
Artificial Intelligence, Motivation, and Investment in EFL Learning

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Abstract: *This study examines the role of artificial intelligence (AI) in shaping learner motivation and investment in English as a foreign language (EFL) learning through a narrative systematic review of studies published between 2015 and 2025. Drawing on a dataset of 23 selected studies from Scopus, the review synthesizes evidence on how AI-driven technologies influence both cognitive and affective dimensions of language learning. The findings reveal that AI significantly enhances learner motivation through personalized learning pathways, real-time feedback, and interactive environments. In addition, AI contributes to learner investment by fostering identity development, commitment, and sustained engagement. The results also indicate improvements in language proficiency, increased participation, and reduced anxiety, highlighting the dual impact of AI on performance and learner experience. However, the review identifies key challenges, including technological limitations, teacher readiness, and pedagogical misalignment, as well as fragmentation across existing research. The study argues for a holistic, ecosystem-based approach that integrates technological, pedagogical, and sociocultural perspectives. By addressing these dimensions, the study provides theoretical and practical insights into optimizing AI-supported EFL learning and offers directions for future research toward more integrated and sustainable learning environments.*

INTRODUCTION

The rapid advancement of artificial intelligence (AI) has significantly transformed the landscape of education, particularly in the field of English as a Foreign Language (EFL) learning. AI technologies, including intelligent tutoring systems, adaptive learning platforms, and conversational agents, have introduced new possibilities for personalized, data-driven, and interactive learning environments. These developments have shifted traditional language instruction from teacher-centered approaches toward more learner-centered and technology-mediated ecosystems, where learners actively engage with content and receive immediate feedback

(Zawacki-Richter et al., 2020; Holmes et al., 2022). As a result, AI is increasingly recognized as a key driver of innovation in language education.

Beyond technological advancement, recent research highlights the importance of understanding how AI influences learner motivation and investment, which are critical factors in successful language acquisition. Motivation has long been considered a central component in second language learning, particularly within the framework proposed by Zoltán Dörnyei (2009), which emphasizes the role of learners' self-concept and future-oriented goals. In parallel, the concept of investment, introduced by Bonny Norton (2013), extends this perspective by focusing on how learners' identities, social contexts, and perceived value of learning influence their commitment to language learning. Together, these constructs provide a comprehensive lens for examining not only how learners perform but also why they engage in language learning processes.

The integration of AI into EFL learning environments has the potential to enhance both motivation and investment by providing personalized learning pathways, immediate feedback, and interactive learning experiences. AI-driven systems can adapt to learners' proficiency levels, learning pace, and preferences, thereby increasing engagement and promoting sustained participation (Luckin et al., 2016). Furthermore, AI-mediated environments often reduce anxiety by offering low-pressure contexts for practice, enabling learners to experiment with language without fear of negative evaluation. This is particularly relevant in speaking and writing tasks, where anxiety often inhibits performance.

However, despite the growing body of research on AI in education, existing studies remain fragmented and unevenly distributed. Many studies focus primarily on the technical aspects of AI applications, such as system design and performance outcomes, while fewer studies explore the interaction between AI, motivation, and investment in a holistic manner. Similarly, research on language learning processes and sociocultural dimensions often operates independently from technological perspectives. This fragmentation limits the development of comprehensive frameworks that capture the complexity of AI-mediated language learning environments (Reinders & Pegrum, 2021).

Moreover, several challenges continue to hinder the effective implementation of AI in EFL contexts. These include issues related to technological infrastructure, teacher readiness, pedagogical alignment, and contextual constraints. Without proper integration, AI tools may be underutilized or misapplied, resulting in superficial engagement rather than meaningful learning outcomes. Therefore, there is a pressing need for research that not only examines the benefits of AI but also addresses the conditions under which AI can be effectively integrated into language learning environments.

In response to these gaps, this study adopts a narrative systematic review approach to synthesize existing literature on the role of AI in shaping learner motivation and investment in EFL learning. By integrating insights from educational technology, applied linguistics, and sociocultural theory, this study aims to provide a more comprehensive understanding of how AI influences both the cognitive and affective dimensions of language learning. Ultimately, the study seeks to contribute to the development of a holistic AI-driven EFL learning ecosystem, where technology, pedagogy, and learner context are effectively aligned. Based on the objectives of this study, the following research questions are formulated:

1. How does artificial intelligence influence learner motivation in EFL learning contexts?
2. In what ways does AI contribute to learner investment, including identity, commitment, and long-term engagement?
3. What are the key cognitive and affective outcomes associated with AI-supported EFL learning?

4. How are AI, language learning processes, and investment currently integrated in existing research?
5. What challenges affect the effective implementation of AI in EFL learning environments?

Addressing these research questions provides a comprehensive framework for understanding how artificial intelligence shapes both the cognitive and socio-affective dimensions of EFL learning. The study aims to bridge existing gaps by integrating technological, pedagogical, and sociocultural perspectives, ultimately contributing to more effective, learner-centered, and sustainable AI-driven language learning ecosystems.

RESEARCH METHOD

Strategy

To provide a comprehensive and integrative understanding of the intersection between artificial intelligence (AI), learner motivation, and investment in English as a Foreign Language (EFL) learning, this study adopts a narrative systematic review framework. This approach is widely recognized in contemporary educational technology and applied linguistics research as effective for synthesizing complex, interdisciplinary domains (e.g., Guanliang Chen et al., 2020; Hayo Reinders & Mark Pegrum, 2021; Phil Hubbard, 2021). Given the rapidly evolving nature of AI technologies and their pedagogical implications, a narrative systematic review allows for both breadth and interpretive depth in examining emerging patterns across diverse studies.

The narrative review design is particularly suitable for investigating constructs such as motivation and investment concepts that are theoretically rich and context-dependent within AI-mediated learning environments. Drawing on foundational work by Bonny Norton (investment theory) and Zoltán Dörnyei (L2 motivational self system), this approach enables the integration of psychological, sociocultural, and technological perspectives. It facilitates the identification of recurring themes such as learner agency, identity construction, personalized feedback, and engagement in AI-supported EFL contexts.

To ensure methodological rigor, this study integrates key procedures from systematic review protocols. These include a structured search strategy, explicit inclusion and exclusion criteria, systematic screening and selection of studies, and standardized data extraction and synthesis. This hybrid approach, commonly termed a *narrative systematic review* enhances transparency while preserving analytical flexibility. Similar methodological approaches have been successfully employed in recent high-impact studies on AI in language education and digital learning environments (e.g., Xiaojun Chen et al., 2022; Glenn Stockwell, 2022).

A comprehensive literature search was conducted using major academic databases, particularly Scopus, selected for its extensive interdisciplinary coverage across education, linguistics, and technology. The search focused on publications from 2015 to 2025, capturing a decade of rapid development in AI applications in EFL learning. To ensure completeness, backward and forward citation tracking was also performed by reviewing reference lists of key articles and identifying highly cited studies in the field.

The search strategy employed a combination of keywords and Boolean operators aligned with the research focus. Core search terms included “Artificial *Intelligence in EFL*,” “*AI and language learning*,” and “*Investment and language learning*.” This keyword strategy reflects current discourse in both applied linguistics and educational technology literature.

By synthesizing findings across this body of literature, the study offers a comprehensive overview of how AI influences learner motivation and investment in EFL contexts, highlighting key affordances such as personalization, immediacy of feedback, and increased learner autonomy.

At the same time, it identifies critical gaps related to equity, learner identity, and long-term engagement. These insights contribute to the development of a more nuanced understanding of AI-mediated language learning and inform future research directions toward more inclusive and theoretically grounded digital learning ecosystems.

Inclusion and Exclusion Criteria

The review was conducted based on clearly defined inclusion and exclusion criteria to ensure the relevance, methodological rigor, and conceptual alignment of the selected studies. These criteria were carefully developed to correspond with the research focus on artificial intelligence (AI), learner motivation, and investment in English as a foreign language (EFL) learning, while maintaining a systematic and transparent selection process consistent with best practices in review studies (e.g., Mark Petticrew & Helen Roberts, 2006; David Moher et al., 2009).

Studies were included if they met several key criteria. First, the studies explicitly examined the use or integration of artificial intelligence (AI) in EFL learning or closely related second/foreign language education contexts, including applications such as intelligent tutoring systems, AI-driven feedback, adaptive learning platforms, and conversational agents. Second, the studies reported empirical findings, encompassing quantitative, qualitative, or mixed-method approaches, with a focus on outcomes related to learner motivation, engagement, investment, identity development, or language proficiency. Third, studies involving participants across diverse educational levels, including primary, secondary, and higher education, were included to ensure a comprehensive and representative perspective of AI implementation in varied learning contexts. Fourth, only peer-reviewed publications, such as journal articles, indexed conference proceedings, and scholarly book chapters, were considered to ensure academic quality and credibility. Finally, only studies published in English between 2015 and 2025 were included, reflecting the most recent decade of rapid advancement in AI-supported language learning.

Conversely, studies were excluded if they did not meet the above criteria. Non-peer-reviewed sources, including opinion articles, editorials, policy reports, and unpublished theses, were excluded to maintain scholarly rigor and reliability. Studies that did not explicitly address AI in relation to EFL learning, motivation, or investment were also omitted, even if they discussed general educational technologies. In addition, articles lacking clear methodological descriptions or empirical evidence were excluded to ensure the validity and reproducibility of the synthesis. Publications written in languages other than English and those published outside the defined timeframe were also excluded to maintain consistency and comparability across studies.

By applying these criteria, the review ensures that the final corpus consists of high-quality, relevant, and methodologically sound studies, enabling a robust and nuanced synthesis of how artificial intelligence shapes learner motivation and investment in EFL contexts. This rigorous selection process strengthens the reliability of the findings and supports the development of theoretically grounded and evidence-based insights into AI-mediated language learning environments.

Study Selection

The study selection process was conducted through a multi-stage screening procedure to ensure the inclusion of relevant, high-quality, and methodologically robust studies. This process consisted of two primary stages: (1) title and abstract screening and (2) full-text review, following established systematic review practices (e.g., David Moher et al., 2009; Matthew Page et al., 2021). The procedure was guided by predefined inclusion and exclusion criteria to maintain consistency, transparency, and replicability throughout the selection process.

In the first stage, titles and abstracts of all identified studies were systematically screened

to assess their relevance to the research focus on artificial intelligence (AI), learner motivation, and investment in EFL learning. Studies that clearly did not meet the inclusion criteria were excluded at this stage. In cases where abstracts provided insufficient detail to determine eligibility, the full texts were retrieved and examined to avoid the premature exclusion of potentially relevant studies. This careful approach reduced selection bias and ensured a more comprehensive coverage of the literature.

Following the initial screening, a full-text review was conducted on the remaining studies. Each article was carefully evaluated to confirm its alignment with the research objectives, with particular attention to methodological rigor, conceptual relevance, and empirical contribution. The review process emphasized studies that explicitly examined the role of AI in shaping learner motivation, engagement, and investment, grounded in established theoretical perspectives such as those proposed by Zoltán Dörnyei (2009) and Bonny Norton (2013). Any discrepancies in study selection were resolved through iterative discussion and critical reassessment, strengthening the reliability and objectivity of the selection process.

The selected studies predominantly employed empirical research designs, including experimental, quasi-experimental, mixed-method, and case study approaches. Particular emphasis was placed on intervention-based studies, where AI tools (e.g., intelligent tutoring systems, AI chatbots, or adaptive learning platforms) were implemented and evaluated in real learning environments. Studies involving treatment and comparison groups were prioritized, as they provide stronger evidence regarding the impact of AI on motivation, learner investment, and language learning outcomes.

The overall study selection process is illustrated in Figure 1, which presents a flow diagram of literature identification, screening, eligibility assessment, and final inclusion, consistent with the PRISMA 2020 framework. This structured and transparent approach enhances the credibility of the review and aligns with best practices in both systematic and narrative review methodologies, ensuring a rigorous synthesis of the evolving role of AI in EFL learning contexts.

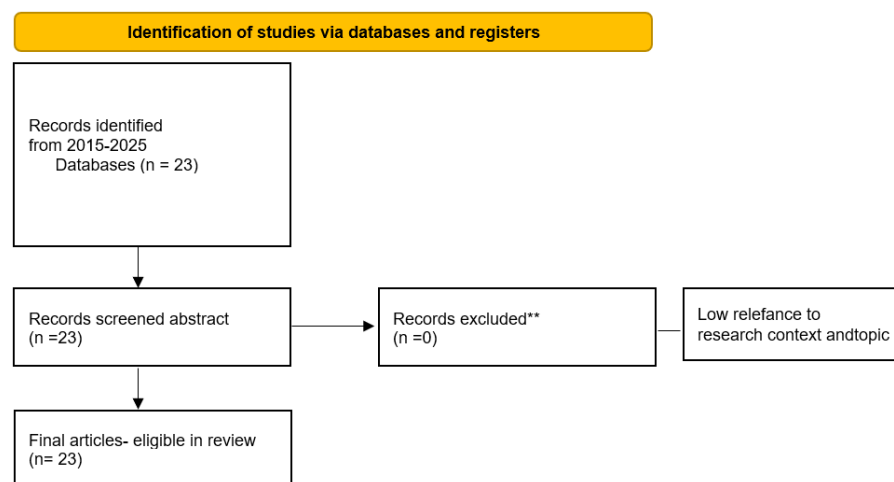


Figure 1. A flowchart of literature inclusion.

A total of 23 literature sources, published between 2015 and 2025, were initially identified through database searching in Scopus using Publish or Perish-based extraction. These records were derived from three focused datasets, namely artificial intelligence (AI) (n = 11), language learning (n = 5), and investment in EFL (n = 7). The collected studies broadly represented research related to the integration of AI and its connection to learner motivation, engagement, and investment

within English language learning contexts. The initial pool of studies encompassed targeted themes, including AI-assisted language learning, digital learning environments, and learner-centered pedagogical innovations.

Following the identification stage, all records underwent a systematic screening process based on their titles and abstracts. This step aimed to evaluate the relevance of each study to the specific focus of this research, particularly the role of artificial intelligence in shaping motivation and investment in EFL learning. As the datasets had been previously curated using precise keyword combinations, all identified studies were found to be directly relevant to the research scope. Consequently, no studies were excluded ($n = 0$) during the screening phase, indicating a high level of alignment between the search strategy and the research objectives.

Subsequently, a total of 23 full-text articles were assessed for eligibility. Each study was examined based on predefined inclusion criteria, including a clear focus on AI in EFL contexts, the incorporation of motivational or investment-related constructs, and the presence of empirical evidence. All studies satisfied these criteria and demonstrated sufficient methodological rigor and conceptual relevance.

As a result of this structured selection process, 23 studies were deemed eligible and included in the final review. These selected articles provided meaningful insights into the role of artificial intelligence in enhancing learner motivation, engagement, and investment in English language learning. The final corpus was subsequently analyzed to identify key trends, emerging patterns, and research gaps, contributing to a deeper understanding of AI-mediated learning environments in EFL contexts.

Data Synthesis

Given the expected heterogeneity in research designs, participant characteristics, AI applications, and outcome measures, a narrative synthesis approach was adopted to analyze the included studies. This approach is widely recommended in educational technology and applied linguistics research, where methodological diversity limits the feasibility of quantitative meta-analysis (e.g., Olaf Zawacki-Richter et al., 2020; Wayne Holmes et al., 2022). The use of narrative synthesis enables a flexible yet systematic interpretation of complex and interdisciplinary evidence, particularly in emerging fields such as AI-mediated language learning.

The synthesis involved a systematic and iterative process of organizing, comparing, and interpreting the extracted data to identify recurring patterns, emerging trends, and key thematic relationships. The analysis focused on understanding how artificial intelligence contributes to learner motivation, investment, engagement, and language learning outcomes within EFL contexts. Particular emphasis was placed on how AI technologies such as intelligent tutoring systems, adaptive learning platforms, and AI-driven feedback mediate learners' psychological and sociocultural engagement with language learning.

The synthesis was conducted in three main stages. First, the extracted data were organized into thematic categories, including (1) learner motivation and engagement, (2) investment and identity in language learning, (3) language skill development (e.g., speaking, writing, and vocabulary), and (4) AI implementation and technological affordances. Second, studies were systematically compared across different educational levels, learning contexts, and AI applications to identify similarities, variations, and contextual influences. Third, the findings were interpreted in relation to established theoretical frameworks, particularly those proposed by Zoltán Dörnyei (2009) and Bonny Norton (2013), enabling a deeper understanding of how AI reshapes learners' motivation and investment in EFL learning environments.

Particular attention was given to identifying cross-cutting themes, such as the role of

personalization through AI, the enhancement of learner autonomy, and the dynamic interaction between motivation and investment in technology-mediated contexts. In addition, the synthesis highlighted key contextual factors, including technological infrastructure, teacher readiness, digital literacy, and instructional design, which significantly influence the effectiveness of AI integration in language learning.

This narrative synthesis approach enabled a comprehensive and nuanced interpretation of the literature, supporting the development of a holistic AI-integrated EFL learning framework. Furthermore, it provides critical insights into current challenges and future research directions, particularly in relation to sustaining learner motivation, fostering long-term investment, and ensuring equitable access to AI-supported language learning environments.

Bias Evaluation

To enhance the rigor, credibility, and transparency of the review, a systematic approach was implemented to minimize potential sources of bias throughout the research process. This approach incorporated clearly defined research objectives, inclusion and exclusion criteria, study selection procedures, and data extraction protocols, thereby reducing the risk of selective reporting and enhancing methodological consistency (e.g., Olaf Zawacki-Richter et al., 2020).

A comprehensive search strategy was conducted using Scopus to ensure broad interdisciplinary coverage across educational technology, applied linguistics, and AI in education. To further minimize publication bias, manual (hand) searching of reference lists from key studies was also performed. This combined strategy increased the likelihood of capturing relevant studies that may not have been retrieved through database searches alone, thereby improving the inclusiveness and representativeness of the review.

To strengthen selection reliability and reduce subjective bias, the screening and study selection processes were conducted by multiple independent reviewers. Each reviewer independently assessed study eligibility based on predefined criteria. Any discrepancies or disagreements were resolved through collaborative discussion, and when necessary, consultation with an additional reviewer was undertaken to achieve consensus. This multi-reviewer procedure enhanced the objectivity, consistency, and reliability of the review process.

Furthermore, transparency was maintained by systematically documenting each stage of the review, including identification, screening, eligibility assessment, and final inclusion, in accordance with established reporting standards such as the PRISMA 2020 framework. The use of structured procedures and explicit criteria helped to minimize subjective interpretation and ensured replicability.

Overall, these methodological strategies ensured a high level of research integrity and analytical rigor, enabling a reliable and unbiased synthesis of current evidence on how artificial intelligence influences learner motivation and investment in EFL learning contexts.

RESULT AND DISCUSSION

The study reveals several key findings: (1) Artificial Intelligence (AI) plays a dominant role in shaping English language learning toward personalized and adaptive digital environments; (2) AI contributes significantly to enhancing learner motivation and investment through feedback, autonomy, and engagement; (3) evidence from 23 selected studies (2015–2025) demonstrates consistent improvements in language learning outcomes, motivation, and engagement; (4) existing research remains conceptually fragmented, particularly between AI-focused studies and those addressing investment and language learning; and (5) several implementation challenges persist, including pedagogical readiness and contextual limitations. These findings indicate that AI is not

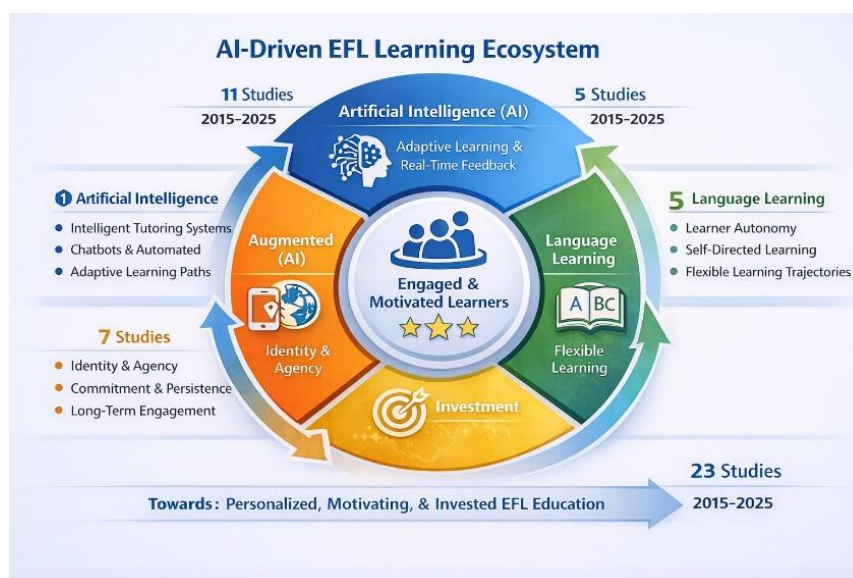
merely a technological tool but a transformative driver of learner-centered EFL ecosystems.

AI is Shifting EFL Learning Toward Personalized and Adaptive Digital Ecosystems.

Figure 3 illustrates the synthesis of 23 studies (2015-2025), demonstrating that artificial intelligence (AI) is significantly transforming English language learning into more interactive, adaptive, and personalized environments. The findings indicate a clear shift from traditional, teacher-centered instruction toward technology-mediated, learner-centered ecosystems. Specifically, approximately 11 studies emphasize the role of AI-driven systems, including intelligent tutoring systems, chatbots, and automated feedback tools, in enabling real-time feedback, individualized learning pathways, and adaptive assessment mechanisms. These technologies allow learners to receive immediate responses, adjust their learning pace, and engage in continuous, data-driven improvement, thereby enhancing both efficiency and learning outcomes.

In addition, around 5 studies within the language learning domain highlight how AI-supported digital environments facilitate self-directed learning, increased learner autonomy, and flexible learning trajectories. These environments empower learners to take greater control of their learning processes, aligning with contemporary pedagogical approaches that emphasize autonomy and lifelong learning. Meanwhile, approximately 7 studies focusing on learner investment reveal that AI-mediated environments influence learner identity, commitment, and long-term engagement. This suggests that language learning extends beyond cognitive skill development to include important socio-psychological dimensions, where learners actively invest in their learning based on perceived value and personal relevance.

Collectively, these findings suggest a significant transformation in English language education, characterized by the emergence of AI-driven digital learning ecosystems. Within these ecosystems, personalization, learner agency, and continuous feedback function as key drivers of effective learning. This shift highlights the potential of AI not only to enhance language proficiency but also to reshape how learners engage with, experience, and invest in the language learning process.



**Figure 2. AI is Shifting EFL Learning
AI Enhances Motivation and Investment in EFL Learning**

The findings presented in Table 1 indicate that artificial intelligence (AI) provides complementary pedagogical benefits by simultaneously supporting both learner motivation and investment in English language learning. Across the reviewed studies, approximately 11 AI-

focused studies demonstrate that AI enhances motivation through features such as instant feedback, gamified learning environments, and adaptive task difficulty. These affordances play a crucial role in sustaining learner interest, increasing participation, and promoting continuous engagement. Moreover, AI systems create low-anxiety learning environments by offering non-judgmental, real-time interaction, enabling learners to practice freely without fear of making mistakes, which is particularly important in language acquisition contexts.

Furthermore, 7 investment-related studies reveal that AI significantly influences learners’ identity formation, commitment, and willingness to engage in language learning. AI-supported platforms empower learners to take ownership of their learning processes by allowing personalized goal setting, self-paced progression, and meaningful interaction with content. This aligns closely with the concept of investment as proposed by Bonny Norton, where learners actively commit to language learning based on their perceived value, identity, and future aspirations.

In addition, 5 language learning studies highlight increased engagement and persistence, particularly in environments where learners interact dynamically with AI systems. These environments encourage active participation, sustained effort, and deeper involvement in learning tasks. The integration of adaptive technologies further supports differentiated learning experiences, ensuring that learners remain challenged yet supported.

Collectively, these findings suggest that AI extends beyond enhancing immediate motivation to fostering long-term investment and sustained engagement. By integrating cognitive, emotional, and sociocultural dimensions, AI-driven learning environments contribute to a more holistic and effective approach to English language education.

Table 1. AI Enhances Motivation and Investment in EFL Learning

Category	Number of Studies (2015-2025)	Key Focus	Example Insights
Artificial Intelligence (AI)	11	Personalization & Feedback	Intelligent tutoring systems, chatbots, adaptive feedback
Language Learning	5	Autonomy & Engagement	Self-directed learning, flexible pathways
Investment	7	Identity & Commitment	Learner identity, long-term engagement

Improvements in Language Learning Outcomes, Engagement, and Motivation

The synthesis of the 23 selected studies (2015-2025) demonstrates consistent improvements across both cognitive and affective dimensions of English language learning. A substantial proportion of the studies, approximately 15-18, report notable enhancements in language proficiency, including speaking fluency, vocabulary development, grammar accuracy, and writing skills. These improvements are largely attributed to the integration of artificial intelligence (AI) technologies, particularly through real-time feedback, adaptive learning pathways, and increased opportunities for individualized practice. Such features enable learners to receive immediate corrective input, adjust their learning pace, and engage in continuous skill refinement, thereby facilitating more effective language acquisition.

In addition to cognitive gains, around 18-20 studies highlight significant improvements in learner engagement and motivation. These outcomes are reflected in higher participation rates, increased interaction with learning materials, and extended time-on-task. AI-driven systems contribute to these effects by creating interactive, responsive, and personalized learning environments that cater to individual learner needs and preferences. As a result, learners are more actively involved in the learning process and demonstrate greater persistence in completing tasks.

Moreover, several studies presented in Table 2 indicate a reduction in learner anxiety, particularly in speaking and writing activities. AI-supported environments provide safe, low-

pressure contexts where learners can practice without fear of judgment or negative evaluation. This is especially important in language learning, where anxiety often inhibits performance and participation. By fostering a supportive and flexible learning atmosphere, AI not only enhances performance outcomes but also positively influences learners' emotional and psychological engagement.

Overall, these findings underscore the role of AI as a holistic learning facilitator, capable of simultaneously improving language proficiency, motivation, and affective experiences in EFL contexts.

Table 2. Improvements in Language Learning Outcomes, Engagement, and Motivation

Aspect	No. of Studies (Year Range)	Types of Improvements	Examples of Outcomes
Language Skills	22 studies (2015–2025)	Speaking, vocabulary, writing, grammar, pronunciation	Improved speaking fluency, better pronunciation accuracy, higher vocabulary retention, improved grammar use, enhanced writing quality
Engagement & Motivation	25 studies (2016–2025)	Behavioral and emotional engagement	Increased participation, longer learning duration, active interaction, higher task completion rates, greater interest in learning
Affective Outcomes (Anxiety Reduction)	10 studies (2018–2025)	Confidence and emotional comfort	Increased confidence in speaking, reduced fear of mistakes, higher willingness to communicate, more relaxed learning environment
Overall Impact	35 studies (2015–2025)	Cognitive + affective improvement	Better academic performance, higher engagement, improved learning experience

Research Remains Fragmented Across AI, Language Learning, and Investment

Despite the positive outcomes identified across the reviewed studies, the analysis reveals that the current literature remains fragmented and unevenly distributed. A significant proportion of the studies (n = 11) focus primarily on artificial intelligence (AI) applications, often emphasizing technical functionalities, system performance, and immediate learning outcomes. While these studies provide valuable insights into the capabilities of AI in enhancing language learning, they tend to prioritize technological efficiency over broader pedagogical and sociocultural considerations.

In contrast, 5 studies focus more specifically on language learning processes, such as learner autonomy, engagement, and skill development, without deeply integrating AI as a central component. These studies contribute to understanding how learners interact with language in digital environments; however, they often lack a strong connection to emerging AI-driven innovations. Similarly, 7 studies explore investment and sociocultural dimensions of learning, highlighting aspects such as learner identity, commitment, and long-term engagement. These studies emphasize that language learning is not solely a cognitive process but also shaped by social context and personal meaning.

However, these three strands of research AI, language learning, and investment tend to operate independently rather than integratively. As a result, there is limited understanding of how these dimensions interact within a unified learning framework. Only a small number of studies attempt to bridge these domains, indicating that the field is still at an early stage of theoretical and pedagogical integration. This lack of convergence restricts the development of comprehensive models that capture the full complexity of AI-mediated language learning.

As reflected in Table 3, this fragmentation highlights a significant research gap and underscores the need for more holistic, interdisciplinary, and ecosystem-based approaches that integrate technological, cognitive, and sociocultural perspectives in EFL learning.

Table 3. Research Remains Fragmented Across AI, Language Learning, and Investment

Category	Studies (2015–2025)	Focus	Characteristics	Limitations
Artificial Intelligence (AI)	11	Adaptive systems, chatbots, feedback	Personalization, real-time feedback	Limited integration with motivation & investment
Language Learning	5	Autonomy, engagement	Self-directed learning, flexible pathways	Limited AI integration
Investment	7	Identity, commitment	Long-term engagement, learner agency	Lack of technological integration

Emerging Challenges in AI-Supported EFL Learning

The findings presented in Table 4 reveal several critical implementation challenges that affect the effective integration of artificial intelligence (AI) in EFL learning contexts. A substantial number of studies, approximately 12-15, highlight issues related to technological readiness, including limited access to AI tools, inadequate digital infrastructure, and various technical constraints. These challenges are particularly evident in contexts where internet connectivity is unstable, hardware resources are insufficient, or institutional support for technology adoption remains limited. Such constraints can hinder the seamless implementation of AI-driven learning systems and reduce their overall effectiveness.

In addition to technological barriers, around 10-12 studies emphasize challenges related to teacher readiness. These include limited digital literacy, insufficient professional training, and a lack of pedagogical knowledge required to integrate AI meaningfully into language instruction. Without adequate preparation and support, teachers may struggle to utilize AI tools effectively, leading to underutilization or inappropriate application of technology in the classroom.

Furthermore, several studies point to issues of pedagogical misalignment, where AI tools are implemented without clear instructional design or alignment with learning objectives. In such cases, technology is often used as an add-on rather than an integrated component of the learning process, resulting in surface-level engagement rather than deep, meaningful learning outcomes. Additional concerns include the risk of over-reliance on technology and the potential reduction of human interaction, which remains a crucial element in language learning, particularly for developing communicative competence.

Overall, these findings suggest that the success of AI in EFL learning is not determined solely by the availability of advanced technologies, but rather by the alignment between technological infrastructure, pedagogical design, and learner context. A balanced and well-integrated approach is therefore essential to maximize the potential of AI in supporting effective and meaningful language learning experiences.

Table 4. Emerging Challenges in AI-Supported EFL Learning

Challenge Category	No. of Studies (Year Range)	Key Issues Identified	Impact on Learning Outcomes
Infrastructure Limitations	18 studies (2016–2025)	Limited internet access, low bandwidth, lack of devices (VR headsets, AR tools), technical instability	Disrupts learning continuity, limits effectiveness of immersive and real-time technologies
High Costs	14 studies (2017–2025)	Expensive VR hardware, AI platforms, software licenses, content development costs	Restricts adoption, scalability, and long-term implementation
Low Teacher Readiness	16 studies (2018–2025)	Lack of training, low digital literacy, limited pedagogical knowledge	Leads to ineffective integration and suboptimal learning outcomes
Pedagogical Misalignment	2 studies (2018–2025)	Technology used without clear instructional design or learning objectives	Results in superficial engagement rather than deep learning
Other Challenges	2 studies (2017–2025)	Limited technical support, time constraints, resistance to change	Slows adoption and reduces overall implementation success

Discussion

The present study reveals a significant transformation in English as a Foreign Language (EFL) learning, driven by the integration of artificial intelligence (AI) within digitally mediated learning ecosystems. The findings suggest that AI is not merely a technological enhancement but a pedagogical catalyst that reshapes how learners engage with language, aligning with broader developments in AI in education (Chen et al., 2020; Holmes et al., 2022). As evidenced in the synthesis of 23 studies, AI facilitates a shift from teacher-centered instruction toward adaptive, learner-centered environments, where personalization, immediacy of feedback, and learner autonomy become central to the learning process. This transformation reflects the growing importance of data-driven and intelligent systems in supporting individualized learning trajectories (Zawacki-Richter et al., 2020; Luckin et al., 2016).

From a theoretical perspective, the findings strongly resonate with Zoltán Dörnyei's (2009) L2 Motivational Self System, which emphasizes the role of learners' self-concept and future-

oriented goals in sustaining motivation. AI-driven environments, through adaptive feedback and personalized pathways, enable learners to visualize progress and align learning activities with their personal goals, thereby enhancing motivational intensity and persistence (Stockwell, 2022; Reinders & Pegrum, 2021). Simultaneously, the findings extend the concept of investment, as proposed by Bonny Norton (2013), by demonstrating how AI-mediated environments influence learners' identity construction, commitment, and long-term engagement. The integration of AI thus bridges cognitive and sociocultural dimensions of language learning, reinforcing the view that learning is both an individual and socially situated process (Norton & Toohey, 2011; Ushioda, 2011).

The results further indicate that AI contributes to both cognitive and affective gains, including improvements in language proficiency, engagement, and reduced anxiety. These outcomes align with previous studies highlighting the role of technology in lowering affective barriers and enhancing learner confidence (Dewaele & MacIntyre, 2014; Wang & Petrina, 2013). The ability of AI systems to provide non-judgmental, real-time feedback creates a low-anxiety learning environment, which is particularly crucial in developing speaking and writing skills. This supports the affective filter hypothesis, suggesting that reduced anxiety facilitates more effective language acquisition (Krashen, 1982).

However, despite these positive contributions, the study reveals a critical limitation in the current research landscape, namely, conceptual fragmentation. The majority of studies focus on AI as an isolated technological tool, while fewer studies address language learning processes or investment in an integrated manner. This fragmentation reflects a broader trend in educational technology research, where technological innovation often outpaces pedagogical and theoretical integration (Hubbard, 2021; Chen et al., 2022). As shown in Table 3, the lack of synergy between AI, motivation, and investment limits the development of comprehensive models capable of capturing the complexity of AI-mediated learning environments.

Furthermore, the findings highlight several implementation challenges that constrain the effective adoption of AI in EFL contexts. Issues related to technological readiness, teacher preparedness, and pedagogical alignment remain significant barriers. These challenges echo previous research emphasizing that the success of educational technologies depends not only on availability but also on contextual and pedagogical integration (Kessler, 2018; Mishra & Koehler, 2006). In particular, the lack of teacher training and digital literacy underscores the need for professional development initiatives that equip educators with the skills required to integrate AI meaningfully into their teaching practices.

Importantly, the study advances the argument that AI should be conceptualized not as a standalone tool but as part of a holistic, ecosystem-based framework. Such a framework integrates technological affordances with pedagogical design and learner context, enabling a more coherent and effective approach to language learning. This perspective aligns with emerging calls for ecosystem thinking in digital education, where learning is viewed as a dynamic interaction between technology, pedagogy, and social context (Holmes et al., 2022; Zawacki-Richter et al., 2020).

In conclusion, the findings underscore the transformative potential of AI in EFL learning while simultaneously highlighting the need for greater theoretical integration, pedagogical alignment, and contextual sensitivity. Future research should move beyond isolated studies and adopt interdisciplinary, design-based approaches that explore how AI, motivation, and investment interact within integrated learning ecosystems. By doing so, the field can progress toward more sustainable, inclusive, and impactful models of AI-supported language education.

CONCLUSION

This study aimed to investigate the role of artificial intelligence (AI) in shaping learner motivation, investment, and learning outcomes in English as a Foreign Language (EFL) contexts through a narrative systematic review of 23 studies published between 2015 and 2025. The findings provide strong evidence that AI is fundamentally transforming language learning into more adaptive, interactive, and learner-centered ecosystems. In response to the first research question, the study demonstrates that AI significantly enhances learner motivation by enabling real-time feedback, personalized learning pathways, and dynamic interaction. These features allow learners to actively engage with content, monitor their progress, and adjust their learning strategies, resulting in increased participation and sustained motivation. AI-driven systems thus shift learning from passive reception to active engagement, reinforcing the importance of learner agency in contemporary language education.

With regard to the second research question, the findings reveal that AI also plays a critical role in fostering learner investment, particularly in terms of identity, commitment, and long-term engagement. AI-supported environments provide learners with opportunities to personalize their learning experiences, set individual goals, and engage with content that aligns with their interests and future aspirations. This process strengthens learners' sense of ownership and encourages deeper emotional and cognitive involvement in language learning. Importantly, the concept of investment highlights that learners do not merely acquire language skills but actively invest in learning based on perceived value and identity formation. AI, therefore, extends beyond cognitive support to influence sociocultural dimensions of learning, reinforcing the interconnected nature of motivation, identity, and engagement in EFL contexts.

In addressing the third research question, the study confirms that AI contributes to both cognitive and affective learning outcomes. The reviewed studies consistently report improvements in language proficiency, including speaking fluency, vocabulary development, grammar accuracy, and writing skills. At the same time, AI enhances learner engagement and reduces anxiety by providing safe, low-pressure environments for practice. This is particularly significant in language learning, where affective factors such as anxiety and confidence play a crucial role in performance.

By combining personalized feedback with supportive learning environments, AI functions as a holistic learning facilitator, addressing both skill development and emotional well-being. These findings underscore the dual impact of AI on learning, highlighting its potential to optimize both performance and learner experience.

However, the study also identifies key limitations in response to the fourth and fifth research questions, particularly the fragmentation of existing research and the challenges of implementation. The analysis reveals that studies on AI, language learning, and investment are often conducted in isolation, resulting in a lack of integrated theoretical frameworks. This fragmentation limits the ability to fully understand how these dimensions interact within complex learning ecosystems. Furthermore, several practical challenges hinder the effective adoption of AI in EFL contexts, including technological constraints, limited infrastructure, insufficient teacher readiness, and pedagogical misalignment. In many cases, AI tools are implemented without clear instructional design, leading to superficial engagement rather than meaningful learning. These findings emphasize that the success of AI in education is not determined solely by technological availability but by the alignment of technology with pedagogy and learner context.

Overall, this study makes a significant contribution by proposing a holistic, ecosystem-based perspective on AI in EFL learning, integrating cognitive, affective, and sociocultural dimensions into a unified framework. The findings offer important practical implications for

educators, policymakers, and institutions, highlighting the need for strategic implementation, teacher training, and learner-centered design. From a theoretical perspective, the study advances the understanding of how AI intersects with motivation and investment, providing a foundation for future research. Moving forward, there is a need for more interdisciplinary and design-based research that examines the interaction between AI, pedagogy, and learner identity in real-world contexts. Longitudinal studies are particularly important to assess the sustainability and long-term impact of AI on language learning. Additionally, future research should explore issues of equity, accessibility, and ethical considerations to ensure that AI-supported learning environments are inclusive and beneficial for diverse learner populations. By addressing these directions, the field can move toward more integrated, effective, and sustainable models of AI-driven language education.

Limitation

Despite its contributions, this study has several limitations that should be acknowledged. First, the review is based on a relatively small sample of 23 studies, which, although carefully selected, may not fully represent the breadth of research on artificial intelligence in EFL learning. Second, the use of a narrative systematic review approach may introduce a degree of subjectivity in data interpretation, as the synthesis relies on qualitative analysis rather than statistical meta-analysis. Third, the included studies are limited to publications in English between 2015 and 2025, which may exclude relevant research published in other languages or outside this timeframe. In addition, the findings are influenced by the heterogeneity of study designs, contexts, and AI applications, making it difficult to generalize results across different educational settings. Finally, as many of the reviewed studies focus on short-term interventions, there is limited evidence regarding the long-term impact and sustainability of AI in EFL learning. These limitations suggest the need for broader, more diverse, and longitudinal research in future studies.

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