Pertanika J. Sci. & Technol. 33 (5): 2125 - 2153 (2025)

PERTANIKA JOURNALS

SCIENCE & TECHNOLOGY

Journal homepage: http://www.pertanika.upm.edu.my/

Review Article

A Systematic Review of AI-Integrated Tools in ESL/EFL Education

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ABSTRACT

Artificial intelligence (AI) tools have demonstrated sophisticated capabilities, offering immediate support in various fields, including English as a Second Language/English as a Foreign Language (ESL/EFL) education. Delivering immediate support, the AI tools promptly answer queries and provide helpful explanations in various fields. EFL/ESL educators still have varied sentiments about the AI's noteworthy capacities and impressive skills in accomplishing different tasks in the second language teaching domain. The twofold purpose of this review is to identify recent publications pertinent to the AI integration in ESL education, with a focus on methodology, commonly used AI applications, pedagogical approaches, and sampling strategies. Secondly, it aims to understand the most frequently used keywords and countries with the highest number of publications. In conducting the exploration, guidelines based on Shaffril et al. (2021) were followed, including the seven steps: review protocol, formulation of research question, systematic searching strategies, quality appraisal, data extraction, data synthesis, and data demonstration. The review involved 921 articles from the Scopus, Web of Science (WoS), and ScienceDirect databases, from which 25 articles were selected for comprehensive analysis based on relevance, following systematic review protocols. The selection criteria included pertinent keywords, field of study, and an emphasis on the studies that focused on the AI-integration in the ESL/EFL education. Finally, the review synthesised the

ARTICLE INFO

Article history:
Received: 17 May 2024
Accepted: 17 April 2025
Published: 28 August 2025

DOI: https://doi.org/10.47836/pjst.33.5.05

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e-ISSN: 2231-8526

findings of 25 articles. The results revealed that the recent studies have integrated the AI-applications in the ESL/EFL contexts, which predominantly emphasised a varied range of AI-based applications. Particularly, ChatGPT and Wordtune are listed as the key sources for language augmentation. The research studies focused on the pedagogical implications for ESL students and teachers to enhance language teaching and learning practices. The AI tools enhance the ESL/EFL education by improving writing skills through real-time grammar feedback, personalised content suggestions, and automated assessments, fostering learner autonomy, and engagement. The results showed the most frequently used keywords and countries with more publications. Despite being confined to the most recent literature available, this review highlights gaps in the AI-driven ESL education, offering valuable insights for future research on the AI's pedagogical applications.

Keywords: AI integration, AI-tools, ESL/EFL, learning, systematic review, teaching

INTRODUCTION

AI encompasses the ability to perform tasks traditionally associated with human intellect (Britannica, 2025; Oxford University Press, n.d.). The AI is currently reshaping and leading institutions and workplaces towards transformation (Liang et al., 2021). This transformative process is also evident in ESL/EFL education. Barrot (2023) emphasises that language learners can improve their writing skills and text editing by integrating the AI-based tools. By using tools like ChatGPT, students can improve their grammar, sentence structures, and overall clarity in their writing (Zhang & Aslan, 2021). Learners can also review their work and decide to accept or reject the modifications made by ChatGPT. While the tool poses challenges to traditional writing, it concurrently fosters new possibilities and methods for teaching and learning writing skills. By recognising the constraints of the AI tools, educators can stimulate learners' creative thinking, guiding them to perceive writing as both an intellectual pursuit and a means of personal development. In addition to these tools, current research has focussed on the influence of the AI writing assistants, with a particular emphasis on teaching English as a foreign language (TEFL) domain, notably, studies including Kurniati and Fithriani (2022), Wang et al. (2022), and Zhao (2022), propose that the AI-integrated applications can play a crucial role in advancing students' writing abilities. Despite the constraints of the AI-driven tools, they allow learners to engage in creative thinking (Liu et al., 2022; Lund et al., 2023; Qadir, 2022). The prevailing literature narrowly encompasses the entire function of the AI tools in augmenting writing skills, including grammar and syntax. Thus, it becomes imperative to discover the classification of the AI applications and their specific approaches in addressing the AI applications in the EFL/ESL context.

Broadly, AI plays a significant role in enhancing learning contexts based on the individual needs of students (H. Gao, 2021). It helps the students engage in autonomous learning (Liang et al., 2021). It allows the learners to manage self-paced learning

conveniently, providing flexibility, instant feedback, and assistance with minimal teacher involvement (Keerthiwansha, 2018). The AI creates a relaxed learning atmosphere for the learners to engage in conversation with machines, providing opportunities for repetitive tasks and language drills. For instance, conversational Chatbots or virtual role-playing platforms offer the learners a relaxed environment to practice real-life interactions, thereby facilitating greater language fluency (N.-Y. Kim, 2019). Educators benefit from the AI-based tools and systems for the development of an intelligent and up-to-date learning and teaching system (Li & Du, 2017). Thus, this systematic review aims to fill the gap by exploring the comprehensive role of the AI applications in the ESL/EFL education, with a focus on their pedagogical and methodological implications.

LITERATURE REVIEW

Current technological breakthroughs, particularly in the field of artificial intelligence, spotlight their impact on everyday life and education. The surge in research on the integration of AI in ESL education is evident. Both ChatGPT and Wordtune have emerged as essential tools in the ESL/EFL contexts, enhancing writing skills by providing automated feedback on grammar, syntax, and style. This integration helps learners build accuracy and fluency in their writing (Kirmani, 2022; Zhao, 2023). These researchers predominantly explore the AI tools or the AI-based applications that utilise specific particular AI methods or classifications (Pikhart, 2020). Recent research (Chen et al., 2023; Moussalli & Cardos, 2020) reveal that language learners have a positive reception towards the integration of the AI technologies in language learning. The AI's ability to deliver instant responses and introduce flexibility and ease into teaching and learning environments is highlighted. Utilising the AI empowers the learners to be involved in an independent and feasible learning experience (Srinivasan, 2022). Concerning language skills, the focus in the AI-based computer-assisted learning (CAL) revolves around writing (Liang et al., 2021). Sharadgah and Sa'di (2022), in their overview of studies on AI in English Language Teaching (ELT) education from 2015 to 2021, shed light on existing gaps. These gaps include inherent challenges associated with body language, gestures, emotions, expressions, and translation. Additionally, the review underscored the dearth of descriptions of teaching resources utilised in the AI-based learning and teaching, as well as uncertainties surrounding the scope of what falls within the domain of the AI. Hence, there is a compelling need for more in-depth investigations across various AI teaching tools (Y. Gao et al., 2021), and considerable research progress still needs to be made. Furthermore, concerns have been raised regarding the readiness of English language teachers to incorporate the AI tools into the teaching process (Kessler, 2021). Therefore, there is a strong need for more research related to the AI integration in various teaching and learning contexts. Ethical concerns also arise regarding privacy and over-reliance on the AI tools. Additionally, there is a risk that over-dependence on the AI

tools may reduce students' active engagement in the learning process (J. Kim et al., 2020; Kessler, 2021; Kirmani, 2022).

While ongoing reports on the AI teaching tools and expression recognition are underway, more studies are needed to bridge the substantial gaps in the field. Moreover, issues regarding ethical considerations in the AI research pertinent to teachers and learners are also being discussed (J. Kim et al., 2020). Further inquiry and training should address the impending challenges and obstacles, including the pedagogical focus and practical growth of the AI applications in advancing language education and their effective utilisation (Jin & Zhuo, 2025). One of the most debatable topics today regarding AI is ChatGPT and its features for writing essays, poems, stories, and letters (Dergaa et al., 2023). Studies aim to identify and discuss the potential benefits of ChatGPT in the field of ESL education, particularly in writing skills. Since its launch in November 2022, ChatGPT has achieved significant success and become one of the most renowned AI tools. The Generative Pre-trained Transformer (GPT) has ushered in a paradigm shift, transforming conventional learning and teaching methodologies for writing (Kirmani, 2022). In a broad context, the AI writing tools analyse written text and provide instant feedback on everything from grammar to the overall structure (Hosseini et al., 2023). Within a concise two-month timeframe, OpenAI's technologies have reached a significant milestone by exceeding 100 million users (Williams, 2023). The AI writing assistant ChatGPT has effectively modernised conventional teaching and learning processes and enhanced writing abilities. Kirmani's analysis (2022) highlights ChatGPT as an advanced language model technology.

The AI plays a pivotal role in the implementation of adapted teaching and learning, as highlighted by Z. Huang et al. (2021). The AI-based applications can create personalised situational learning, allowing these systems to offer tailored teaching and learning activities, analyse students' development, and automatically adjust instructions as needed. Based on the big data, the AI can comprehensively record the learners' data and provide data presentation support to teachers, enabling them to adapt their teaching pedagogies accordingly (X. Yang, 2020). Past studies in the field of Natural Language Processing (NLP) have taken varied approaches, including Esit (2011)'s research related to delivering feedback to learners. This research imparts insights to researchers and teachers on how textual aspects influence the learners' performance (Monteiro & Kim, 2020). Additionally, it explores the utilisation of different devices to optimise and positively impact learning outcomes (Pérez-Paredes et al., 2019). The results of previous studies reveal a general lack of knowledge about these technologies among educators, resulting in their underutilisation. Pérez-Paredes et al. (2019) suggested that language instructors need to be trained in the necessities and advantages of these tools through skills development training related to the NLP technologies.

Therefore, these methodological gaps emphasise the need for future research to provide clear guidelines for the AI integration in teaching practices. In addition to these concerns,

the AI tools differ in their educational focus and impact. While studies such as those by Sharadgah and Sa'di (2022) focus on writing skills, other researchers, like J. Kim et al. (2020), explore the AI's impact on speaking and oral communication, illuminating the diverse applications of the AI in language education. In summary, although the AI tools like Wordtune and ChatGPT have shown potential in enhancing the ESL/EFL education, noticeable gaps persist in understanding their full potential and pedagogical implications. Therefore, this review aims to address these gaps by providing a systematic exploration of the current AI integration in education.

The initial database search and subsequent screening process were conducted to ensure the inclusion of relevant studies. Table 1 outlines the Scopus search string along with the applied screening criteria during the selection process.

Table 1
Search string (Scopus)

Initial search/ topic	**Search items/strings**	**Document found**
Artificial intelligence/ ChatGPT/ Writing skills	TITLE-ABS-KEY (artificial AND intelligence) OR (ai) AND (LIMIT-TO (SUBJAREA , "SOCI") OR LIMIT-TO (SUBJAREA , "ARTS")) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (EXACTKEYWORD , "Education") OR LIMIT-TO (EXACTKEYWORD , "Teaching") OR LIMIT-TO (EXACTKEYWORD , "Artificial Intelligence (AI)")) AND (LIMIT-TO (EXACTSRCTITLE , "International Journal Of Artificial Intelligence In Education") OR LIMIT-TO (EXACTSRCTITLE , "International Journal Of Emerging Technologies In Learning") OR LIMIT-TO (EXACTSRCTITLE , "Computers And Education") OR LIMIT-TO (EXACTSRCTITLE , "Education And Information Technologies"))	195
Screening Process Learning setting, educational level, and focus on ESL/ EFL	TITLE-ABS-KEY (ai) AND (chatgpt) AND (assistant) AND (english) AND (teaching) AND (education) AND (LIMIT-TO (SUBJAREA , "SOCI")) AND (LIMIT-TO (DOCTYPE , "ar") OR LIMIT-TO (DOCTYPE , "cp")) AND (LIMIT-TO } (EXACTSRCTITLE , "Education And Information Technologies") OR LIMIT-TO (EXACTSRCTITLE , "Computers And Education Artificial Intelligence") OR LIMIT-TO (EXACTSRCTITLE , "Journal Of Applied Learning And Teaching") OR LIMIT-TO (EXACTSRCTITLE , "Cogent Education") OR LIMIT-TO (EXACTSRCTITLE , "International Journal Of Educational Technology In Higher Education") OR LIMIT-TO (EXACTSRCTITLE , "International Journal Of Educational Research") OR LIMIT-TO (EXACTSRCTITLE , "Technology Knowledge And Learning"))	28

In the Web of Science database, an initial keyword-based search generated a large number of documents. These results were subsequently refined using specific filters such as research area, document type, publication title, and enriched cited references.

Table 2 displays the number of documents retrieved at each stage of the screening and refinement process.

Table 2
Search string (Web of Science)

Topic	Search items/string	Documents found
Artificial intelligence	ALL=(AI OR ARTIFICIAL INTELLIGENCE AND ESL AND EFL)	119
Refined by: 1) Research area 2) Document type 3) Publication title 4) Enriched cited references	ALL=(Artificial Intelligence or AI and English and ESL and EFL)	56

The search strategy applied to ScienceDirect followed a topic-wise approach, using specific keywords to locate relevant studies. The number of documents retrieved was then refined by applying inclusion criteria. Table 3 presents the search strings used for each topic, along with the corresponding number of documents initially found and those retained after refinement.

Table 3
Search string (ScienceDirect)

Topic	String	Documents found
Artificial intelligence / /English language	"AI", "ARTIFICIAL INTELLIGENCE", "AI TOOLS", "ENGLISH"	607
Refined by Subject areas, article type, publication title, and subject areas	"AI", "ARTIFICIAL INTELLIGENCE", "AI TOOLS", "ENGLISH"	23

For Google Scholar, the articles were identified using relevant keywords, and a handpicking technique was used to shortlist the studies.

METHODOLOGY

The exploration of pertinent literature was conducted through Scopus, WoS, and ScienceDirect research databases. Insights were drawn from relevant literature in the domain of the AI-integrated writing assistance (Ippolito et al., 2022), and a set of research keywords was systematically identified. This study initiated a detailed examination of the

identification and retrieval of existing literature related to the AI tools. The data were refined systematically through the application of relevant criteria. To execute this process, leading databases, including Scopus, WoS, Google Scholar, and ScienceDirect, were utilised.

Review Protocol

This stage highlights the review protocol in which the researcher plans how selected studies are considered suitable and pertinent for the review (Shaffril et al., 2021). By spotlighting the research questions of the study, the researcher ensured that all the studies included in the review were relevant; further filtering was conducted for the final selection. To maintain relevance, inclusion criteria were established to ensure a focus on studies that directly explore the impact of the AI tools on the ESL/EFL teaching practices, prioritising those that involve the AI-driven language models and writing tools. The second criterion was based on the integration of the AI applications in the ESL/EFL education. Therefore, studies that lacked a focus on the AI integration in the ESL/EFL education were ultimately excluded. Referring to publication or reporting standards, several studies were considered eligible based on the criteria set forth in Table 4. A detailed review of the literature is included in the discussion section. To establish guidelines, the current study followed the guidelines outlined by Shaffril et al. (2022). These guidelines suggest that establishing a protocol and referring to different plans can assist researchers in presenting a systematic literature review (SLR) in a transparent, referrable, and replicable manner (Mengist et al., 2020).

Table 4
Inclusion and exclusion criteria

Criteria	Eligibility	Exclusion
Language and educational area / teaching learning	Should have "AI" or "Artificial intelligence "as a basic component in title	Published in a language other than English
Specific focus on ESL/EFL education	Mainly address about ESL/EFL	Book reviews, editorials, chapters, and non-journal articles
Type of literature	Written and published in English	Published by the same author on different databases

Note. ESL = English as a Second Language; EFL = English as a Foreign Language

Formulation of Research Questions

The following research questions will guide the entire research procedure. The approach used and synthesised data are based on the main items in these questions. Researchers emphasise that formulating a research question should not be too general in order to reduce the volume of searched articles (Burgers et al., 2019; Johnson & Hennessy, 2019).

Q1: What methodologies and AI applications are most prevalent in recent studies on the AI integration in the ESL/EFL education, and how do they impact pedagogy and sampling?

Q2: What are the most frequently used keywords, and countries with more publications?

Searching Strategies

In this phase, a rationale for the search strategy was established. The initial step involved "identification" based on keywords to retrieve potential articles. This identification pinpointed diverse journals that focus on the integration of AI in ESL/EFL education. This task was performed through three prominent databases: WoS, Scopus, Google Scholar, and ScienceDirect. Given the significance and depth of the topic, the preliminary search produced more than a thousand papers, as no filters were employed at this initial stage. However, later in the process, the authors applied filters focusing on the research questions. Therefore, the implementation of a three-step process based on Shaffril et al. (2018) was employed. These steps include a) identification, b) screening, and c) eligibility. The search strategy varied for each search engine, as the filters were adjusted to refine the varying degrees of irrelevant data in the chosen databases.

Identification

During the identification process, suggested keywords were added to the ScienceDirect, Scopus, and WoS databases; however, for Google Scholar, the keywords remained the same. Consequently, the use of keywords such as “AI”, “ESL/EFL”, and “education” resulted in the identification of 921 studies. The keywords were refined through iterative searches, focusing on combinations that directly addressed the integration of the AI tools in the ESL/EFL contexts, which resulted in a more manageable dataset of 107 potential articles.

Screening

The second step of the process, screening, involves collecting relevant papers based on predefined inclusion and exclusion criteria. Both manual and automated techniques can be utilised, employing database options and functions to filter search results according to the study's requirements. In this study, the researchers applied both manual methods and database filters to select suitable papers, choosing published studies with a focus on the AI in the ESL/EFL context. Given the study's emphasis on English-language sources, articles were selected from studies in the Social Sciences, Arts, and Humanities. As the filtration process continued, the focus remained primarily on the teaching and learning domains.

Eligibility

In this stage, the titles, abstracts, and other key sections of the papers were reviewed to assess the eligibility of the studies. Through this process, the authors excluded 820 articles. Consequently, 107 articles were deemed broadly relevant. After further reviewing these articles with a focus on the EFL/ESL context, AI, and English language education, an additional 82 articles were excluded for not meeting the selection criteria. Ultimately, only 25 articles met the criteria and proceeded with the quality appraisal process (Figure 1).

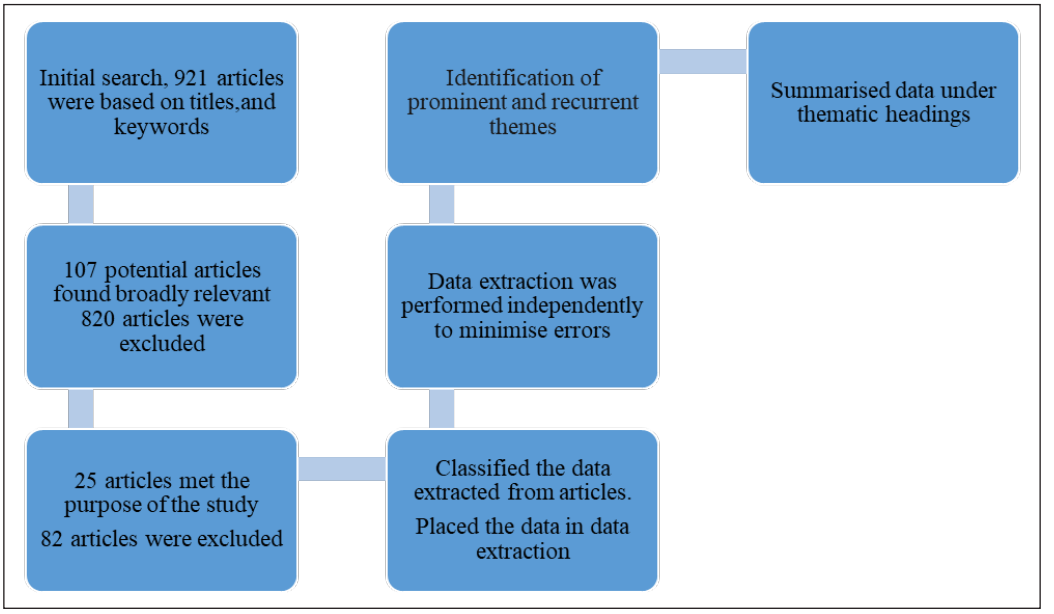

Figure 1. Systematic review process

Quality Appraisal

The articles that have passed the eligibility stage require careful scrutiny to make sure the absence of bias in the quality of the review methodology (Higgins et al., 2019). Each article underwent a rigorous quality appraisal using established guidelines (Shaffril, 2021) to ensure the relevance and reliability of the studies included in the review. At this stage, duplicate articles, articles written in languages other than English, book reviews, editorials, non-journal articles, and papers outside the predetermined focus of the study were removed. To minimise selection bias, the authors established inclusion and exclusion criteria before the extraction stage, as indicated in Table 4. This filtering process ultimately identified 25 articles pertinent to the study.

Data Extraction

At this stage, prior to the final selection of papers, the authors arbitrarily chose five papers and conducted a collaborative review with a qualified assistant to ensure inter-rater reliability in making the inclusion and exclusion decisions. Discrepancies between reviewers were addressed through discussion, ensuring the reliability and consistency of the data extraction process. Each paper was read in its entirety and independently to minimise errors in subsequent stages (Charrois, 2015; Gomersall et al., 2015). Following this, inter-rater reliability was established by identifying connections and noting changes in the extracted data. The selected articles include both the experimental and theoretical studies. For data extraction, the authors discussed thematic concepts and applied established coding, which evolved into broader themes. Ultimately, the information from the 25 papers was categorised under specific headings.

Data Synthesis

The authors and a knowledgeable partner analysed the records by comparing subjects across categories within the articles. This approach facilitated the creation of a systematic review, allowing the authors to reflect on changes in the collected data. Over a two-month period, the authors and expert collaboratively analysed the findings, ultimately formulating a comprehensive summary of the data, as illustrated in the Appendix.

Data Demonstration

It is crucial to use a flow diagram for a systematic literature review (SLR). For this purpose, the current study utilises a tailored flow diagram (Figure 1) introduced by Shaffril et al. (2019). Tables and figures are employed to present data from the findings of the selected articles, along with tables that highlight key statements and main focuses. Additionally, a separate table is used to display the selection and exclusion criteria, providing a comprehensive overview of the current study. Tables were used to visualise the key findings, such as the frequency of the AI applications, and the geographical distribution of the research studies. By following a rigorous, multi-step methodology, this systematic review ensured that only high-quality and relevant, reliable studies were included. The findings from this process offer a comprehensive understanding of the AI integration in ESL/EFL education, which will be discussed in the following sections.

Predefined criteria guided the selection of studies. Table 4 presents the inclusion and exclusion criteria used in the review.

After screening and analysing the selected studies, key thematic areas were identified based on their methodological focus, AI applications, pedagogical approaches, and sampling strategies. Table 5 presents the major themes extracted from the reviewed articles.

Table 5
Themes

No.	Authors	Methodological focus	AI applications	Pedagogical focus	Sampling focus
1	Annamalai et al. (2023)	Questionnaire and interviews	AI Chatbots	Enhancing English language learning	ESL students
2	Mizumoto and Eguchi (2023)	Quantitative research approaches	ChatGPT AI Language Model	Writing evaluation and feedback	Non-native English speakers
3	Fathi et al. (2024)	Mixed method	AI-speaking Chatbot Andy	EFL students speaking WTC	EFL learners
4	Darwin et al. (2024)	Semi-structured interviews	AI-technologies	Enhancing critical thinking skills	EFL Master's degree students
5	Annamalai et al. (2023)	Interviews	AI Chatbots	Motivation to learn English	Undergraduate ESL learners
6	Abdelatif and Siddiqui (2021)	Close-ended questionnaire	Various AI Tools in EFL teaching	Integration and utilisation of AI tools in English language teaching	ESL faculty members from languages and translation
7	Mohammadkarimi (2023)	Questionnaire and interviews	AI- tools	Equipping teachers with AI tools	67 EFL teachers
8	An et al. (2023)	Questionnaire and interviews	Various AI-driven technologies	AI integration EFL teaching practices and learning outcomes	EFL teachers
9	Du and Gao (2022)	Interviews	AI-based applications in EFL studies	Factors influence adoption of AI tools /EFL teachers' perceptions	17 experts
10	Liu et al. (2024)	Recordings and interviews	GAI ChatGPT and Bing Chat	Students' multimodal writing process	Two groups of EFL writers
11	Moorhouse (2024)	In-depth-individual and group interviews	Generative AI tools, specifically ChatGPT	Readiness of language teachers to use GAI tools in their professional work.	Ten beginning teachers and seventeen first-year English language teachers

Table 5 *(continue)*

No.	Authors	Methodological focus	AI applications	Pedagogical focus	Sampling focus
12	Jiang (2022)	Comprehensive overview	Automatic Evaluation Systems Neural Machine Translation Tools, (ITSs) AI Chatting Robots, IVE, Affective Computing (AC) in ITSs	Impact of AI on teaching and learning.	Existing literature
13	Alshumaimeri and Alshememry (2023)	Systematic review	The review covers a wide range of AI technologies/methodologies	Understanding AI influences in ESL education	Scholarly articles, studies and papers
14	Anggoro and Pratiwi (2023)	Overview	Quizizz GAI	Promoting independent learning	ESL students and teachers
15	Zhao (2023)	Tech review	Writing assistant (Wordtune)	Facilitating ESL learners in the writing process	Not specified
16	Jeon (2021)	Semi-structured interviews	Customised Chatbots, Google Dialog flow	ESL learners motivation to learn English	Thirty-six Korean primary school learners
17	Al-Garaady and Albuhairy (2023)	Statistical analysis, *F*-score and *p*-value	LLM ChatGPT	Focus on identifying writing errors/ effectiveness of ChatGPT	EFL learners
18	Madhavi et al. (2023)	Non-ICT with traditional and ICT-AI speaking test	Several AI and ICT tools and resources	Specific focus on speaking skills or spoken communication	100 students /ICT and non-ICT
19	Fleckenstein et al. (2024)	Inventory lime survey	ChatGPT	Students' text or writing skills	Pre-service teachers
20	Sun et al. (2021)	Deep learning assisted approach	AI module to create a modern tool program	Enhancing English language teaching efficiency	Online English teaching system

Table 5 *(continue)*

No.	Authors	Methodological focus	AI applications	Pedagogical focus	Sampling focus
21	Sharadgah and Sa'di (2022)	Systematic literature review from 2015 to 2021	Range of AI approaches including NLP, MLNN	To highlight the positive impact of AI approaches on ESL language optimization	The study examined 200 articles, retaining 64
22	Al Mahmud (2023)	Pre-posttest writing samples/	Wordtune, an AI-powered writing tool and Grammarly	Impact of Wordune on EFL learners writing quality	ESL students
23	Kohnke et al. (2023)	Semi-structured interviews	GAI tools in English language teaching	Identification of digital competencies and pedagogical knowledge required for integrating GAI in education	Twelve higher education English language teachers in Hong Kong
24	Moulieswaran and Prasantha Kumar (2023)	Utilising survey instruments with a 5-point Likert Scale	AI-assisted language learning (AI-ALL)	Problems faced by ESL learners regarding AI-assisted language learning and teaching	The study includes 81 engineering stream students
25	Alharbi (2023)	Pre-test Post-test	Machine Translation/Google Translate	Writing skills	234 university EFL students

Note. AI = Artificial intelligence; ESL = English as a Second Language; EFL = English as a Foreign Language; WTC = Willingness to communicate; GAI = General Ability Index; ITSs = Intelligent Tutoring Systems; IVE = Immersive virtual environment; AC = Affective computing; LLM = Large language model; ICT = Information and Communication Technology; NLP = Natural Language Processing; MLNN = Multilayer neural network; ALL = Adaptive language learning

RESULTS

The 25 studies provide significant insights into the integration of the AI tools in the ESL/EFL education, focusing on methodological trends, diverse AI applications, and their broader pedagogical impact.

Q1: What is the methodological focus, most commonly used AI applications, sampling focus, and pedagogical focus in the AI-integrated teaching and learning in the ESL/EFL studies?

The results of the reviewed studies revealed the following themes:

Methodological Focus

Figure 2 illustrates the primary methodological focus of the 25 reviewed studies. Most of the studies examine the effectiveness of AI technologies in relation to English language acquisition for ESL/EFL learners, encompassing a range of methodologies within the context of ESL/EFL education.

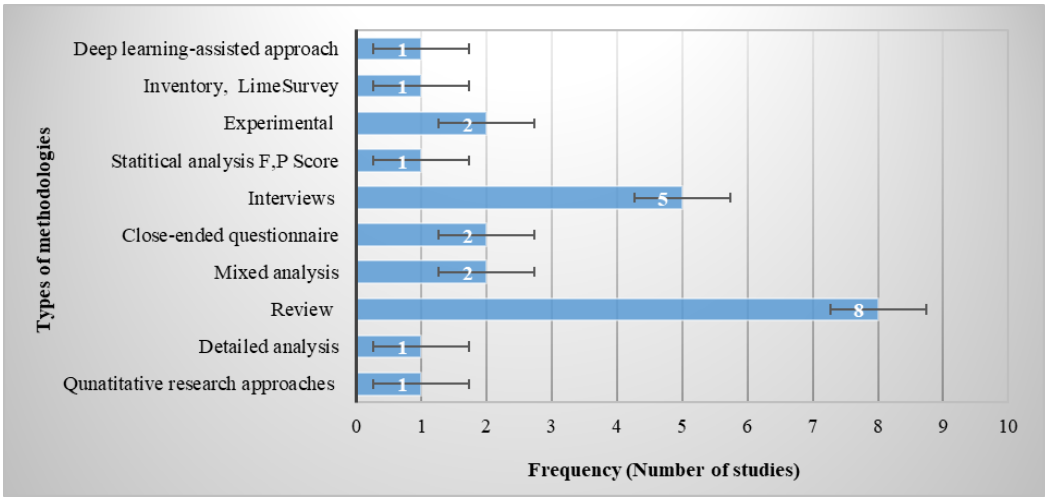

Figure 2. Methodological focus

The reviewed studies include various strategies that integrate AI tools into the classroom. Most studies aimed to understand and explore the benefits of the AI tools in the ESL/EFL classes. These strategies employed a range of approaches, including qualitative techniques, mixed-method designs, and quantitative analyses, to provide a deeper understanding of the AI and GAI-based tools and applications. Among the studies, literature reviews were the most common methodology (f = 8), followed by interviews (f = 5), experimental studies

(f = 2), close-ended questionnaires (f = 2), quantitative research (f = 1), class-based activities (f = 1), statistical analysis (f = 1), detailed analysis (f = 1), mixed-method analyses (f = 2), and inventories or surveys (f = 1). Most studies utilised qualitative methods, such as interviews and reviews, indicating a strong emphasis on understanding the practical use of the AI tools and learner experiences in the ESL/EFL context.

AI Applications

Figure 3 illustrates the most commonly used AI applications and trends in research regarding the AI integration in ESL/EFL education, including Chatbots, ChatGPT, Wordtune, AI-speaking chatbots, GAI, Bing, and Wordtune.

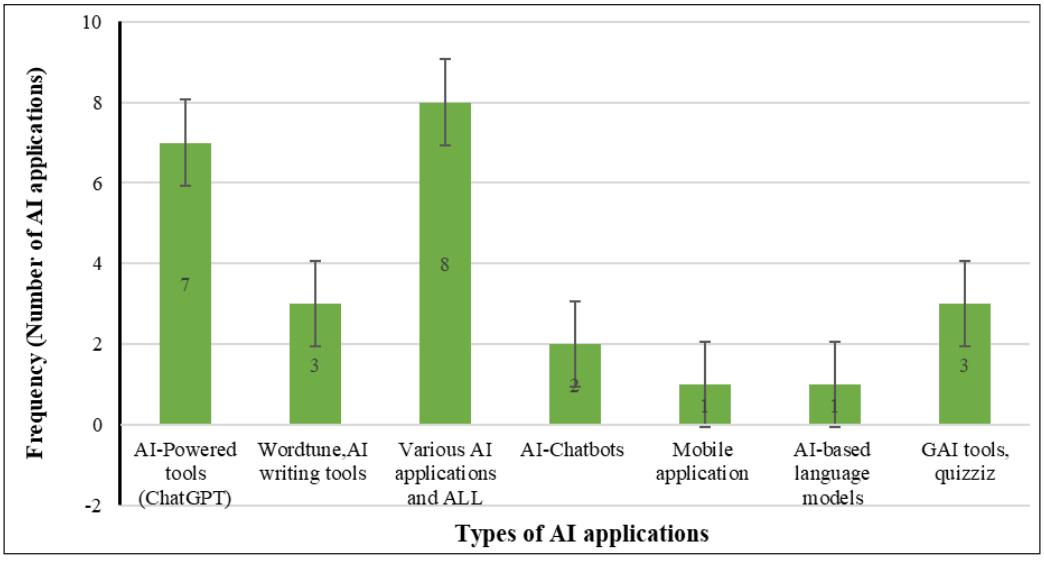

Figure 3. Most commonly used AI Applications in ESL/EFL studies
Note. AI = Artificial intelligence; ALL = Adaptive language learning; GAI = Generative artificial intelligence

The studies explored various AI applications, including AI chatbots, AI-powered ChatGPT, and AI-based language learning models. Researchers also identified tools such as Wordtune and Quizizz. A few studies examined AI-assisted tools, including the NLP, neural networks (NN), and machine learning (ML), highlighting the broad scope of the artificial intelligence and GAI in English language teaching. The integration of various AI applications was the most popular research topic in the ESL/EFL education (f = 7). The ChatGPT emerged as the second most frequently used AI application (f = 6), followed by Wordtune and other AI writing tools (f = 3). Additionally, the GAI and Quizizz were employed with equal frequency (f = 3). Conversely, the AI-based language models, mobile applications, tailored chatbots, AI-based social robots, and cloud computing appeared in

only one study each (f = 1). Consequently, the ChatGPT was frequently used to support writing, grammatical accuracy, and syntax accuracy, while the Wordtune was employed to enhance coherence and fluency in students' written tasks.

Pedagogical Focus

Pedagogical focus presents the number of review studies focussing on different pedagogical themes within the ESL/ELT education. Figure 4 illustrates those involving the AI integration particularly.

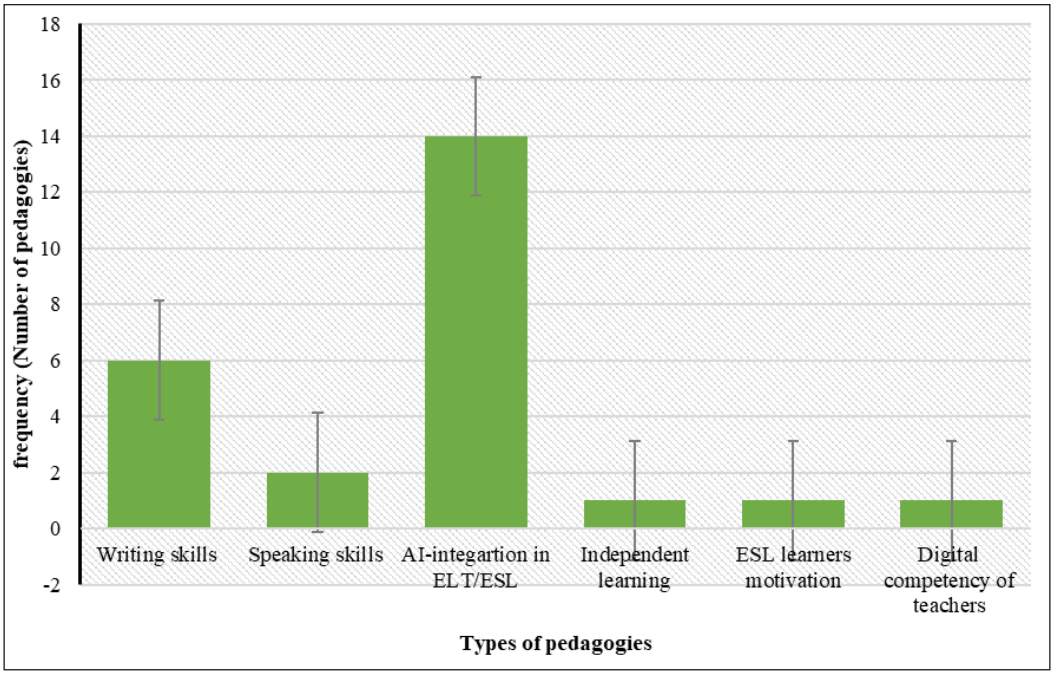

Figure 4. Pedagogical focusses of review studies
Note. AI = Artificial intelligence; ELT = English language teaching; ESL = English as a second language

The studies revealed a primary focus on the incorporation of the AI-based applications in the ESL/EFL instruction (f = 14). The second most common pedagogical focus was on writing skills (f = 6). One study explored the digital competency and proficiency of the ESL/EFL instructors in integrating the AI tools within the teaching and learning contexts (f = 1). Additionally, some studies highlighted recent advancements in the GAI within the educational landscape and explored the enhancement of speaking skills using the GAI tools in English-speaking classes (f = 2). It is evident that the AI integration has been extensively investigated in a general context to understand the tools, applications, and their importance in the English language teaching and learning. Ultimately, the studies emphasised a strong

association between the AI and writing skills. A few studies also examined topics such as independent learning (f = 1) and the ESL students' motivation (f = 1). The emphasis on the writing skills within the AI applications stems from the real-time feedback and ease with which the AI can provide automated, individualised assistance on writing style, structure, and grammar. This not only streamlines the learning process but also makes writing a prime area for the AI integration in the ESL/EFL contexts.

Sampling Focus

The studies employed diverse sampling strategies as displayed in Figure 5.

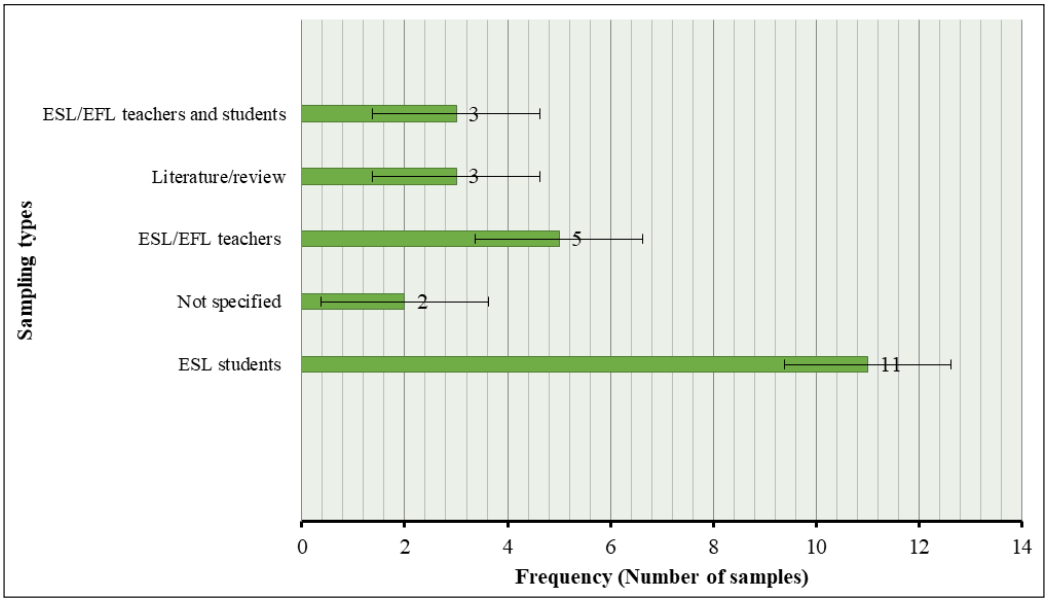

Figure 5. Sampling focus of review studies
Note. ESL = English as a second language; EFL = English as a foreign language

Empirical studies involving the ChatGPT collected data from 17 experts, although a few studies (f = 2) did not specify sample details. Other studies included male and female students, higher education language teachers from Hong Kong, and technical students from India. One study (f = 1) focussed on an English course using questionnaires for the data collection. Similarly, 67 primary-level students from Korea and 100 EFL students participated in some studies as samples

Nevertheless, the ESL students represent the highest sampling focus category, indicating (f = 11), while the ESL/EFL teachers (f = 5) constitute the second most common sampling focus in the AI-based studies. Some studies (f = 3) used extant literature as the primary data source in the context of the AI-based applications in the English language teaching,

whereas the comparison between teachers and students (f = 3) appeared to be less prevalent. Thus, research involving teachers typically raised issues regarding digital literacy and the challenges of the AI adoption, while studies focussed on students highlighted how the AI applications affected learning outcomes, engagement, and performance.

Q2: What are the most frequently used keywords, and countries with more publications?

Keywords with Greater Frequency

The authors identified 3,894 words as the main keywords. The minimum threshold to determine the keywords with higher frequency was set at nine for the co-occurrence of author keywords. As a result, 24 keywords were grouped into five categories.

Table 6 presents the frequently occurring keywords across the reviewed studies, grouped by thematic relevance.

Table 6
Keywords with greater frequency

Groups	Keywords
Group 1	Artificial intelligence technologies (29), Artificial intelligence in education (21), ChatGPT (39), Chatbots (29), AI systems (28)
Group 2	Teaching (105), Interactive learning environment (24), Learning system (92), Natural language processing system (115), Innovation (38)
Group 3	Education (103), Education computing (53), Computer-aided instruction (81), Feedback (11), Educational technology (24), Technology (49)
Group 4	Teaching and learning (9), Machine learning (240), Virtual reality (24), English teaching (10), Students (203)

Table 6 illustrates the most influential keywords. The most frequently used keywords by researchers included artificial intelligence, machine learning, students, natural language processing systems, and teaching. From 2018 to 2024, the artificial intelligence in the English language teaching has primarily been associated with addressing digital transformation. However, terms like AI, learning systems, artificial intelligence technology, and ChatGPT have emerged as recent keywords in the studies.

The analysis of 25 articles, based on question two, is discussed below.

Figure 6 illustrates the countries with the highest number of publications in the selected field.

Figure 6 shows the countries with more publications were the United States (f = 90), China (f = 62), United Kingdom (f = 31), Taiwan (f = 26), Australia (f = 19), Canada (f = 18), Spain (f = 16), Brazil (f = 13), Greece (f = 13), Germany (f = 11), Hong Kong (f = 10), Saudi Arabia (f = 10), France (f = 8), Malaysia (f = 7), Morocco (f = 7), the Netherlands (f = 7), South Korea (f = 7), Turkey (f = 7), India (f = 6), Indonesia (f = 6),

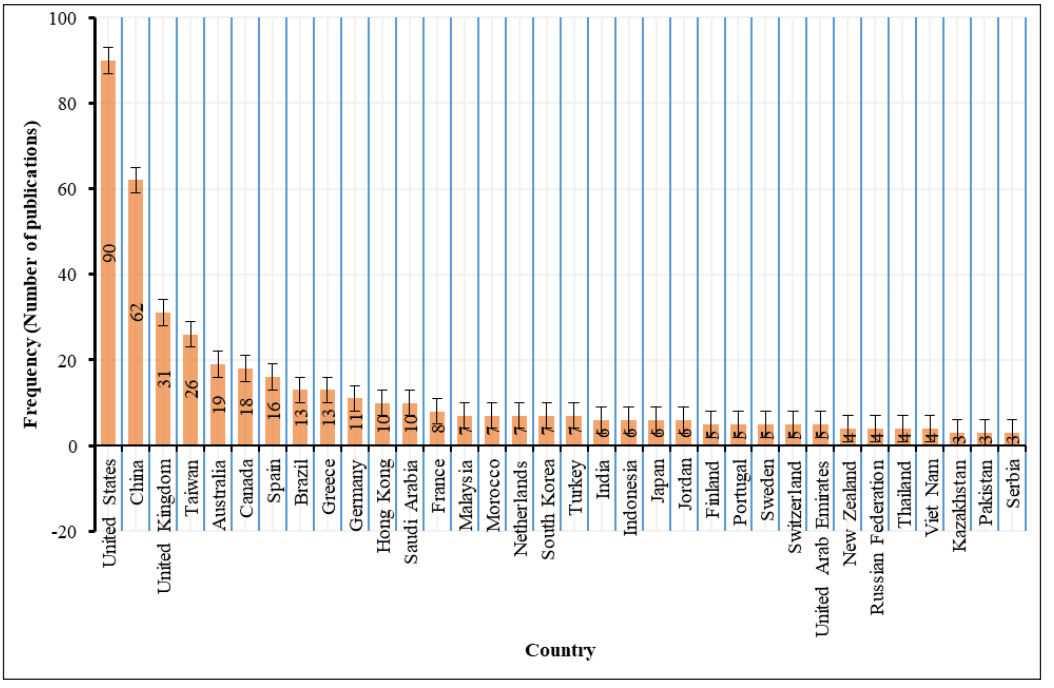

Figure 6. *Countries* with more publications

Japan (f = 6), Jordan (f = 6), Finland (f = 5), Portugal (f = 5), Sweden (f = 5), Switzerland (f = 5), and New Zealand (f = 4). However, various countries remained less productive in terms of publications with a number less than 5 (Figure 5). In light of publication trends, the dominance of the United States and China in the AI research can be attributed to their substantial investments in educational innovation and technology, as well as the widespread implementation of the AI within their education systems. These findings provide a comprehensive overview of trends in the AI integration in the ESL/EFL education, offering valuable insights into the applications, methodologies, and pedagogical aspects that have attracted the most scholarly attention.

DISCUSSION

The review found that the AI tools predominantly enhance writing skills in the ESL/EFL contexts, with the ChatGPT and Wordtune being the most frequently used applications. This aligns with the research question exploring the most used AI applications and their methodological focus. Similarly, the second research question aimed to identify the most used keywords and countries with the highest number of publications. Initial database searches on the topic yielded 921 documents, as no filters were initially applied to the publication years. This number was subsequently reduced to 107 potential articles based

on relevance, after applying the inclusion and exclusion criteria. Following a rigorous selection process, 25 articles remained for a blinded review (Table 6).

Through the systematic analysis, the research pinpoints the methodological focus, pedagogical focus, AI tools or applications, and sampling focus. Recent studies have sought to understand and explore the benefits of the AI tools in the ESL/EFL classes. Many studies emphasised the general integration of the AI tools in the English language teaching, with a specific focus on writing skills as the second most common pedagogical area. Researchers also explored topics like teachers' digital competency and speaking skills. A few studies investigated diverse topics, highlighting the evolving nature of the AI technology in the ESL education. Consistent with Sharadgah and Sa'di (2022), this review also noted that writing skills remain the dominant focus of the AI tools in the ESL/EFL education, highlighting the AI's role in providing real-time feedback and tailored support.

This review highlighted that teachers could incorporate the AI tools, such as the Wordtune for peer review exercises or the ChatGPT, to create conversational practice, thereby encouraging collaboration among the learners. In this context, concentrated pedagogical focusses included 'motivation of learners', 'independent learning', 'parental involvement and role', and 'traditional versus ChatGPT-based instruction'. Furthermore, these methodologies employed approaches based on qualitative techniques, mixed-method designs, and quantitative analysis. The most used methodology was 'review', aimed at providing a deeper understanding of artificial intelligence or GAI-based tools and applications. However, some studies encompassed a range of methodologies within the context of ESL/EFL education.

The United States and China had the most publications, indicating their significant involvement in research on the AI integration in ESL education. These findings align with K. Huang et al. (2023), who concluded that the United States and Arizona State University are actively engaged in studies on AI-based language education. However, according to the Business of Apps data, the United States is the second top country for using and downloading AI applications. Both China and the United States are further advanced in terms of resources, technological innovation, and educational development, which positions them as leaders in the AI integration within language education. Additionally, the most frequently used keywords in the ESL/EFL context were 'artificial intelligence,' 'machine learning,' 'students,' and 'natural language processing systems'. In addition, the findings also revealed that over-reliance on the AI tools may limit the learners' chances to engage in critical thinking and creativity. Moreover, privacy concerns arise with applications like ChatGPT that collect user data.

Incorporating the AI tools into everyday ESL/EFL classroom practices can facilitate differentiated learning by providing individual support. The AI applications can offer personalised feedback on writing tasks while also simulate real-time conversations to help

the learners enhance their speaking skills according to their individual learning needs. Future research should investigate the use of the AI tools in enhancing oral communication skills, especially within immersive learning environments like virtual or augmented reality, which could provide a more realistic learning experience. It would also be valuable to explore how AI can support educators in creating more interactive and dynamic lessons, offering insights into the integration of AI in facilitating real-time student progress. In conclusion, the AI tools such as ChatGPT and Wordtune have shown great effectiveness in enhancing writing skills; however, there is still much unexplored potential for the AI to revolutionise other facets of language learning. Addressing ethical issues will be essential, as it will equip teachers with the necessary skills for the successful integration of AI in ESL/EFL education.

CONCLUSION

This review addressed two key research questions: the methodological focus and most used AI applications in the ESL/EFL education, as well as the frequently used keywords and geographical distribution of publications. The findings indicated that the AI tools, primarily ChatGPT and Wordtune, have had a significant impact on writing skills, with an emphasis on qualitative methodologies in the reviewed studies. The surge in research publications in the field highlights the depth and academic value of the artificial intelligence tools in ESL/EFL education. This review also noted that, with the help of selected studies for the current research, the initial emphasis was on education in general, but over time, this focus has expanded to include diverse pedagogical approaches. Despite the positive impact, the AI is still considered insufficient and requires more research in the domain of English language teaching. This inadequacy is evident in the results, which emphasise the importance of AI for learners of English as a second language. The focus should be on providing training to teachers to effectively utilise these applications in their instruction. It is also evident that proficiency in using the AI-based applications is a necessary skill for both the learners and educators to achieve future success. Recent studies have emphasised the need for more research related to the AI-based language learning in real-life classroom settings (H. Yang & Kyun, 2022). Researchers widely concur with the impact of the AI applications and tools after COVID-19; however, the ELT/ESL research still demands systematic investigation. Several obstacles persist in the educational process due to the evolving nature of AI and GAI, which validates the need for more empirical research to address various issues and assist language teachers.

Considering the limitations of the current study, specific exploration with clear objectives necessitates more in-depth research on the AI technologies in the ESL/EFL education. One limitation of this review is its focus on the latest studies, which may have excluded valuable insights from earlier research. Additionally, the review primarily focussed on the AI's role

in writing, with less attention given to other language skills such as speaking and listening. For educators, these findings suggest that the AI tools can significantly improve language instruction by offering personalised feedback and promoting self-directed learning. For researchers, there remains an urgent need to explore the AI's scope in education, particularly by investigating its impact on speaking skills and facilitating classroom interactions. Future research should examine the AI's role in improving oral communication and listening skills among the ESL/EFL students. Additionally, more empirical studies are needed to evaluate the lasting impact of the AI integration on overall language proficiency and address the ethical concerns associated with the AI use in education. As the AI technology advances, its integration into the ESL/EFL education presents promising opportunities and effective approaches to language learning.

ACKNOWLEDGEMENTS

The corresponding author would like to express her sincere gratitude to Mr. Muhammad Nawaz from the School of Languages, Literacies and Translation, Universiti Sains Malaysia (USM), for his intellectual guidance and active role in data extraction and analysis, which significantly enriched this study. Special thanks are also extended to Professor Dr. Hazri Jamil, the research supervisor at the School of Educational Studies, USM, for his unwavering academic guidance, insightful feedback, and motivational support throughout the research process.

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APPENDIX

The list of 25 articles is as follows:

Abdelatif, K., & Siddiqui, A. (2021). Incorporating artificial intelligence (AI) tools in EFL classes at King Khalid University (KKU). *Journal of Tianjin University Science and Technology*, *54*(10), 197-221. https://doi.org/10.17605/OSF.IO/N7QSF

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