continuous development of students' competencies.

A cross-study analysis of Li et al. (2025), Syatriana & Dzilarsy (2025), and Hattie & Yates (2014) shows that AI-generated feedback is the most significant innovation in English language learning assessment. AI is capable of providing rapid and personalized feedback on various aspects of student performance, such as grammar, vocabulary choice, writing organization, and coherence of ideas. Real-time feedback allows students to immediately revise their work, correct errors, and develop independent learning strategies. However, the effectiveness of feedback depends not only on the system's speed but also on the ability of teachers and students to interpret the information generated by AI. Although AI can accurately identify patterns of errors, teachers' pedagogical judgment remains essential to ensure that feedback aligns with learning objectives, students'

proficiency levels, and the communicative context. Thus, AI serves as an enhancement to formative assessment, not a substitute for teachers' professional judgment.

In addition to adaptive feedback, AI-based e-portfolios expand assessment functions through the longitudinal documentation of learning progress. Unlike conventional assessments that focus on final outcomes, e-portfolios allow teachers and students to track the development of competencies based on a collection of authentic evidence of learning. AI supports this process through data management, the identification of development patterns, and the visualization of learning progress, which facilitates reflection. This approach strengthens authentic assessment because learning success is evaluated based on the process, improvement, and development of competencies rather than solely on achievements at a single point in time.

These findings align with Visible Learning theory, which emphasizes the importance of feedback in helping students understand their learning progress, the goals they aim to achieve, and the steps needed to improve their performance. From this perspective, AI enhances the transparency of the learning process through progress analysis and the presentation of data that can be utilized by both teachers and students. Assessment no longer serves merely as a tool for final evaluation but becomes the foundation for reflection and evidence-based decision-making to continuously improve the learning process.

In the context of EFL education in Indonesia, AI-based assessment innovations have the potential to support the implementation of differentiated instruction and authentic assessment, as mandated by the Merdeka Curriculum. AI can help teachers provide more personalized feedback, reduce the administrative burden of assessment, and provide more comprehensive learning data to design appropriate interventions. However, such implementation requires enhancing teachers' competencies in digital assessment and data literacy, accompanied by policies that ensure data protection, algorithmic transparency, and the ethical use of AI. Therefore, the success of AI-based assessment is determined not only by technological sophistication but also by teacher readiness, institutional support, and educational governance that ensures AI is utilized fairly, accountably, and with a focus on improving the quality of learning. These findings underscore that AI-based assessment serves as a bridge between classroom learning practices and decision-making at the institutional level. Consequently, the following discussion focuses on AI Leadership and Educational Governance as key factors determining the sustainability of AI implementation in education.

4) AI Leadership and Educational Governance

The thematic synthesis indicates that the successful implementation of Artificial Intelligence (AI) in English as a Foreign Language (EFL) education depends not only on instructional innovation, teacher professional development, and assessment but also on educational leadership and institutional governance. An analysis of the studies by Sposato (2025) and Zawacki-Richter et al. (2024) reveals that AI integration constitutes an organizational transformation requiring a strategic vision, institutional policies, infrastructure, data governance, and oversight mechanisms that ensure the effective, ethical, and sustainable implementation of AI. Thus, AI must be understood as part of the transformation of the education system rather than merely as an innovation occurring in the classroom.

Both studies identify leadership as a strategic enabler that fosters an ecosystem of innovation. Educational leaders no longer function merely as administrators but as change agents who build a shared vision, foster a culture of innovation, strengthen collaboration, and ensure the organization's readiness for digital transformation. At the same time, educational governance plays a role through the development of policies, operational standards, data usage regulations, and ethical guidelines that minimize the risks associated with AI use. This synthesis indicates that the effectiveness of AI implementation is determined more by institutional readiness than by the sophistication of the technology used.

A cross-study analysis also reveals that the leadership dimension still receives relatively less attention than the technological and pedagogical aspects. In fact, various failures in educational innovation are more often caused by a weak organizational vision, poor coordination among stakeholders, and a lack of institutional support than by technological limitations. Therefore, educational leadership needs to shift toward transformational digital leadership—that is, leadership capable of integrating technology, organizational culture, teacher development, and data-driven decision-making. From this perspective, AI serves as a strategic source of information for monitoring student progress, evaluating the quality of learning, identifying teacher development needs, and supporting evidence-based policy formulation.

In the Indonesian context, these findings underscore the need for institutional policies that systematically regulate the use of AI. Although various schools and universities have begun to utilize AI, its implementation is still dominated by individual teachers' initiatives. Therefore, educational leadership needs to provide ongoing professional development programs, strengthen digital infrastructure, establish ethical

guidelines and data protection measures, and foster a collaborative culture that enables all stakeholders to participate in innovation. In this way, digital transformation can evolve into an organizational change focused on improving the overall quality of education.

Overall, this theme demonstrates that leadership and governance are integrative dimensions that link learning, teacher development, and assessment into a sustainable education system. However, the successful implementation of AI remains subject to various challenges that must be comprehensively addressed, as discussed in the next theme.

5) Challenges and Future Directions

The thematic synthesis indicates that the implementation of AI in EFL education presents significant opportunities to improve the quality of learning but, at the same time, raises multidimensional challenges that determine the sustainability of this transformation. Various studies indicate that the success of AI implementation is influenced not only by technological advancements but also by human, institutional, and policy readiness. The main challenges identified include ethics, the digital divide, infrastructure, teacher competencies, regulations, and cultural adaptation.

Ethical issues have been a consistent focus in the literature. The use of AI raises concerns regarding algorithmic transparency, information accuracy, systemic bias, data security, intellectual property rights, and academic integrity. Although AI is capable of rapidly generating content and feedback, the technology is not yet able to fully understand complex pedagogical, social, and cultural contexts. Unsupervised use of AI has the potential to increase students' dependence, reduce their critical thinking skills, and pose a risk of plagiarism. Therefore, all studies emphasize the importance of a human-centered AI approach—that is, positioning AI as an augmentative technology that reinforces rather than replaces teachers' professional judgment and students' learning autonomy. This approach requires the development of ethical guidelines, AI literacy, and data governance that ensure a balance between innovation and academic responsibility.

In addition to ethical considerations, the digital divide and infrastructure limitations remain major obstacles. The synthesis indicates that the benefits of AI are more readily accessible to institutions with access to digital devices, stable internet connectivity, and adequate resource support. Conversely, infrastructure limitations have the potential to widen the gap in educational quality. In the Indonesian context, geographical conditions and disparities in capacity across regions necessitate a phased implementation of AI tailored to each institution's readiness. Therefore, investment in digital infrastructure should be viewed as part of a strategy to improve educational quality rather than merely as the procurement of technology.

Teacher readiness is also a key factor in the successful implementation of AI. The literature indicates that many teachers still face difficulties in understanding how AI works, evaluating system outputs, and integrating AI into their teaching practices. This suggests that AI literacy must be part of teachers' professional competencies. Continuing professional development should focus on strengthening pedagogical skills, critical thinking, data literacy, and the ethical and responsible use of AI.

On the other hand, policy regulations play a strategic role in creating a consistent implementation environment. Various studies emphasize the importance of policies governing data protection, system quality standards, evaluation mechanisms, and ethical guidelines for both teachers and students. Without clear regulations, the implementation of AI risks becoming fragmented and uneven, preventing its benefits from being fully realized.

Another equally important aspect is cultural adaptation. Most AI technologies are developed based on a global context that may not necessarily align with the social, linguistic, and cultural characteristics of each country. In EFL education in Indonesia, AI needs to be adapted to support English language learning without neglecting local values, cultural identity, and the characteristics of students. Thus, AI not only enhances linguistic competence but also enriches cross-cultural communication and critical thinking skills.

Overall, this theme indicates that the challenges of AI implementation are interrelated and must be managed through a systemic, collaborative, and sustainable approach. This synthesis serves as the foundation for the development of a conceptual model that integrates all dimensions of AI implementation in EFL education.

B. *Synthesis and Proposed AI-Integrated EFL Innovation Framework (AIEIF)*

Based on a synthesis of twelve articles, this study developed the AI-Integrated EFL Innovation Framework (AIEIF) as a conceptual model that integrates five main themes in the implementation of AI in EFL education. This model is based on the assumption that the success of AI is not determined by a single

component but rather by the dynamic relationship among student learning, teacher professional development, assessment innovation, educational leadership, and contextual factors.

Figure 1 visualizes the AI-Integrated EFL Innovation Framework (AIEIF) as a conceptual model explaining how the implementation of Artificial Intelligence (AI) in English language education evolves through dynamic relationships among pedagogical, professional, organizational, and contextual dimensions. Unlike AI implementation frameworks that generally place technology at the center of innovation, the AIEIF adopts a human-centered approach, placing learners, teachers, and educational leaders as the primary actors of transformation, while AI serves as an enabling technology that strengthens human capacity to achieve learning goals. This model is built on the results of a thematic synthesis of twelve international articles so that each component represents a pattern of relationships that consistently emerges across various research contexts. Therefore, this diagram not only illustrates the results of the literature synthesis but also offers a conceptual framework that can be used as a basis for empirical research and policy development for AI implementation in English language education.

At the center of the diagram is the Human-Centered Learning and Growth component, which serves as the core of the entire model. The placement of this component demonstrates that the primary goal of AI implementation is not to increase the automation of learning but rather to develop human capacity by enhancing learner agency, teacher agency, well-being, inclusivity, and ethical responsibility in the use of technology. In other words, all AI innovations applied to English language learning must culminate in strengthening students' ability to learn independently, teachers' ability to make reflective pedagogical decisions, and institutions' ability to build equitable, inclusive, and sustainable learning environments. This perspective also emphasizes that AI is not a substitute for humans but rather an instrument that expands human capabilities in the learning process and educational management.

The first component, AI-Supported Student Learning, illustrates the pedagogical foundation of the AIEIF framework. Based on a synthesis of the studies by Heikkinen et al. (2025), Li et al. (2025), Ramendra et al. (2025), Shafiee Rad (2025), and Syatriana & Dzilarasy (2025), AI supports learning through personalized content, strengthened student engagement, enhanced self-regulated learning, contextual learning, and continuous reflection. The arrows from this component toward the center of the model indicate that all AI-based learning innovations are directed toward strengthening students' agency as active learners. Furthermore, the two-way relationship between student learning and the assessment component shows that the learning process generates data that forms the basis for providing feedback, while assessment results are used to refine student learning strategies. Thus, learning does not occur linearly but develops through a continuous cycle of reflection and improvement.

The second component, AI for Teacher Professional Development, demonstrates that learning transformation can occur only if teachers simultaneously undergo professional transformation. A synthesis of the studies by Mercer & Pawlak (2024), Arefian et al. (2026), Hajar & Manan (2026), and Li & Zeng (2024) shows that AI strengthens professional curiosity, encourages the formation of Communities of Practice, develops AI competencies, and reconstructs teacher identity. The two-way relationship between teachers and the center of the model indicates that increasing teacher capacity directly impacts the quality of student learning, while student learning experiences also serve as sources of professional reflection for teachers. This diagram emphasizes that teachers are no longer positioned as conveyors of information but as learning designers, facilitators, mentors, and pedagogical decision-makers who utilize AI critically and responsibly.

The third component, AI-Based Assessment Innovation, serves as a connecting mechanism between the learning process and the continuous improvement of learning quality. Based on the studies by Li et al. (2025), Syatriana & Dzilarasy (2025), and Hattie & Yates (2014), the integration of e-portfolios, AI-generated feedback, and the principles of Visible Learning demonstrates that assessment in the AI era is no longer limited to measuring learning outcomes but has become a feedback system that supports reflection, self-regulation, and competency improvement. The arrow connecting assessment to learning and teacher professional development illustrates a continuous feedback loop in which learning outcome data are used to refine learning strategies, improve teaching practices, and support more informed decision-making. Thus, assessment becomes a key mechanism for maintaining the continuity of AI-based learning innovation.

At the organizational level, AI Leadership and Educational Governance is positioned at the top of the diagram to demonstrate its strategic role in guiding the overall system. Based on the studies synthesized by Sposato (2025) and Zawacki-Richter et al. (2024), educational leadership is responsible for establishing a digital transformation vision, developing AI policies, managing educational data, ensuring implementation quality, and allocating the necessary resources. The position of this component demonstrates that leadership

does not operate in isolation from learning but rather provides institutional support for the entire innovation process. The arrows connecting leadership to learning, teacher professional development, and assessment demonstrate that strategic decisions must be based on information generated from learning practices, thereby establishing an evidence-based educational governance mechanism. Thus, AI leadership not only manages technology but also integrates educational data, policies, and practices into a mutually supportive system.

All of these core components are influenced by the fifth component, Contextual Challenges and Future Directions, which is visualized as a contextual frame surrounding the diagram. This position demonstrates that ethics, the digital divide, infrastructure, teacher readiness, policies, and cultural adaptation are not operational components but rather contextual factors that influence the entire AI implementation process. The dotted lines connecting this component to the entire system indicate that these challenges influence all dimensions, from classroom learning to institutional governance. Thus, the success of AI implementation is determined not only by the quality of the technology but also by the ability of institutions and stakeholders to manage various contextual factors in an integrated manner.

The rightmost section of the diagram presents Sustainable Outcomes for EFL Education as the final output of AIEIF implementation. These outcomes include improving the quality of inclusive learning, strengthening student and teacher agency, supporting data-driven decision-making, improving institutional quality, and establishing an English language education ecosystem that adapts to technological developments. The position of this component emphasizes that the goal of AI implementation is not simply to increase learning efficiency but to create sustainable educational transformation through the synergy among pedagogical innovation, professional development, assessment, leadership, and educational governance.

Overall, Figure 1 demonstrates that the AI-Integrated EFL Innovation Framework (AIEIF) is a holistic, systemic, dynamic, and contextual conceptual model. This model explains that the implementation of AI in English language education must be understood as an ecosystem consisting of components that interact through mechanisms of learning, reflection, feedback, leadership, and evidence-based decision-making. By integrating the five main themes resulting from the literature synthesis into a single conceptual framework, the AIEIF provides a theoretical contribution that broadens the understanding of AI implementation in English language education while also providing a conceptual foundation for future empirical research, curriculum development, and educational policy formulation, particularly in the context of EFL education in Indonesia.

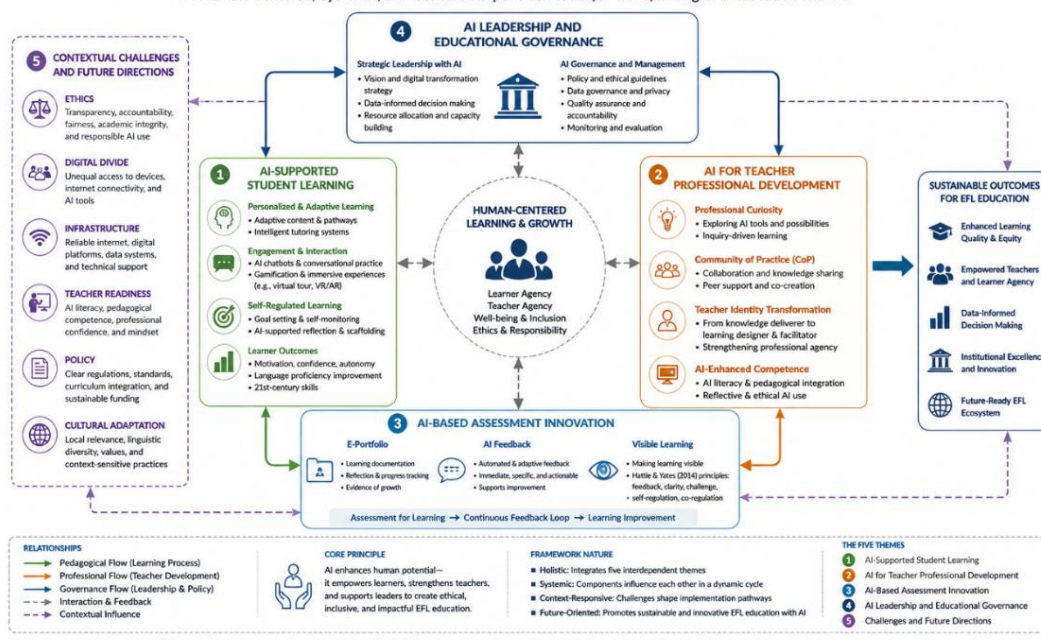


Figure 1. AI-Integrated EFL Innovation Framework (AIEIF): A Human-Centered, Systemic, and Context-Responsive Framework for Sustainable AI Integration in Indonesian EFL Education
 Source: Developed by the authors based on thematic synthesis of Heikkinen et al., (2025), Mercer & Pawlak, (2024), Li et al., (2025), B. Li & Zeng, (2024), Ramendra et al., (2025), Arefian et al., (2026); Hajar & Manan, (2026); Hattie, John; Yates, (2014); Shafiee Rad, (2025); Sposato, (2025); Syatriana & Dzilaray, (2025); Zawacki-Richter et al., (2024)

4. CONCLUSION

This study shows that the implementation of AI in EFL education is a systemic transformation that links student learning, teacher professional development, assessment innovation, educational leadership, and institutional governance into a single, mutually reinforcing ecosystem. The successful implementation of AI cannot be achieved through technology adoption alone; it requires pedagogical, institutional, and policy integration that supports the continuous improvement of educational quality.

The main contribution of this study is the development of the AI-Integrated EFL Innovation Framework (AIEIF), which integrates various dimensions of AI implementation into a single, comprehensive conceptual framework. This model expands the literature by demonstrating that AI should be understood as part of an educational ecosystem that connects adaptive learning, teacher development, data-driven assessment, transformational leadership, and responsible governance.

In practical terms, this study confirms that educational institutions need to prioritize strengthening AI literacy, professional development for teachers, innovation in authentic assessment, the formulation of institutional policies, and governance that ensures the ethical, transparent, and inclusive use of AI. This study is limited to a synthesis of twelve articles published between 2024 and 2025; therefore, the AIEIF model requires empirical validation across various educational levels and contexts. Future research is recommended to examine the relationships among the variables in the AIEIF model using quantitative, qualitative, or mixed-methods approaches so that this model can serve as a foundation for the development of more adaptive, humanistic, and sustainable EFL educational policies and practices.

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