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An NLP-enhanced large-scale review of AI trends and research gaps in English language education

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Abstract
Artificial intelligence (AI) tools such as chatbots have become an inseparable part of education with the advancements in large language models. As more studies have been conducted, researchers and practitioners may have challenges in finding the gaps in the literature and/or deciding on which tools are beneficial or not for instruction. These challenges can be addressed with bibliometric reviews that can provide a comprehensive overview of the current trends in AI use in ELT. This study addresses that need with a novel methodology by examining the ERIC and Scopus databases. Using computational data analysis tools and natural language processing, we examined 856 journal articles and provided several trends, such as keywords, the most cited papers, subject matrices, and geolocations of the articles, as well as several implications for practitioners. A key result is that the research on the use of AI tools is increasing substantially, with a clear focus on teaching methods and writing instruction. Our study offers valuable information for the researchers and practitioners who seek techniques to integrate AI tools into language instruction.

Keywords Data mining in education, Artificial intelligence, Educational technology trends, ELT pedagogy

1 Introduction

Education has gone through a profound change with the increase in the use of modern artificial intelligence (AI) systems, which are large language models (LLMs) trained primarily on data from the Internet to generate human-like responses [8]. Thanks to advancements in AI models, teachers, specifically English language teaching (ELT) practitioners, have begun to incorporate AI into instruction [15]. While researchers examined the use of AI tools to teach specific language skills (e.g., [21]), others studied user perspectives or attitudes (e.g., [27]) and teaching methods [25]. As research on the use of AI tools in ELT expands in scope and volume, it becomes challenging for researchers to decide which topics lack further investigation and which tools reveal effective results for teaching and learning. Thus, in parallel with the growing body of research on the use of AI tools in ELT, the need for trend analyses has correspondingly increased. Trend

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studies such as bibliometric analysis, meta-analysis, or systematic reviews have begun to be conducted to provide a general tendency of the AI use in ELT. While most of the previous trend studies were based on the publications in Web of Science indexing, the present study expands this scope by incorporating journal articles from ERIC and Scopus. These databases are uniquely positioned to capture specialized pedagogical discourse, as they index education-related journals. By examining this metadata, we aim to provide a holistic overview of emerging sources, thereby bridging the gap between theoretical research and practical application for educators across all disciplines.

With the increase in the use of AI in education, various review studies have been conducted mapping the trends of AI use in education (e.g., [14]). Bozkurt [5] revealed the trends regarding the genAI chatbots used in education with most prominent themes such as engagement, experience, and knowledge acquisition. Aravantinos et al. [3] analyzed the AI use in primary education in the Scopus database and categorized learning levels and pedagogical strategies in which AI was used in primary education. Yusuf et al. [49] examined the publications indexed in Web of Science, ScienceDirect, and Scopus, and emphasized the gaps as a lack of research in K-12 settings as well as ethical concerns. Xiaoyu et al. [47] found similar challenges, such as bias and academic integrity, by examining the Web of Science-indexed high-impact factor journals. Alfarwan [1] examined the Scopus and Web of Science databases for the use of AI in K-12 settings and found from 30 articles that high schools were the research sites for most of the papers. Overall, despite the exponential increase in the research on the use of AI in education, discipline-specific reviews are also critical. This perspective can also serve both specialized researchers and the wider teaching community.

Review studies focusing on the use of AI in English language education vary in focus; while some examined the AI use in general, others investigated the AI use in teaching or learning language skills such as reading and writing. Across these studies, a general result is that AI tools will be an inseparable part of language education, and more training is needed for teachers and learners. Only some of the studies included information about the journal information and keywords examined in these studies. Due to their criteria for article inclusion, these studies remained limited in their volume and scope, which urged us to conduct this bibliometric study with computational tools and natural language processing.

Review studies considering the overall trends in ELT and AI use revealed that most of the authors were outside of the ELT discipline, and the understanding of AI was still in development [39]. In line with this, there is still a "lack of elaborate description of teaching material used for learning driven by AI" (p. 338). Moreover, AI was mostly used as a tutor or as an assistant in assessment and evaluation [29]. They concluded that there is a need for studies examining the use of AI in in- and out-of-class applications.

Some researchers reviewed the use of AI tools in academic writing. The most common AI tools examined in such studies were ChatGPT [12, 18] and Grammarly [9]. They concluded that AI could be used as a support mechanism in several ways, such as providing feedback [18]. Moreover, they urged other researchers to conduct more studies on the use of AI in ELT writing instruction [12]. On the other side, they also asserted that teacher use might not be present as expected [9]. Overall, these bibliometric studies were narrow in scope as they only focused on academic writing and specific AI tools.

Other studies were broader in their scope, examining the use of specific AI tools in second language learning such as Google Assistant [36], ChatGPT [34], neural machine translation [23], and other relevant tools [22]. These studies yielded various results, mostly in favor of the uses of AI in ELT. Google Assistant was helpful for language learners thanks to its being an interactive and "user-friendly communicative tool" [38, p. 90]. Similarly, ChatGPT was used as an error detection tool or "personalized learning resource" by the learners, or it was used in assisting the material development and lesson planning by the teachers [34], pp. 9–11. As for assessment, it was used as an automated scorer, item writer, or feedback provider (p. 11). Additionally, the most used applications were for vocabulary instruction, and the use of technological tools increased student motivation [22]. The use of neural machine translation (NMT) in language learning was thought to be supportive in "post-editing and writing skills" [23], p. 676, especially when the users were informed and guided by the instructors. Speech-recognition chatbots are found to be used more [19]. Law [26] suggested conducting more empirical research, using GenAI tools with caution, and providing instructors with professional development activities. These reviews provided an overview of the current studies to some extent, urging more review and empirical studies to be conducted.

Researchers also examined the literature along with some theories such as Activity Theory [48] and self-determination theory [28]. These studies proposed conducting further studies on more interactional studies [48] and paying more careful consideration to the needs based on self-determination theory so teachers could help their learners improve their motivation, "autonomy, and competence" [28], p. 12. They also noted that teachers had five major roles in the use of chatbots in language education: "teachers as prior knowledge presenters, designers, facilitators, assessors, and resource providers" [28], p. 5.

In addition to these, bibliometric studies examined the specific uses of AI tools in language education, only recently, have some trend studies been published to provide information about the publications and trending topics that could be helpful for researchers. Huang et al. [16] conducted their bibliometric analysis with 516 published articles between 2000 and 2019 and found that the AI use in ELT was on the rise, with topics such as "automated writing scoring, intelligent tutoring systems for reading and writing, and automated error scoring…" (p. 112). Kartal and Yeşilyurt [20] examined 185 SSCI-indexed publications published between 1995 and 2022 and noted that AI has become a part of language education, mostly used as tutors. Ma et al. [31] reviewed 384 articles published only in the Web of Science database. They provided statistical information, such as hot topics, citation information, and countries of publication, and suggested more interdisciplinary collaboration as well as improvement in users' AI literacy.

Whether the review studies were conducted for general education or for ELT, most of these review studies examined papers published in Web of Science, few screened Scopus and nearly none of them searched ERIC, which provides invaluable information about educational research. Thus, this study aims to fill the gap by covering publications from the date of the first relevant publication to July 2025 in the ERIC and Scopus databases, which are highly recognized and credible databases publishing peer-reviewed publications.

Contrary to other reviews, our study also employed specialized AI and big data analytics tools to conduct a large-scale investigation into the AI use in ELT. By applying a novel

and detailed coding scheme, we reached a higher number of articles contrary to other reviews, and we enhanced the validity and reliability of our findings. The comprehensive analysis offers crucial guidance for educators, researchers, policymakers, and graduate students, enabling them to identify promising research avenues and make informed decisions in this rapidly evolving field.

Therefore, in this study, we aim to answer these questions:

What are the trends in studies published in Scopus- and ERIC-indexed journals that examine the AI use in English language teaching, specifically in terms of:

a. number of publications per year, country, and journal
b. matrix of the geographic location of the publication and the publishing journals
c. citation matrices (on Scopus)
d. subject matrices (on ERIC)
e. subject matrices by education levels (on ERIC)?

2 Methodology

In this study, we used a Python-based computational bibliometric analysis enhanced with natural language processing. Bibliometric analysis "summarizes the bibliometric and intellectual structure of a field by analyzing the social and structural relationships between different research constituents (e.g., authors, countries, institutions, topics)" [10], p. 287. They are fundamental in research, as they reveal emerging trends, offer valuable insights, and consolidate a substantial body of prior studies. We had some inclusion criteria regarding the AI use in ELT (Fig. 1). As some studies examined only the Web of Science database (e.g., [31]) or SSCI-indexed journals [20], we see value in ours as it encompasses ERIC and Scopus. We also utilized computational tools to reach a wider pool of articles. Thus, our inquiry was confined to the application of AI in English as a second or foreign language education. Our primary goal is to provide researchers in the field with a clear overview that enables them to identify gaps in research on English language instruction. Hence, we limited our analysis to journal articles to provide researchers with a clearer understanding of publication trends based on empirical studies. Unlike other bibliometric studies, a key highlight of our research is the development of a unique, user-friendly search system that enables researchers to investigate topics in greater detail with ease. We developed a comprehensive technical framework using the Python programming language to address several key aspects of our analysis:

1. *Data retrieval capabilities*: Python libraries (i.e., *requests*) provide powerful API interaction handling, which was important for retrieving data from both databases with correct authentication and pagination.
2. *Data processing capabilities*: Libraries such as *pandas* helped us manage and transform datasets from both databases, allowing us to efficiently handle large-scale data operations.
3. *Visualization capabilities*: A combination of libraries, such as *matplotlib* and *seaborn,* enabled us to design publication-quality visualizations to display the trends.
4. *Reproducibility*: Python scripts let us build a reproducible workflow that can be shared with other researchers.

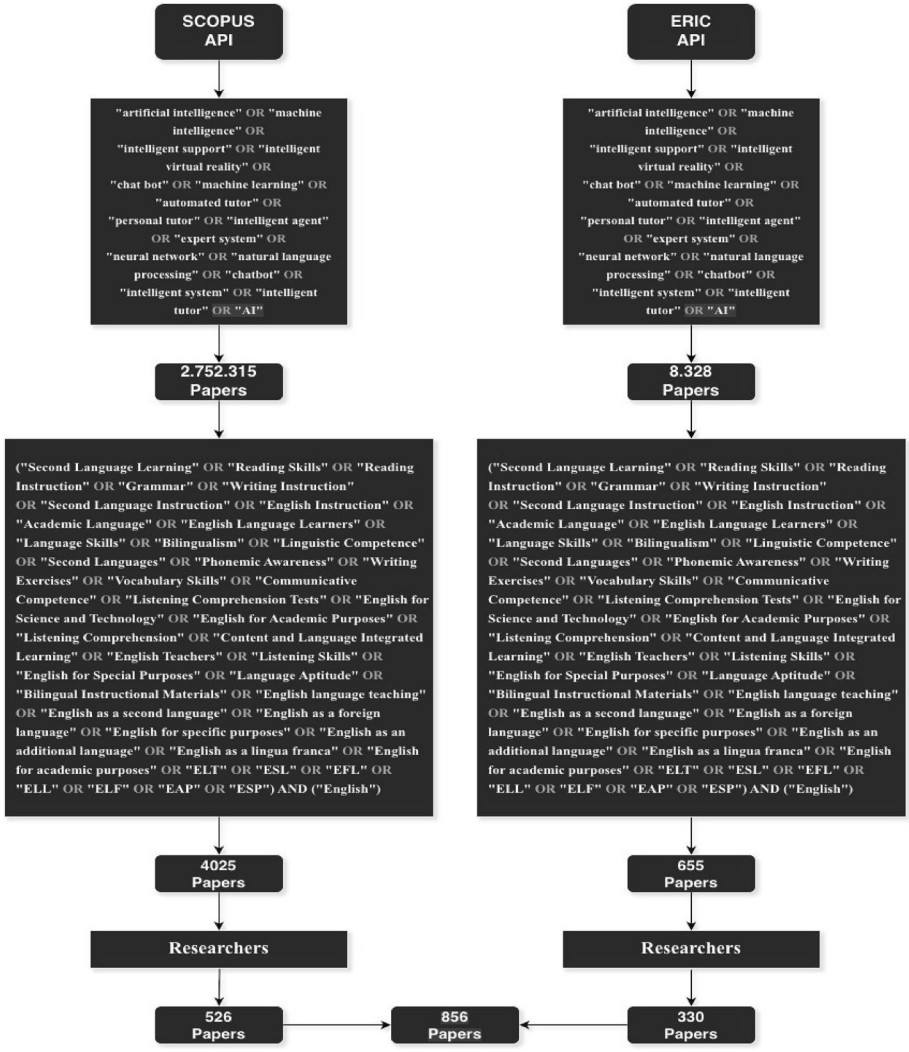


Fig. 1 Keywords for data collection process

2.1 Data collection

We used two widely recognized databases, Scopus and ERIC, and the data collection process ended in June 2025. For ERIC, data retrieval was performed using the ERIC API (https://eric.ed.gov/?api). We implemented Python scripts with the *requests* library to efficiently handle API pagination and communication, and included a comprehensive set of AI-related keywords in our search query (Fig. 1). We requested 11 fields for the records (id, description, subject, publication, date, year, title, author, education_level, publication_type, source, identifiers_geo, ies_cited) to ensure a comprehensive analysis. To handle large amounts of data, we used pagination with a batch size of 200 records per API process, iteratively retrieving all the matched records. After receiving all the records, we filtered them in two stages: (1) include only journal articles that contain "English" (queried across all fields), and (2) filter using regular expression patterns, utilizing the *re* library in Python, and matching ELT keywords.

For Scopus, we utilized the Elsevier API (https://dev.elsevier.com) with institutional credentials. We also used the *requests* library to efficiently handle API communication and pagination. To overcome the Elsevier API's 5,000 result limitation, our search

strategy combined three sets of keywords: AI-related keywords, ELT keywords, and an "English" filter term; and a year-by-year retrieval strategy (2003–2025). We extracted 23 metadata fields (title, creator, identifier, eid, publication_name, issn, volume, page_range, cover_date, cover_display_date, doi, pii, aggregation_type, url, citedby_count, subtype, subtype_description, source_id, openaccess, openaccess_flag, affiliation_names, affiliation_cities, affiliation_countries) for our analysis.

2.2 Data processing pipeline

We implemented a data processing pipeline to ensure compatibility of data from both ERIC and Scopus databases. This pipeline consisted of the following key components:

1. *Normalization:* We standardized field names and formats across both databases and converted publication dates into a uniform year format.
2. *Journal location enhancement*: Since neither API provided journal country information, we manually collected it from Scimago Journal & Country Rank.
3. *Geographic data processing*: We normalized the country name separators, which are common in Scopus data, where multiple affiliated countries were often listed together and separated by semicolons.

2.3 Data analysis and visualization tools

We implemented the analytical framework using the Python ecosystem. For data manipulation, we used the *pandas* library [42] for handling big datasets, which supports various operations such as aggregation, filtering, and transformation of the metadata. To visualize our analysis, we combined Matplotlib [17], which provided foundational plotting abilities, and Seaborn [45], enabling higher-level visualizations of our statistical analysis. We applied consistent visual styling for all the graphics we constructed, including standardized typography, color schemes, and 300 DPI resolution to ensure visual coherence and interpretability.

2.4 NLP-based text analysis

Beyond the keyword co-occurrence mapping, we applied text-based NLP analysis to the article texts to surface themes directly from the corpus. The text processed comprised the article titles and, for ERIC records, the abstracts. Texts were tokenized and lower-cased, English stop words and a small set of widespread domain terms such as "AI, language, learning" were removed, and frequent bigrams were merged. We then (i) generated a corpus-wide word cloud of term frequencies and (ii) fitted a Latent Dirichlet Allocation (LDA) [4] topic model using gensim [38]. The analysis was run on the full corpus.

2.5 Keywords and search tools

We examined the literature and identified key search words and utilized the available API from Scopus and ERIC via a specific tool to locate the articles (Fig. 1). The search using these keywords yielded over two million papers in Scopus and more than 8000 papers in ERIC. After filtering the results with keywords related to ELT, we carefully screened the titles and abstracts to exclude irrelevant papers from our dataset. Our inquiry yielded 856 papers. The exact search strings, the inclusion–exclusion criteria, and the regex pattern enhanced with natural language processing that were used for

filtering are provided in full in Appendix 1. The record was included only if (i) it was a journal article, (ii) it contained "English" in its metadata, and (iii) it matched at least one of the 41 ELT terms in its title or abstract via a word-boundary regex; records not matching any of these criteria were excluded. After the automated filtering, two of the authors independently screened the titles and the abstracts of the remaining records to remove papers in which did not concern the use of AI in English language teaching. In case of doubts, researchers consulted each other for final decisions.

There were 76 papers that appeared in both databases. Because ERIC and Scopus index different journals and provide different metadata, we treated them as two distinct sources and analyzed them separately. These overlapping articles were therefore retained within each database specific analysis. In the combined totals reported across both databases (856), these articles are consequently counted twice; so, the number of unique articles is 780. We verified that this overlap does not affect overall findings because after removing the duplicates, the combined yearly distribution retains the same shape, and the relative country rankings are unchanged. Hence, we present the results for each database separately while making this overlap explicit.

Data analysis involved creating plots and graphics to reveal trends in the AI use in ELT. To provide a comprehensive overview of the studies for researchers, the articles were examined across various dimensions, such as publication years, top 10 journals, the country of publication, the institution of the authors, topic focus, and other relevant clusters.

3 Results and discussion

The screening of papers resulted in 856 papers on the AI use in ELT, published between 2003 and 2025. The analysis revealed both similarities and differences compared to previous bibliometric analyses. Figure 2 presents the distribution of publications by year. While ERIC has 330 articles, Scopus has 526. In line with the current developments in AI, the number of AI-related articles peaked in 2024 with 433 publications, consistent with findings from previous studies [16, 20, 31]. The results demonstrate that the surge in research on AI is a recent phenomenon. This increase has accelerated following the introduction of commercial LLMs such as ChatGPT in late 2022. Because different journals and publications are indexed in each database and each provides distinct API information, general information on yearly publication trends and geographic distribution will be presented first, followed by separate detailed results for each database—starting with Scopus and then ERIC—in the subsequent sections.

When it comes to research sites, a total of 73 unique locations were identified, with China leading the list, followed by Hong Kong, Indonesia, and Iran. Similarly, Ma et al. [31] also reported China to be the most productive country. Although we located Hong Kong separately in our study, Ma et al. [31] included the results related to Hong Kong with those from China (p. 25,222). Overall, more than 70% of the publications originated from the top 10 countries, as seen in Fig. 3. As we limited our search query to the contexts where English is taught as a foreign language, most of the top 10 countries are in Asia. Figure 4 shows the yearly distribution of the top five countries in both databases, in which China leads the list with 185 journal articles.

An examination of the research locations by database revealed some differences between ERIC and Scopus (Fig. 5). For example, research on the AI use in ELT

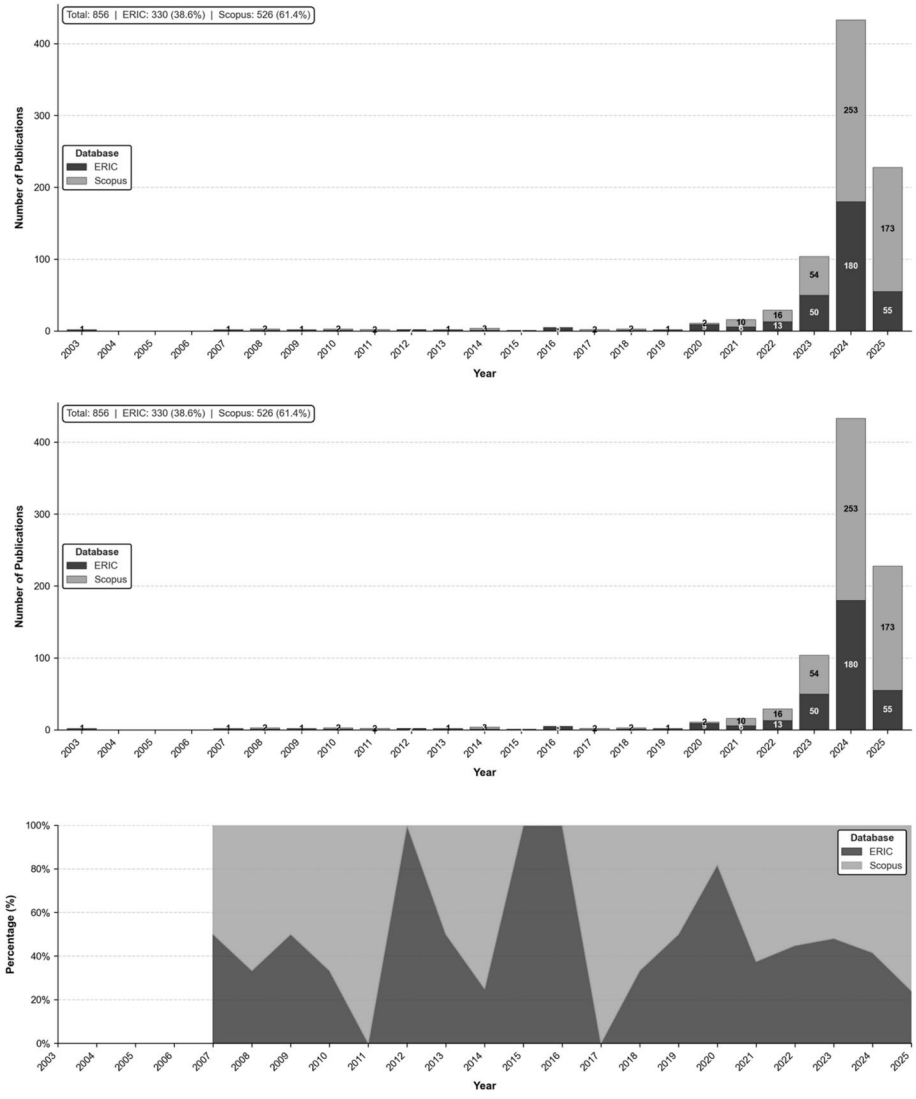


Fig. 2 Yearly publication in Scopus and ERIC

conducted in Türkiye was evenly represented in both ERIC and Scopus databases. Only one study on this topic, coming from Malaysia, was published in ERIC, and the rest were in Scopus (n = 23). Out of the 185 studies from China, 145 were published in Scopus, and 40 appeared in ERIC.

We also examined the keywords which revealed details about the most common topics examined in these papers (Fig. 6). Several keywords are learner engagement, technology integration, teacher attitudes, translation, and error correction, most of which had also an increasing trend in Bozkurt [5] and Huang et al. [16]. It seems that educators use AI tools for various purposes. Instructors aim to increase the learner engagement and instructional effectiveness by integrating AI tools in error correction, teaching writing skills and language tests.

When the strength of each keyword in relation to artificial intelligence was examined, the key topics in the use of AI tools were found to be mostly on error correction, feedback, and writing improvement (Fig. 7), which also showed an upward trend in Kartal and Yeşilyurt [20]. It may seem that instructors may want to increase the workload of

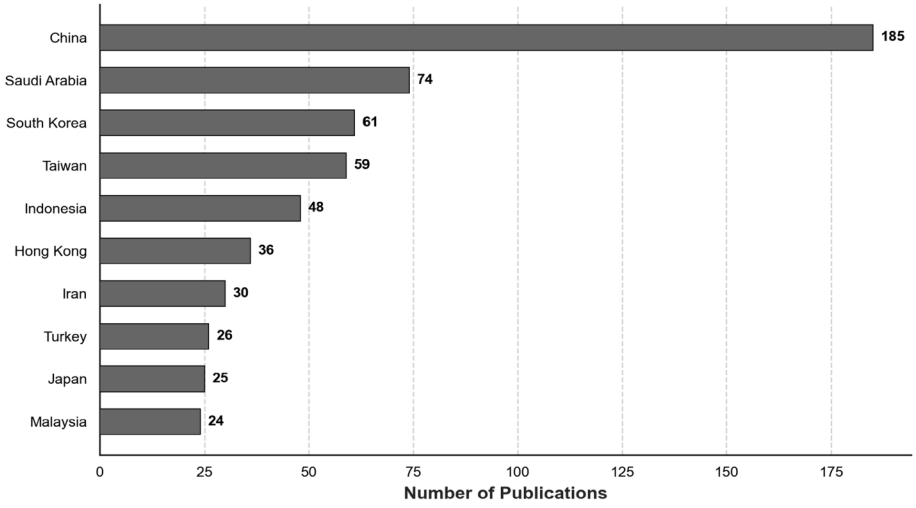


Fig. 3 Top 10 locations in both databases

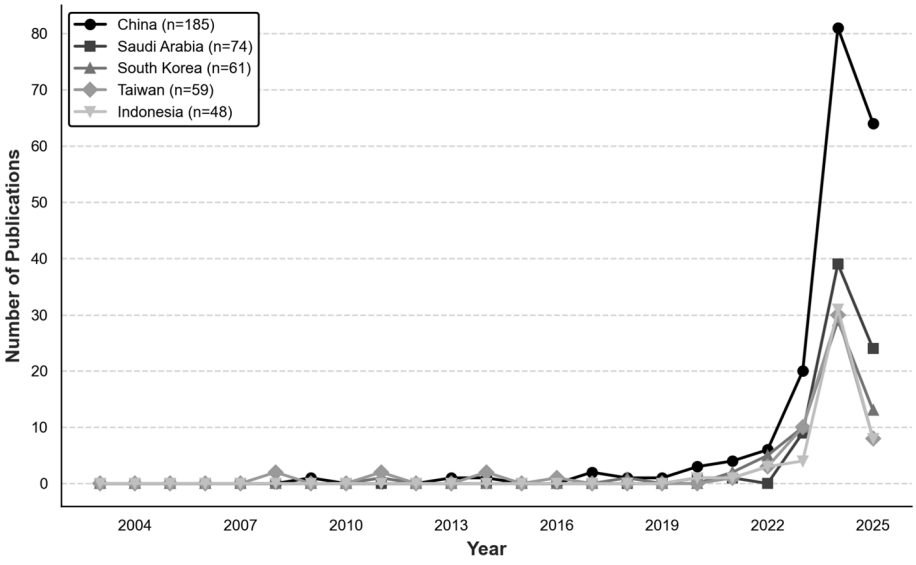


Fig. 4 Top 5 locations per year in both databases

giving feedback to the students by using AI tools. Studies may show how providing feedback through AI tools increase the learning and motivation, while they can focus on other aspects of instruction. It also shows that higher education seems to be a research site where AI tools have been tried the most, which is also revealed in previous reviews.

Examining the density of the words provides information where the researchers mostly focused on. Considering our inquiry words, the density of the keywords related to the use of AI tools in ELT was clustered mostly on feedback, student attitudes, and teacher attitudes (Fig. 8). Previous reviews revealed the importance of teacher and student perspectives.

Previous review studies reported their results collectively in that they did not present the results per database. We decided to present the results per database as each provides unique information about the publications. Thus, despite commonalities between the two databases, we observe some key differences in the distribution of studies across

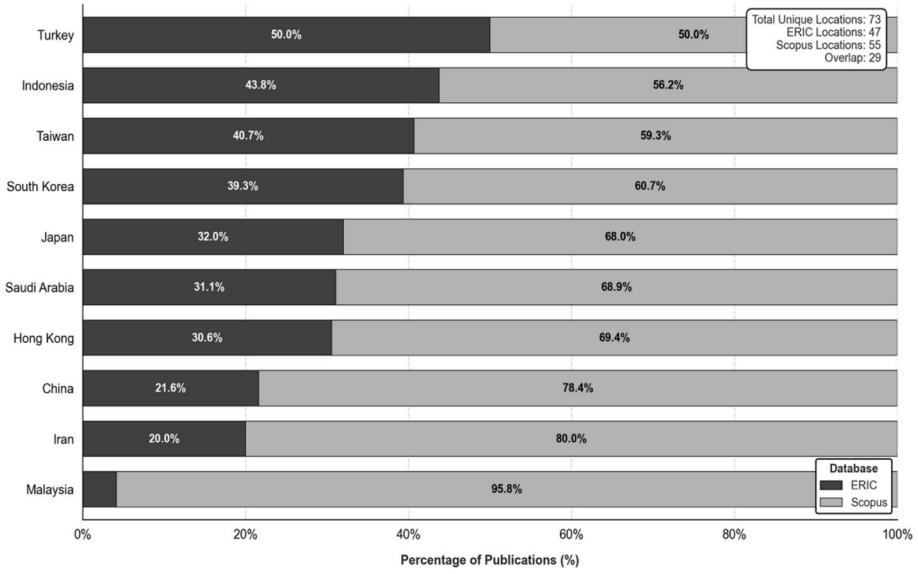


Fig. 5 Database coverage by location

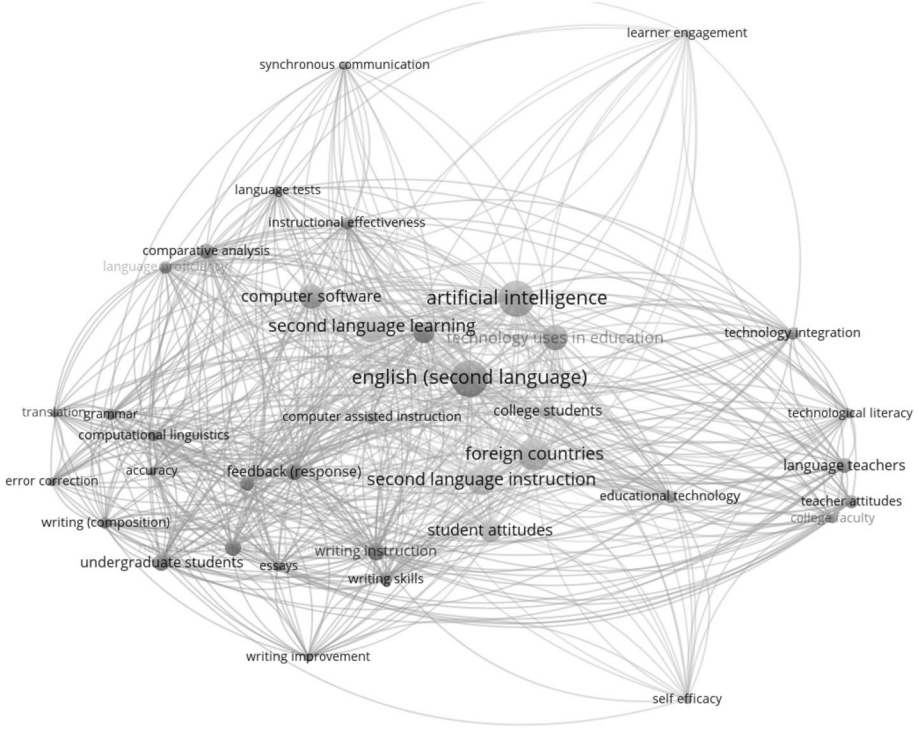


Fig. 6 Occurrences of keywords related to AI in ELT

ERIC and Scopus. Thus, the remainder of this section presents the results for each database separately, starting with Scopus.

3.1 Trends in Scopus-indexed journals

The earliest publication about AI in ELT dates to 2003 in the Scopus database. Starting from 2003, the number of articles published remained low, with only one or two articles published until 2021. Research on this topic was not consistently published over the

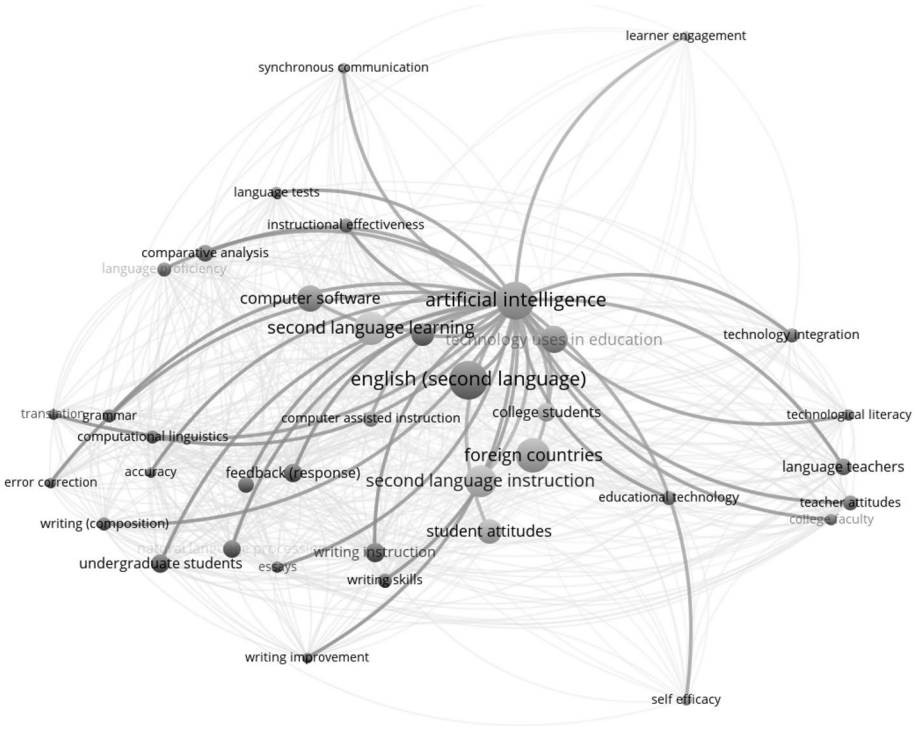


Fig. 7 Total strength of co-occurrences of the keywords related to AI in ELT

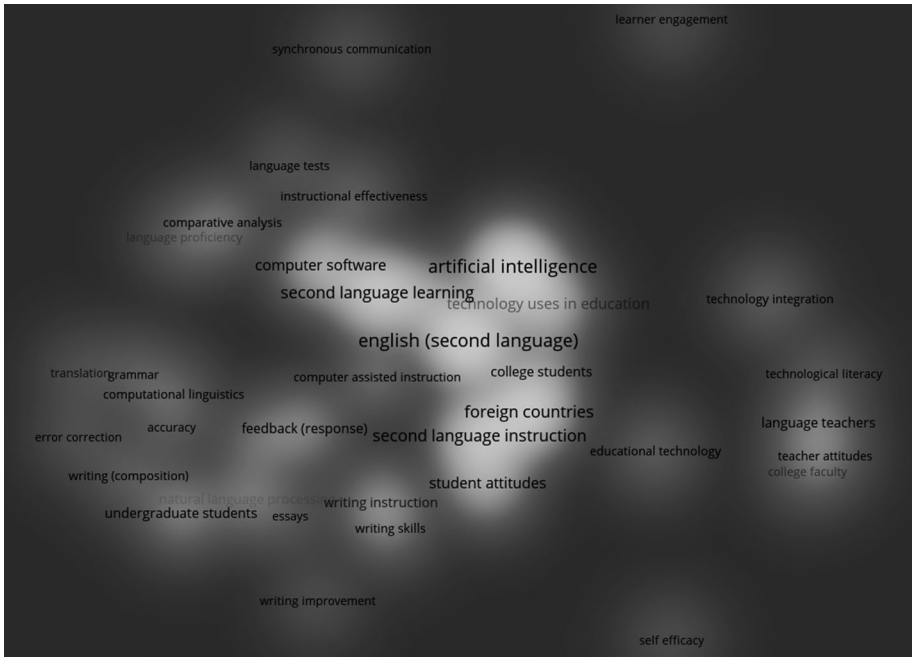


Fig. 8 Density of the keywords related to AI in ELT

years; for instance, there were no publications in 2015 and 2016. However, since 2017, at least one study has been published annually, reflecting a continued interest in the topic. In 2022, the number of articles rose to 16, followed by a significant leap to 54 articles in 2023. The peak was in 2024 with 253 articles, and in 2025, 173 articles were published by June (Fig. 9). These findings align with previous studies showing an upward trend in

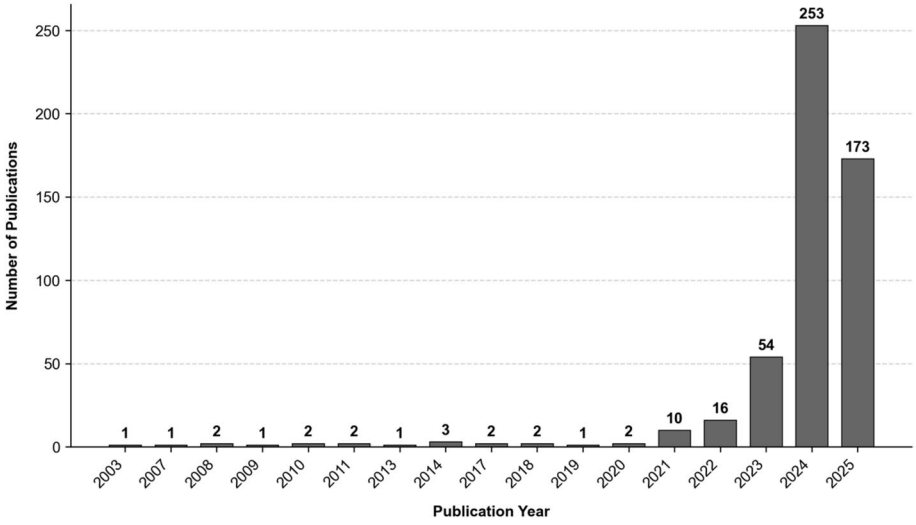


Fig. 9 Annual publication trends in the Scopus database

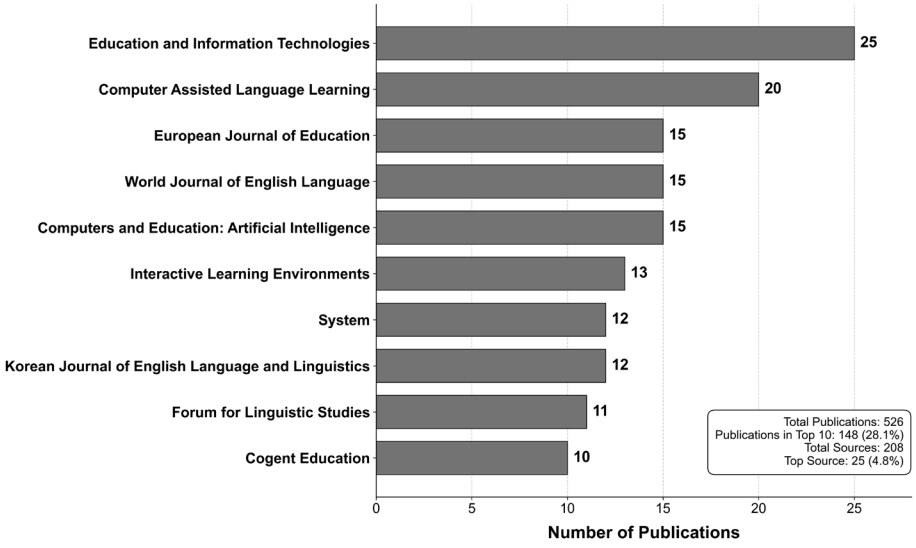


Fig. 10 Top 10 publication sources in the Scopus database

AI-related studies [16, 20, 31]. Considering the trend in the first half of 2025, it is reasonable to anticipate that the number of articles will surpass the total published in 2024, continuing the upward trajectory.

As for journals, on the use of AI tools in ELT, 526 articles were published in 208 different journals, and almost 30% of the articles (n = 148) were published in the top 10 journals (Fig. 10). *Education and Information Technologies (EAIT)* and *Computer Assisted Language Learning* published more than 20 articles on this subject, similar to the results found in Ma et al. [31].

We also examined the top 10 publishing countries and top 10 publishing journals (Fig. 11) on the use of AI tools in ELT, encompassing 117 papers, slightly over than 20% of the dataset. Due to the large volume of articles and similarities in author names, we did not analyze the individual authors or their collaborations. Instead, we used the corresponding author's address information, as provided in the database, to determine a

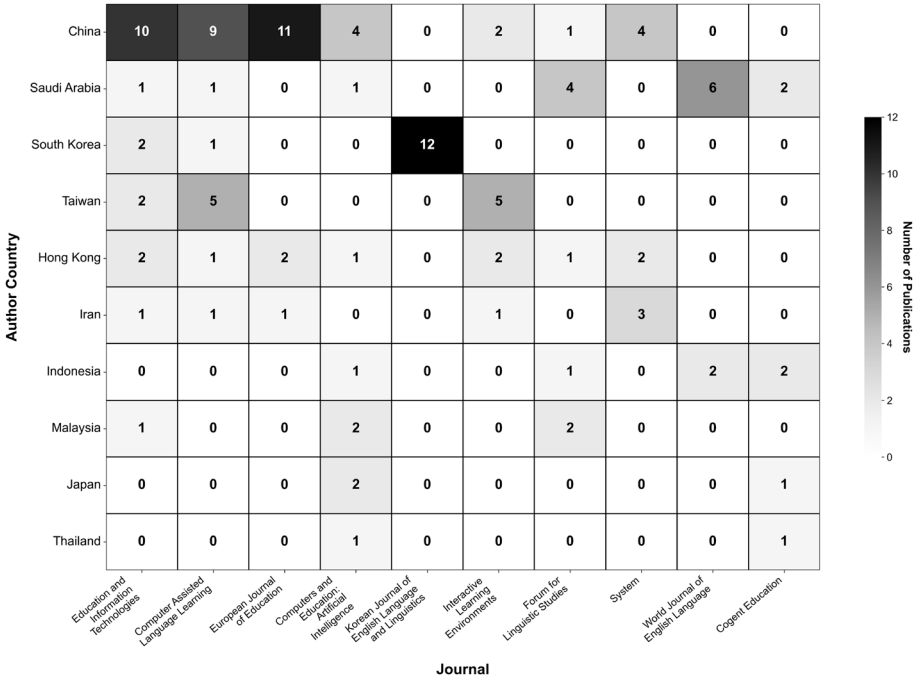


Fig. 11 Publications by author country and journal

publication's geolocation. While papers from China on the AI use in ELT were published in around seven different sources, authors from Saudi Arabia published in six different journals. The *Education and Information Technologies* journal published articles on the use of AI tools in ELT coming from various countries, mostly from China (n = 10), while articles on this topic published in the *World Journal of English Language* were sent mostly from Saudi Arabia (n = 6) and Indonesia (n = 2).

The analysis also yielded information about the intersection of the top 10 journal countries and the top 10 corresponding authors' countries. In terms of corresponding authors' countries, China leads the list with 54 publications published in the UK-based journals, 35 publications in US-based journals, and 32 publications in journals in other countries. Authors from Taiwan (n = 14) and authors from Hong Kong (n = 13) mostly published in the UK-based journals. In terms of the top 10 journal countries, the UK leads the list with a total of 135 articles, followed by the USA with 79 articles (Fig. 12). The papers on the AI use in ELT coming from the top 10 countries except Japan were published by US-based journals.

The data about the top 10 publication countries showed that China leads the list with 129 articles, followed by Saudi Arabia (n = 49) and South Korea (n = 37) (Fig. 13). When examined yearly distribution for the top 5 countries, China seemed to be the most productive country since 2020 having the highest number of publications each year (Fig. 14).

While the articles published before 2020 were from either China, South Korea, or the USA, since 2021, China has been the country with the highest number of articles with 334 articles for the last five years among the top ten countries (Fig. 15). Moreover, this shows a geographical shift and increase in the studies related to ELT in English as a foreign language (EFL) settings.

When we examined the years between 2021 and 2025, the most productive countries in the use of AI tools in ELT were South Korea and China with available data of 116

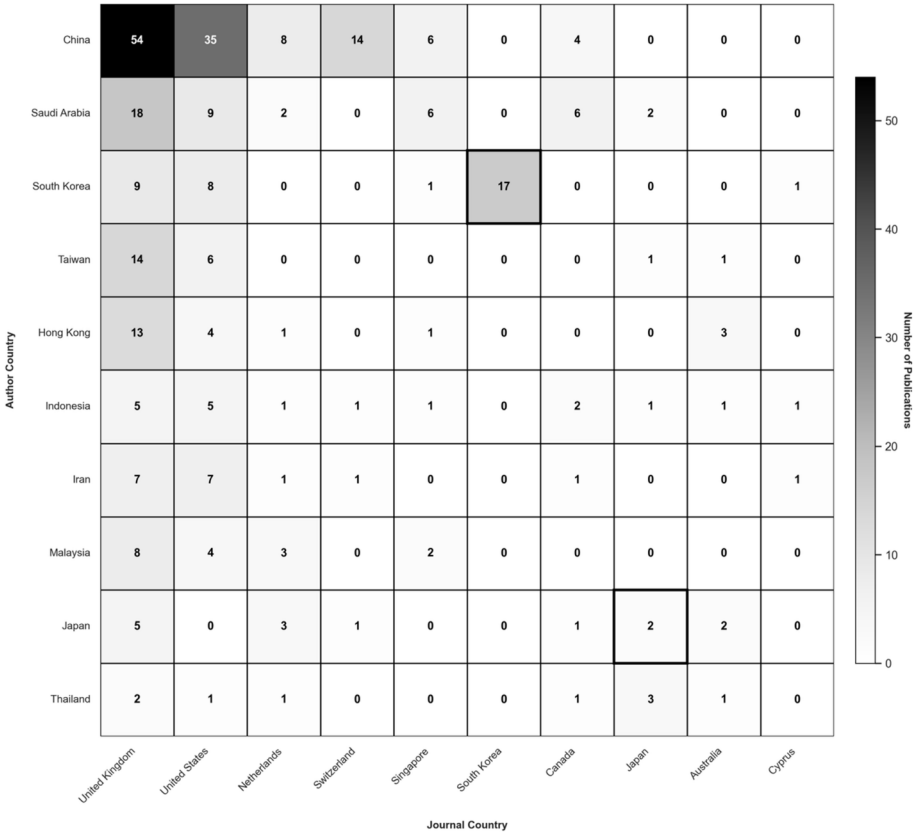


Fig. 12 Publications by author country versus journal country

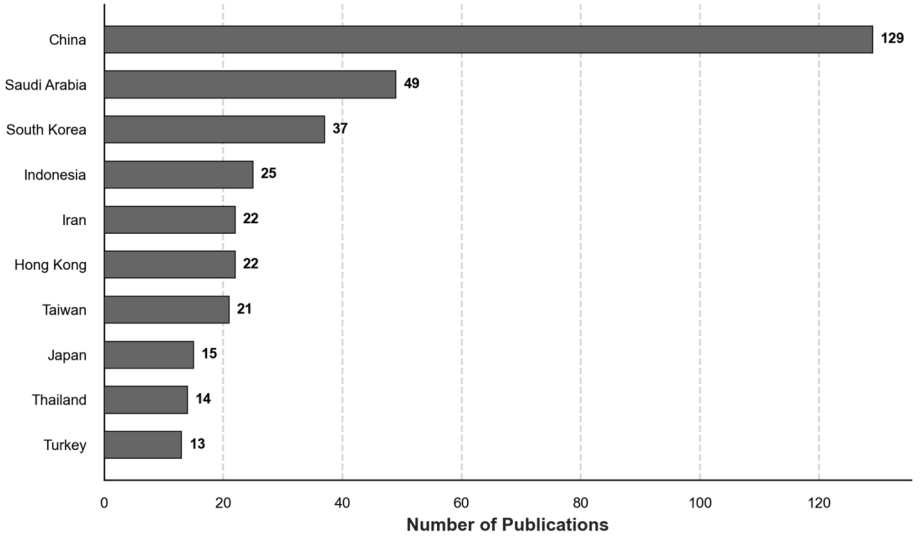


Fig. 13 Geographic distribution of publications: top 10 countries

publications. In these years, three journals led the list to publish articles on this topic (Fig. 16) similar to the results of the previous studies [31]. With an immense increase in the use of LLMs in language education, studies began to examine these tools. After 2023, studies covered many different topics ranging from language skills such as speaking (e.g., [32]) to psychological well-being of learners such as motivation [46] and willingness to

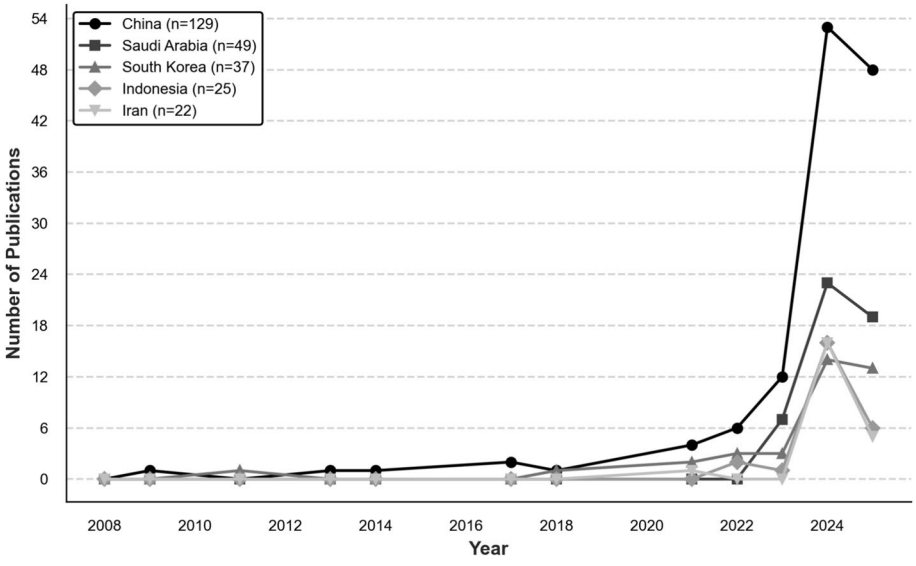


Fig. 14 Number of publications by top 5 countries each year

Year	Total Publications	Active Countries	Top Country	Top Country Publications	Year	Total Publications	Active Countries	Top Country	Top Country Publications
2008	2	2	United States	1	2018	2	2	South Korea	1
2009	1	1	China	1	2021	8	4	China	4
2010	2	1	United States	2	2022	14	6	China	6
2011	1	1	South Korea	1	2023	35	9	China	12
2013	1	1	China	1	2024	164	10	China	53
2014	2	2	United States	1	2025	113	9	China	48
2017	2	1	China	2					

Fig. 15 Total publications and number of publications by top countries each year

Year	Total Publications	Countries Active	Journals Active	Most Productive Country	Most Popular Journal
2021	2	1	1	South Korea	*Korean Journal of English Language and Linguistics*
2022	4	3	3	South Korea	*Korean Journal of English Language and Linguistics*
2023	9	6	6	China	*Education and Information Technologies*
2024	50	9	10	China	*Computer Assisted Language Learning*
2025	51	9	10	China	*Education and Information Technologies*

Fig. 16 Total publications and most popular journals between 2021 and 2025

communicate (e.g., [44, 50]). User perceptions have also been studied for learners (e.g., [51]) and teachers (e.g., [2]), as it is essential to understand the challenges they face while using these tools. In the meantime, journals focusing on technology-assisted language learning seemed to publish more articles related to the AI tools.

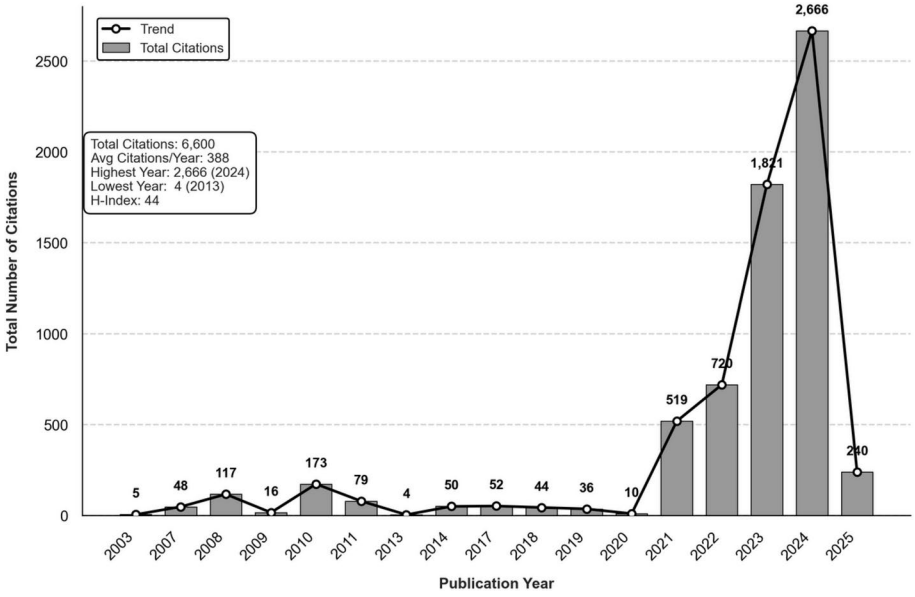


Fig. 17 Total citations per year in the Scopus database

Year	Total Citations	Publication Count	Year	Total Citations	Publication Count
2003	5	1	2018	44	2
2007	48	1	2019	36	1
2008	117	2	2020	10	2
2009	16	1	2021	519	10
2010	173	2	2022	720	16
2011	79	2	2023	1821	54
2013	4	1	2024	2666	253
2014	50	3	2025	240	173
2017	52	2			

Fig. 18 Yearly publication counts and citations made to these publications

The Scopus database also provides citation information, which helps researchers identify the popularity and impact of the subject. The articles published between 2003 and 2025 got 6600 citations in total (Fig. 17). 253 papers (out of 526) published in 2024 got almost three thousand citations, which indicates the substantial amount of research conducted related to AI.

When examined yearly, the number of citations fluctuated; until 2021, there were one or two papers published, but despite this, some papers got a substantial number of citations, and the most cited papers were written in 2010 (Fig. 18). For example, although there were only two papers in 2010, the total number of citations is 173. Both papers were published in *Language Testing*: "The utility of article and preposition error correction systems for English language learners: Feedback and assessment" by Chodorow et al. [7] got 88 citations, and "Complementing human judgment of essays written by English language learners with e-rater® scoring" by Enright and Quinlan [11] got 85 citations. AI tools seemed to be primarily implemented in assessment and providing feedback. After

Year	Title	Citations	Journal
2003	Natural Language Processing (NLP) as an instrument of raising the language awareness of learners of English as a second language	5	*Language Awareness*
2007	Artificial intelligence and second language learning: An efficient approach to error remediation	48	*Language Awareness*
2008	An automatic collocation writing assistant for Taiwanese EFL learners: A case of corpus-based NLP technology	60	*Computer Assisted Language Learning*
2009	An AI framework to teach English as a foreign language: CSIEC	16	*AI Magazine*
2010	The utility of article and preposition error correction systems for English language learners: Feedback and assessment	88	*Language Testing*
2011	Data mining for adaptive learning in a TESL-based e-learning system	71	*Expert Systems with Applications*
2013	Intelligent sentence writing tutor: A system development cycle	4	*International Journal of Artificial Intelligence in Education*
2014	Automated essay scoring by capturing relative writing quality	29	*Computer Journal*

Fig. 19 The top-cited paper per year (2003–2014)

Year	Title	Citations	Journal
2017	Automated essay feedback generation and its impact on revision	52	*IEEE Transactions on Learning Technologies*
2018	The exploration of a machine learning approach for the assessment of learning styles changes	31	*Mechatronic Systems and Control*
2019	Applying ai chatbot for teaching a foreign language: An empirical research	36	*International Journal of Scientific and Technology Research*
2020	An assistive environment for EAL academic writing using formulaic sequences classification	7	*Interactive Learning Environments*
2021	Application of Artificial Intelligence powered digital writing assistant in higher education: randomized controlled trial	171	*Heliyon*
2022	Exploring an AI-based writing Assistant's impact on English language learners	160	*Computers and Education: Artificial Intelligence*
2023	The impact of AI writing tools on the content and organization of students' writing: EFL teachers' perspective	161	*Cogent Education*
2024	Measuring EFL learners' use of ChatGPT in informal digital learning of English based on the technology	190	*Innovation in Language Learning and Teaching*
2025	Students' appraisals post-ChatGPT use: Students' narrative after using ChatGPT for writing	21	*Innovations in Education and Teaching International*

Fig. 20 The top-cited paper per year (2017–2025)

2021, with the increase in the number of publications and topics examined, the number of citations increased correspondingly.

Yearly examination of the citation information yielded the most-cited papers in each year (Figs. 19 and 20). While the number of the citations shows fluctuations until 2020, always below 90, it surged immensely after 2020. This not only shows the increase in the number of studies examining AI in education but also indicates that the recent papers got recognition compared to the previous studies. Like the results of the keyword analysis, the titles of the most cited papers reveal that AI use is considerably high in EFL

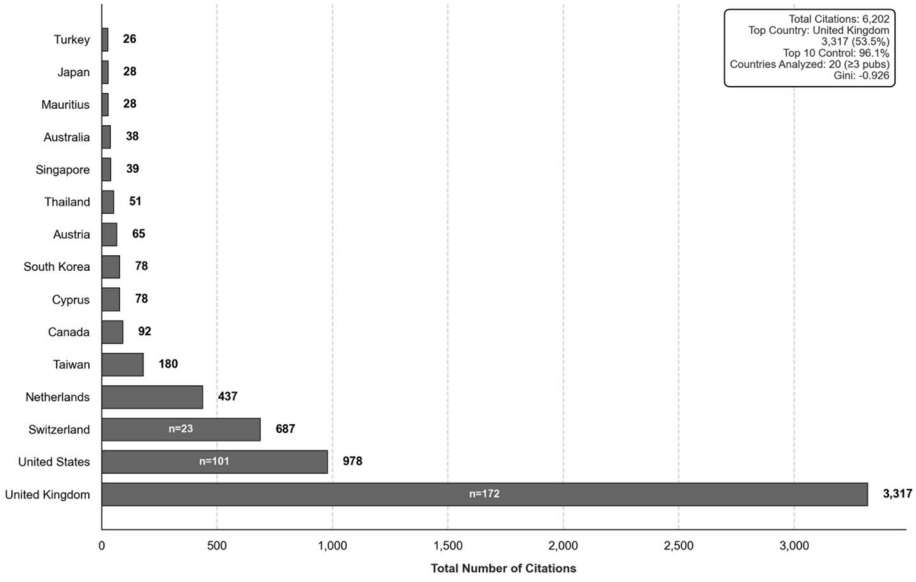


Fig. 21 Total citations per journal country

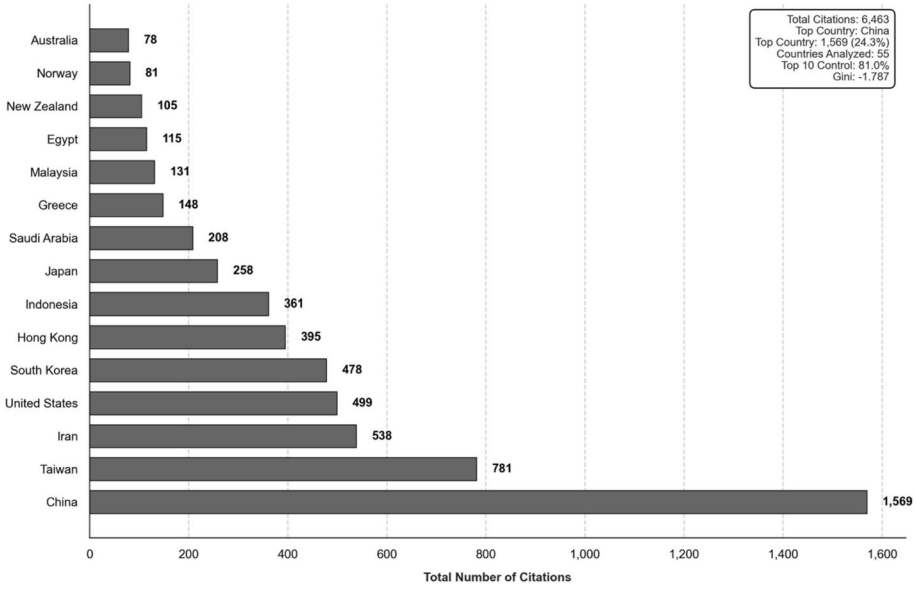


Fig. 22 Total citations by author country

writing (e.g. [13, 33]), and the most recent top-cited papers were on both writing and ChatGPT [30, 37].

The data also included information about the citations of the journals per country (Fig. 21). The UK-based journals published 172 articles and got 3,317 citations, followed by US-based journals with almost a thousand citations for 101 articles.

However, when examined in terms of country, China leads the list with more than 1500 citations in total, and the top 10 countries had around 80% of total citations (Fig. 22). These results demonstrate that China leads the field in AI-integrated ELT research signaling a growing scholarly interest in the application of AI to English language teaching within the Chinese context.

When total citations by journals were examined, the *Computer Assisted Language Learning* journal leads the list with receiving 570 citations for 20 papers, followed by *EAIT* with 479 citations for 25 papers (Fig. 23), which was also found in Ma et al. [31].

Recent trends in academia indicate a shift towards Open Access (OA) publishing. The goal is to democratize research by making it freely available worldwide. This is particularly vital for researchers in developing nations, as they gain easier access to recent developments in their fields. Even though authors are typically expected to pay article processing charges (APCs), the citation rates of open-access journals demonstrate that this model is an effective way to gain broader scholarly recognition. Consequently, we examined the open access policies of the journals in our study. As Fig. 24 represents, our analysis revealed that approximately 50% of the publications currently adhere to OA, while the rest may either have hybrid or subscription-only access. Even though the policies may change over time, the data represents the current situation in accessible resources related to AI use in ELT.

Four journals, *Forum for Linguistic Studies*, *World Journal of English Language, Cogent Education,* and *Computers and Education: Artificial Intelligence,* had full access, while *Interactive Learning Environments (ILE)* and *Korean Journal of English Language and Linguistics (KJELL)* had no open access (Fig. 25) for the publications listed in our dataset for 526 articles. However, it is important to note that journals may change their open access policies over time. For example, *ILE* has a hybrid access option while *KJELL* may have an OA policy right now.

When the yearly open access rates were examined, the papers published in 2009 had full access, followed by around 70% in 2023 (Fig. 26). Most of the papers published in other years have no open access options. In recent years, between 2017 and 2020, articles have not reached all researchers.

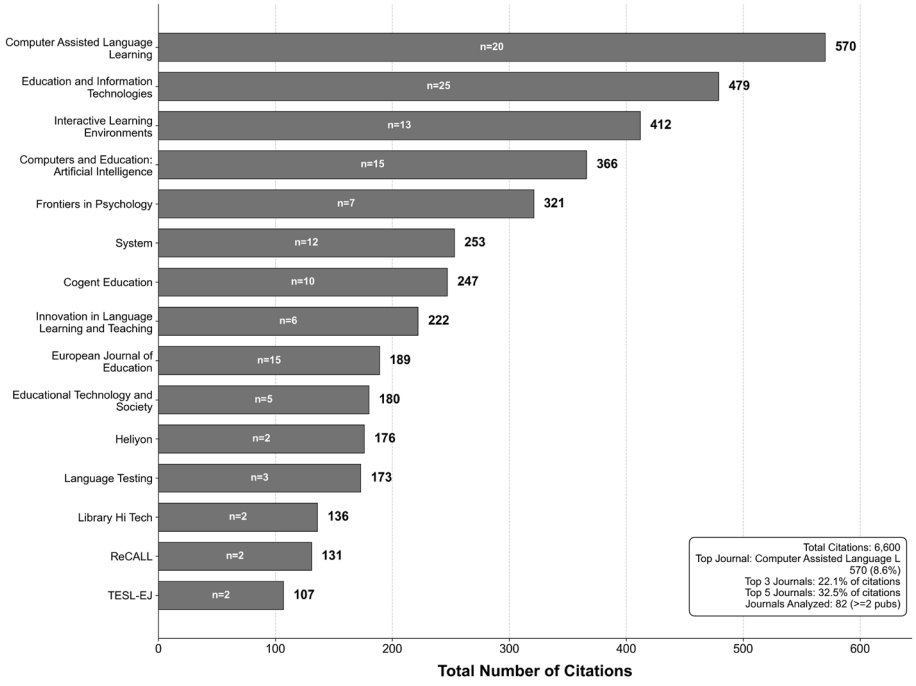


Fig. 23 Total number of publications and citations per journal

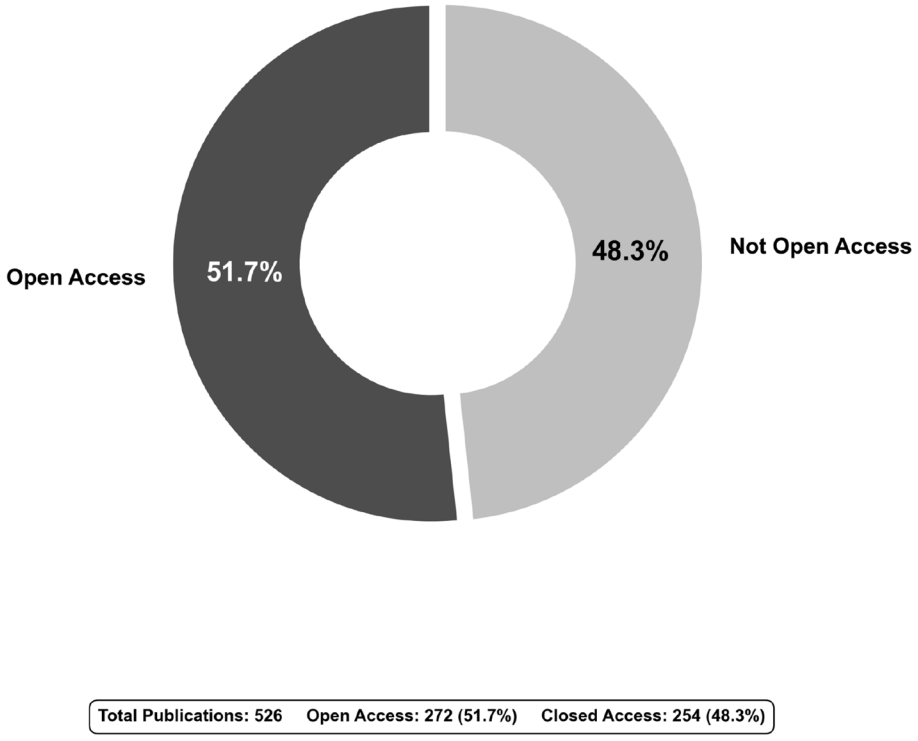


Fig. 24 Distribution of open-access publications

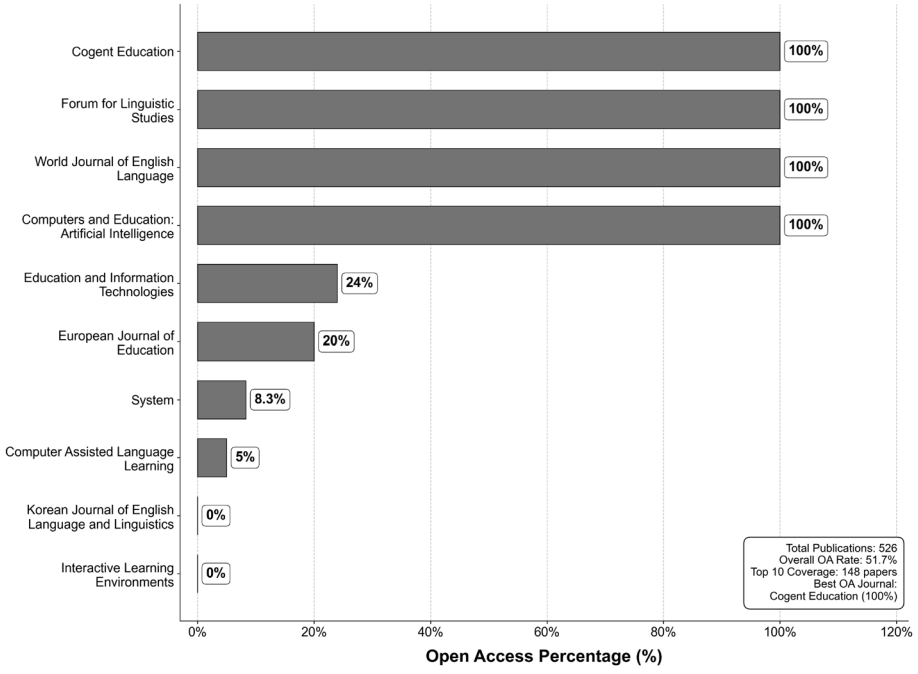


Fig. 25 Open access percentage in top 10 journals

By applying computational tools, we were able to examine a substantial body of literature that, until now, had not been fully explored in previous reviews. Thus, this study offers a fresh look at the use of AI tools in English language teaching. This dataset allowed us to pinpoint key global research trends and the way knowledge about AI

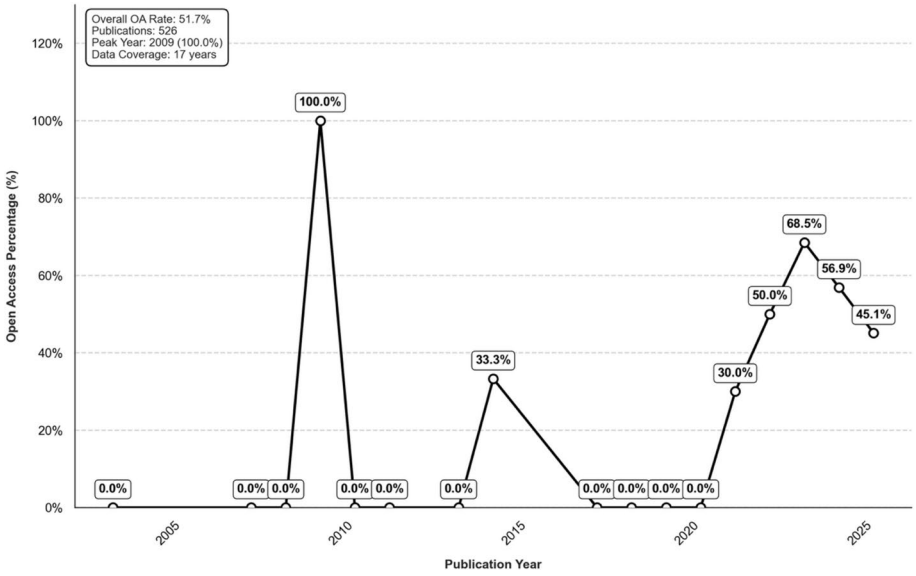


Fig. 26 Open access publication percentage per year

in ELT is shared and implemented in various educational settings as well as key topics shaping the instruction. Our results highlight a clear and significant growth in academic interest, marking a recognized shift in the field, as AI tends to be placed into the center of contemporary ELT research.

3.2 Trends in ERIC-indexed journals

In our study, we wanted to see the trends in the ERIC database, as it was less examined although it was mostly on educational research. Moreover, we were able to see the most studied educational levels, as provided in its API. Our analysis of the data from ERIC-indexed journals yielded 330 articles published between 2003 and 2025, ranging from a single publication in 2003 to 180 publications in 2024. Consistent with previous studies and data from the Scopus database, the number of publications has increased in recent years, paralleling developments in artificial intelligence. The upward trend appears to be continuing with 55 publications in the first half of 2025 (Fig. 27).

Among 330 publications, 149 articles were published in the top 10 journals. 30 articles were published in the *Education and Information Technologies,* 24 were published by the *Computer Assisted Language Learning,* and 16 were published by the *European Journal of Education* (Fig. 28), which were closely found in previous studies (e.g., [31]).

Among the top 10 paper locations, China leads the list with 40 articles, most of which were published in 2024. Taiwan and South Korea followed China with 24 publications each, while papers from Saudi Arabia were 23 (Fig. 29). The papers from the top 10 countries mostly began to be published before or in 2020 except South Korea from which papers began to be published in 2022 and Egypt and Vietnam from which papers began to be published after 2024.

As a database of resources on educational practices, ERIC provides information on the educational level at which studies were conducted. However, some papers did not specify an education level, and no standardized format exists for reporting grade levels. To address this, we categorized the studies into five levels: preschool, elementary (grades 1–4), middle school (grades 5–8), secondary school (grades 9–12), and post-secondary

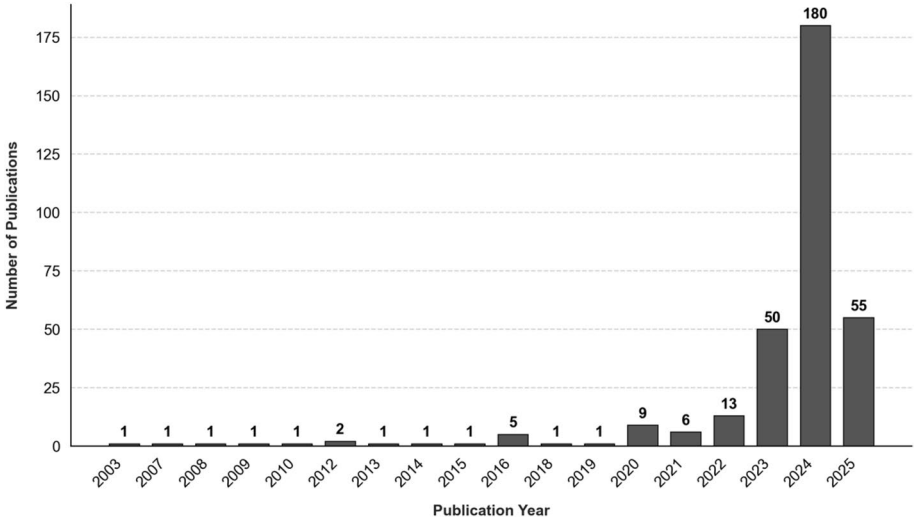


Fig. 27 Annual publication trends in the ERIC database

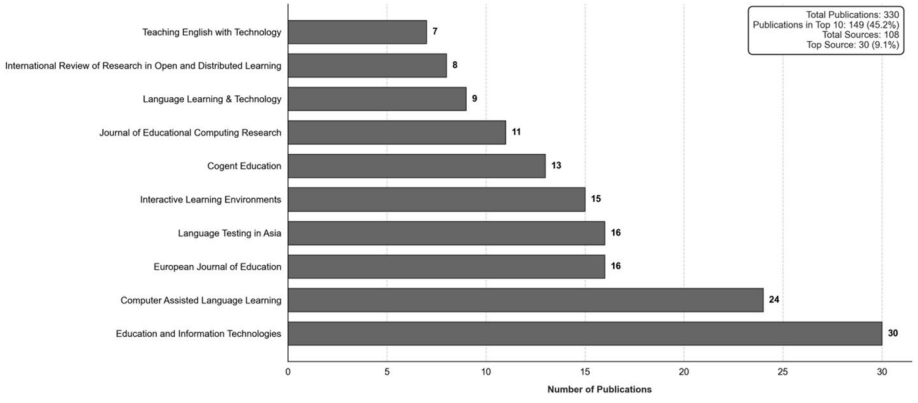


Fig. 28 Top 10 journals in ERIC and the number of publications

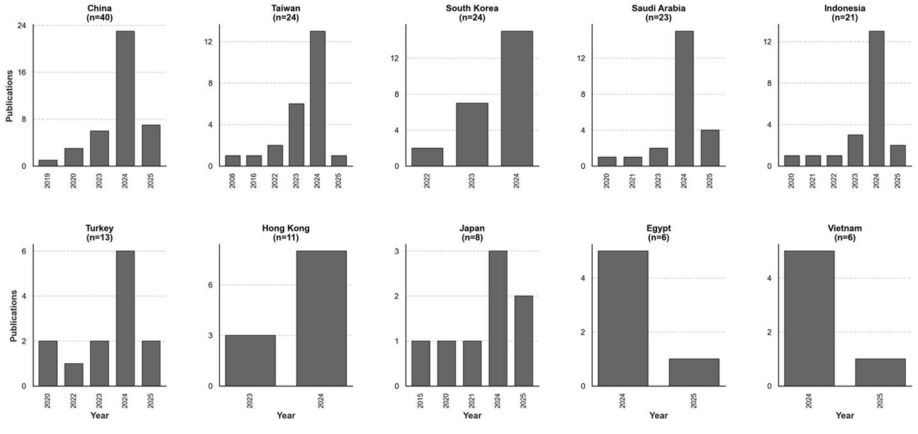


Fig. 29 Top 10 countries and the number of publications by year

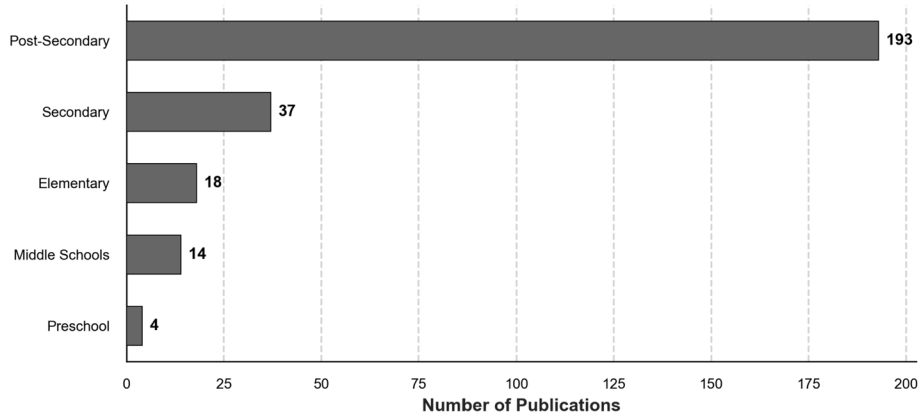


Fig. 30 Total number of publications by education level

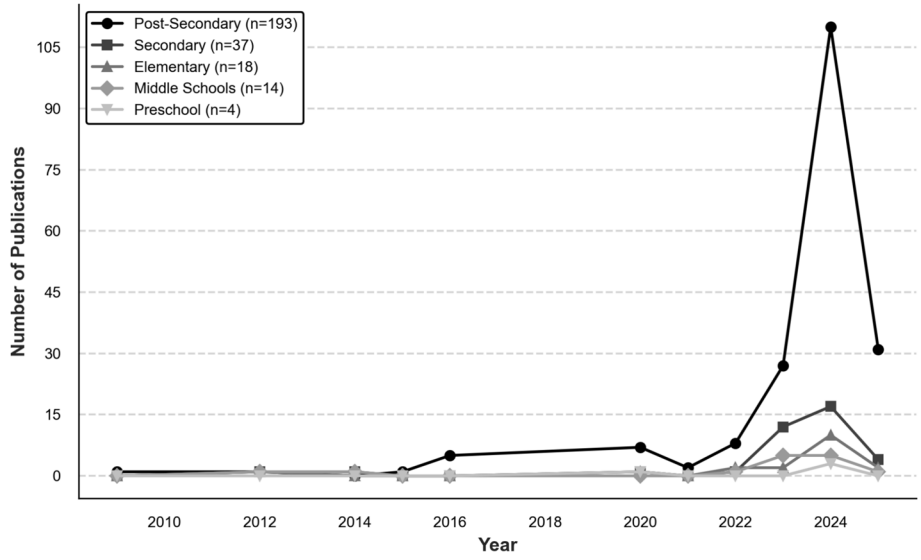


Fig. 31 Trends in the Publications by education level per year

(higher education) based on the information available in the publications (Fig. 30). The results revealed that most studies were conducted at higher education levels: 193 out of 241 articles shared information about the education level, which was also found in Dizon and Gayed's review focusing on the use of Grammarly (2024). Yearly examination of the publications also revealed a similar trend in that researchers studied the uses of AI in ELT, mostly in higher education and the least in pre-school (Fig. 31). These site choices may stem from the technological access of higher levels as well as easiness to get ethical permission for conducting research in higher education compared to working with minorities.

When the subjects (keywords) associated with AI were examined, the top six were *foreign countries*, *technology uses in education*, *computer software*, *student attitudes*, *teaching methods,* and *college students* (Fig. 32). These findings align with those reported in Huang et al. [16], Kartal and Yeşilyurt [20], and Bozkurt [5].

Researchers examined various subjects for various educational levels. Thus, there is no major tendency for a specific level or specific subject. The total number of studies conducted in higher education is 193, with generally on the subjects such as foreign

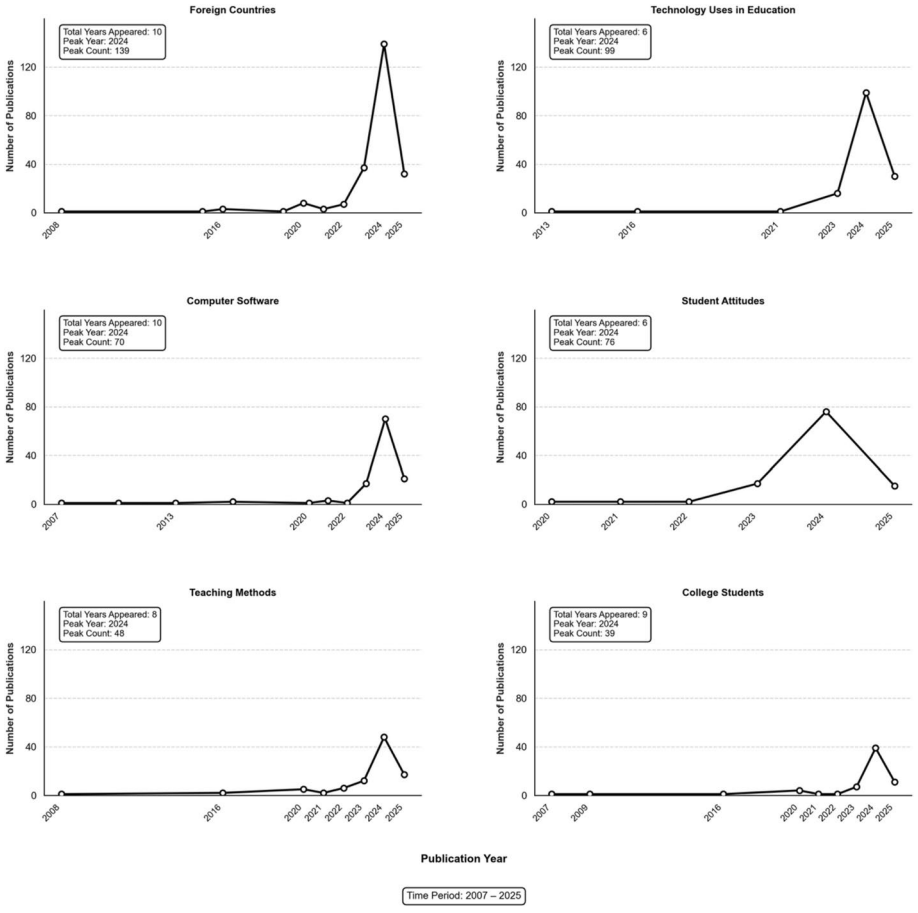


Fig. 32 Publication trends for top six subjects per year

countries, technology uses in education, and student attitudes (Fig. 33), which was supported by Jeon et al. [19] and Klimova et al. [22]. While student attitudes toward AI have been examined across all educational levels, research on writing evaluation remains concentrated in secondary and post-secondary education. Writing has emerged as a primary research focus and it is currently the most cited topic in the field, as data from the Scopus database also reveals. Writing remains one of the most challenging skills for learners to master, and providing comprehensive feedback requires an immense time commitment from instructors. Consequently, researchers aim to utilize AI tools to exemplify the uses of AI in providing effective feedback for instructors while enabling learners to improve their skills at their own pace.

Another valuable feature of ERIC is its data on the subjects covered in each journal, which helps researchers find the best fit for their interests (Fig. 34). Although the numbers are small, they provide information about the trending topics for each journal. Among the top six journals, the most common subjects in journals vary considerably. For example, *feedback* appeared in 16% of 30 papers in *Education and Information Technologies*, while *student attitudes* dominated in *Interactive Learning Environments* with 53.3% of the 15 papers. In *Language Testing in Asia,* almost 40% of the 16 papers were published on *teaching methods* and *feedback.* Teaching methods also featured prominently in *CALL* (almost 60% of 24 papers) and in the *Journal of Educational Computing Research* (about 40% of 11 papers). In *Cogent Education*, *student attitudes* were

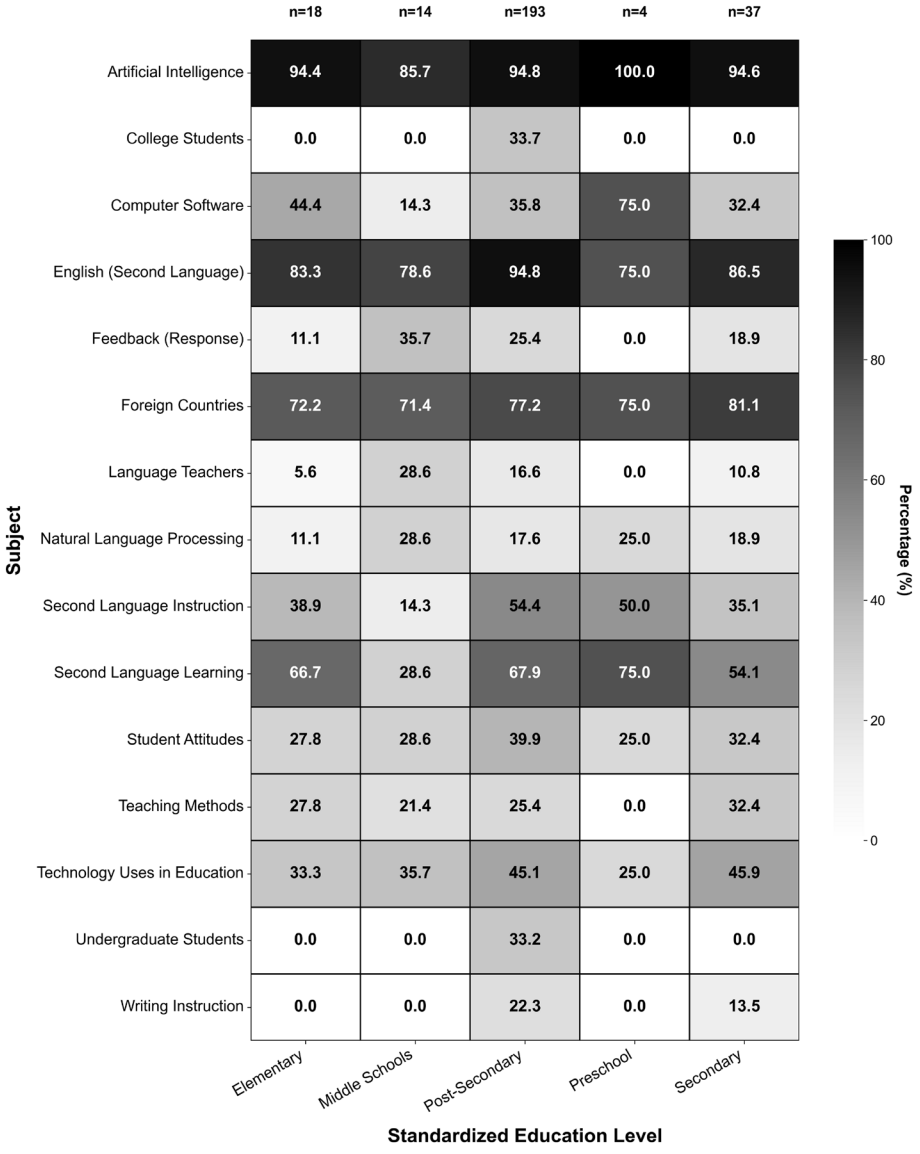


Fig. 33 Percentages of publications on AI related subjects by education level

examined in 60% of 13 papers. To sum up, writing evaluation, feedback, and language skills as a topic where AI tools were used were studied relatively more frequently, similar to the results found in other trend studies [9, 12, 18, 29, 34].

We examined the top locations associated with specific subjects. In this regard, papers originating from China (n = 42), Taiwan (n = 24), and South Korea (n = 25) most frequently addressed *student attitudes* to examine the use of AI tools in ELT. Among the 13 papers published in Türkiye, the most common subjects were *technology uses in education* and *computer software* (Fig. 35), aligning with topics recommended by other researchers conducting systematic reviews (e.g., [39]).

Although papers from the top 10 countries were published across the top 10 journals, there was limited diversity in the geographic origins of publications within individual journals on the topic of AI use in ELT (Fig. 36). For example, while articles on this topic sent from China appeared in seven different journals, papers on this topic sent from Türkiye, Japan, and Taiwan appeared in two journals. Papers on the use of AI tools in

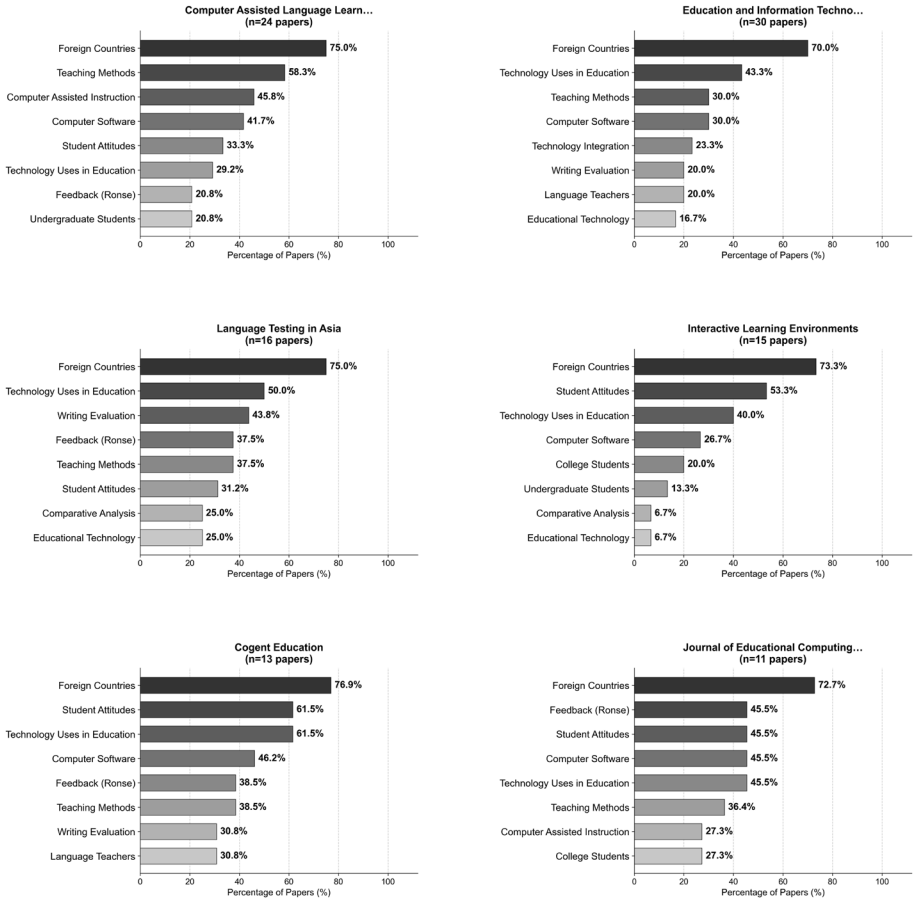


Fig. 34 Percentages of top topics in top six journals

ELT coming from seven different countries were published in *Education and Information Technologies*.

ERIC offers extensive information about journals, but, unlike Scopus, does not provide citation data. Thus, citation metrics for these papers were not compiled. Nevertheless, analyzing the key subjects, journals accepting papers from various countries, and countries actively researching AI in ELT offers valuable insights into current trends in the field.

3.3 NLP-based results on the AI use in ELT

As a unique tool to our study, we implemented topic modelling to reveal the topics discussed in the papers. Our NLP-based analysis showed that writing, ChatGPT, feedback, teachers, tools, and perceptions dominate the corpus, as shown in the word cloud (Fig. 37). In line with the key word analysis, in-depth analysis of the data indicated a major tendency towards the of a highly accessible and well-known tool.

Apart from this, LDA identified six themes across 856 papers (Fig. 38): AI feedback on writing (n=205), teacher-learner perceptions of AI tools (n=196), chatbots and speaking practice (n=140), teacher engagement and strategies (n=126), ChatGPT-generative AI potential (n=103), and reading-vocabulary (n=86). Topics (Appendix 2) over time show that all themes were marginal until 2022 and then peaked in 2024.

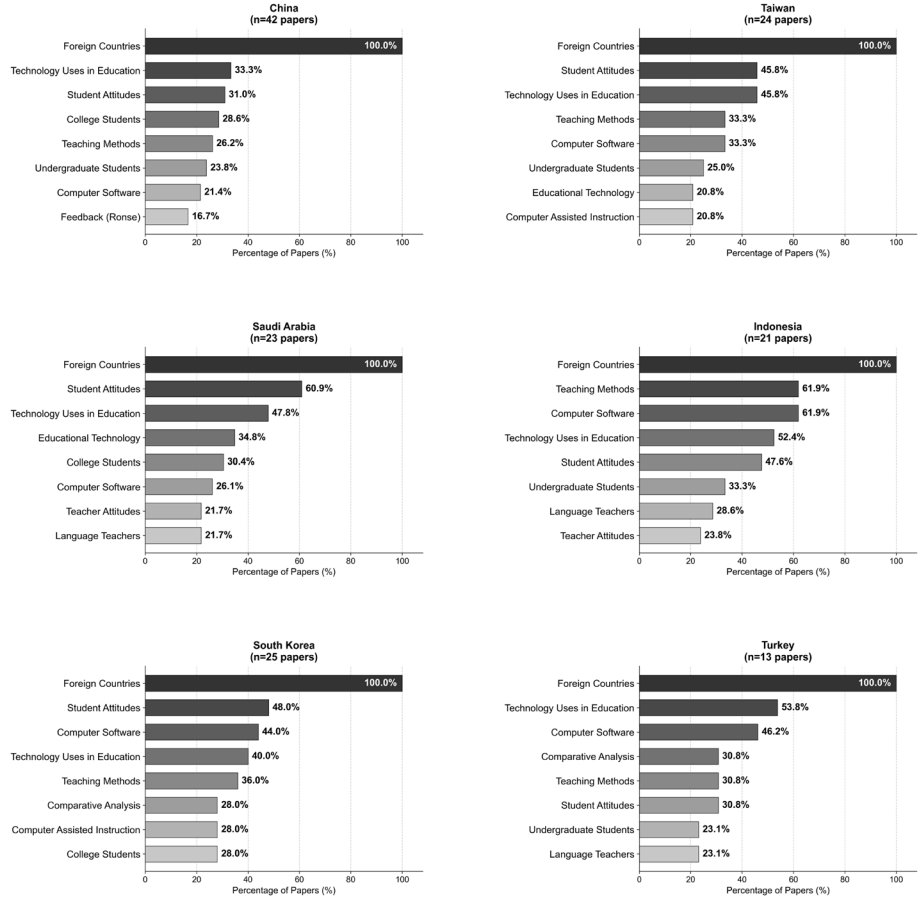


Fig. 35 Percentages of the top subjects in top six locations

In summary, our topic modeling analysis revealed the current trends in AI use in EFL settings, triangulating the findings in both databases. The trends in AI use is substantially increasing, while the research interests are mostly towards some specific tools and language skills, mostly writing, it seems that the research agenda for other topics such as vocabulary, speaking and perceptions is on the developing stage.

4 Conclusion and implications

This study aimed to identify the most recent trends in the application of artificial intelligence within ELT. Research topics in ELT are evolving swiftly along with the rapid developments in the field of AI. Consistent with previous studies, this analysis confirms an increase in the applications of AI in the teaching of English as a second or foreign language and the number of studies is increasing incrementally. This study not only highlights current trends but also builds upon prior research by revealing additional dimensions of interest within language education and shows that the topic is becoming a global phenomenon. In line with this, more bibliometric analyses and meta-analyses can be conducted to see the effectiveness of AI tools in ELT. As we included only studies conducted in EFL settings, studies on foreign language education for other languages can be examined.

We can indicate that China seems to lead the lists in both databases showing that EFL applications in China and its surrounding countries are becoming a widespread and

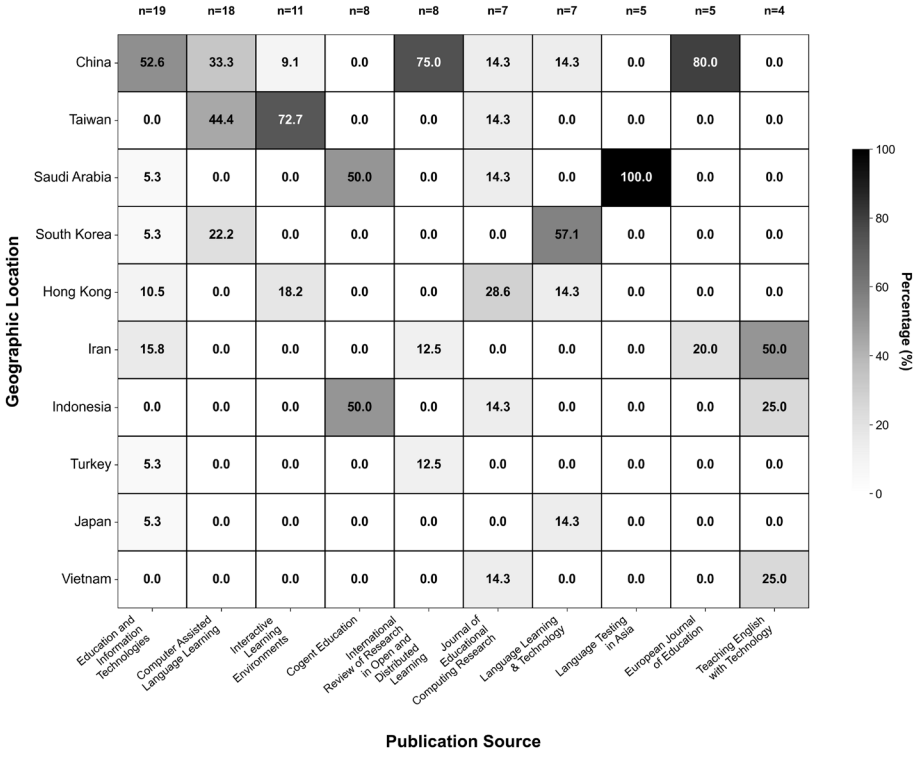


Fig. 36 Percentages of geographic distribution of publications by top 10 journals



Fig. 37 Word cloud of the corpus

teachers tend to integrate current advancements into the instruction. Geolocation information reveals that even though journals tend to publish publications from various countries, we can also see that due to the language of publication, some publications seem to be published in specific countries. Thus, authors may check the language requirements of the journals. Moreover, these location-based statistics show that we still need to hear more from other countries regarding the technological access as well as the strategies integrating AI in not only for teaching English but also other languages. Research conducted in less studied countries will also give us a clear map of understanding the actual

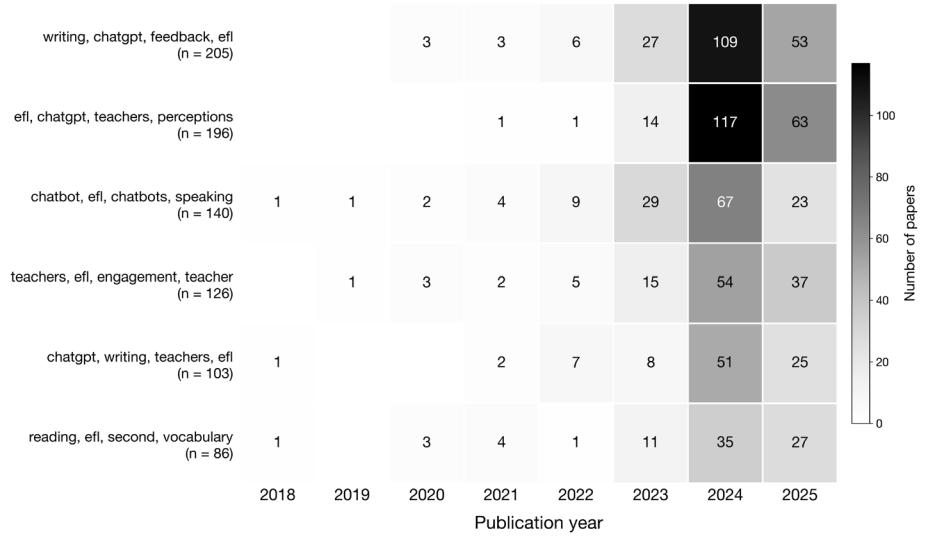


Fig. 38 Topic prevalence by year (LDA, 856 papers)

advantages of AI tools in diverse settings. In line with these, the wide range of journals indicate that publishers are supportive in providing opportunities to researchers to share their results with the wider community about the use of AI in ELT. Information about author locations can help researchers in these countries to establish a more solid and acceptable research agenda with a view to filling a gap in the literature.

In addition to overall implications, we can discuss some implications in reference to the results revealed in each database. For instance, citation information on Scopus shows that as the publications on AI use in ELT increase, it is highly possible for researchers to get recognized and cited in this subject. Thus, researchers who have concerns about their citation index can consider working on AI use in ELT. More specifically, the most cited papers are about writing and ChatGPT. This indicates that interest in the use of AI in writing and specific and well-known tools such as ChatGPT continues to persist. Researchers can focus on these topics for examining its effectiveness in different contexts. Or conversely, researchers can find other less examined tools to explore their applicability and feasibility so that teachers and learners can be informed about other possibilities without depending on only one or two publicly known tools. Open access options indicate several journals to be fully open access, so the researchers who want to reach more researchers, policymakers and ELT instructors can aim for open access journals.

As for ERIC database, we can recognize that ERIC seems to be an important database for educational researchers as it reveals specific information about the education level and hot topics. More importantly, it provides information about the educational level of a conducted study. Our study revealed the relative scarcity of research focused on educational levels other than higher education, indicating a significant gap in the literature. This gap offers opportunities for future research, particularly at preschool, elementary, middle, and secondary education levels. This can be an eye-opening result for the novice researchers who want to add novelty to the literature. As the use of AI and technological tools is becoming widespread in K-12 settings even though there are some restrictions on the use of social media or phones in daily life, researchers can conduct more studies regarding this age group to examine AI tools' effectiveness for them.

The findings of the key subjects indicate that student attitudes towards AI use and teaching methods are on the rise, which shows that researchers are concerned about the feasibility of the AI use and how the students, the actual beneficiaries of these teaching strategies, perceive these tools and our analysis revealed a significant gap in the AI use specifically for *language instruction* and *teaching methods*, highlighting these areas as promising directions for future research. Thus, the keywords and subjects identified in this analysis can also guide researchers in narrowing down their research focus. Our study only aims to show the trends; however, a quick overview of a couple of abstracts revealed that students tend to accept the effectiveness of AI tools [41] even though they have some ethical concerns [24] and some challenges with the results they got from their queries [40]. Thus, more careful examination of the results of these studies will help teacher educators and policymakers. Another topic highly examined is use of AI tools in providing feedback. ELT instructors can examine these tools and implement these tools depending on their context, as these tools seem to aid educators immensely and effectively, especially in terms of "metalinguistic guidance" [6]. However, effectiveness of AI tools in providing in-depth feedback is still a concern [35], which requires careful attention of the instructors in that both learners and the instructors should be aware of the quality of the feedback and teachers should not only rely on sharing AI-generated feedback. In this sense, more studies should be conducted to see the benefits, as the tools are constantly improved. Additionally, the developers can look for ways to improve the features of the tools that will enhance language instruction and feedback strategies.

ERIC also provides information about the subjects published in specific journals. The analysis of this information will help to design future research agendas better and help journals to see how they approach the issue and whether to expand their approach to other subjects. This will also help the researchers to recognize the focus of the journals as well as have a solid suggestion to address the gap and disseminate the findings through a journal with a better choice.

Utilizing a rigorous, multi-iteration computational search strategy with diverse criteria, this study identified 856 relevant papers—the largest dataset among review studies to date. The findings indicate that although there is a surge in research on AI in ELT, much of the current research remains at moderate levels, focusing mostly on perceptions rather than practical applications. Many indexed records concern perceptions, attitudes, feedback, writing, and higher education contexts. Hence, researchers are encouraged to address practical applications of AI in teaching in future studies.

Beyond the field of ELT, the results have also pointed to broader educational issues which deserve attention. The concentration of AI research at the higher education level might indicate unequal access to technological resources, infrastructure, and pre-service teacher training across different educational levels. This imbalance might deepen existing educational inequalities if younger learners and K–12 teachers are not provided with sufficient guidance and opportunities regarding AI tools. In addition, the increasing use of AI tools in feedback, writing instruction, and assessment raises important questions considering teacher roles, digital literacies, and the ethical use of technology in education. As AI tools become more prevalent in teaching and learning contexts, there will be a need to invest not only in technological access to relevant resources but also in pre- and in-service teacher training and curriculum adaptation which support equitable AI integration.

While this study focused on English language teaching, its limitations could be addressed in future research by incorporating additional languages, AI-related conferences, and other academic databases. Despite these limitations, the study provides comprehensive insights, especially for early career researchers in the field of ELT who seek information on AI-related tools in language teaching, the top 10 publishing journals, and the most frequently examined subjects in recent years.

Overall, this study tries to clarify the trends in the use of AI tool in ELT based on the journal articles shared in Scopus and ERIC databases, which are among the prominent stakeholders in the field of academia. Key words and detailed information on citations, journals and education levels will help ELT educators, policymakers, publishers and researchers in various aspects such as setting research agenda, being aware of most studied subjects, and broadening the scope of the research so that we can get better and comprehensive results for a better quality education, which is the fourth goal in the United Nation's Sustainable Development Goals [43].

Appendix 1

ERIC API query

Records were retrieved from the ERIC API by issuing GET requesets to:

https://api.ies.ed.gov/eric/?search=<QUERY>&rows=200&format=json&start=<OFFSET>, where <OFFSET> was incremented by 200 until all matched records were retrieved. The AI-related query <QUERY> was:

subject:"artificial intelligence" OR subject:"machine intelligence" OR
subject:"intelligent support" OR subject:"intelligent virtual reality" OR
subject:"chat bot" OR subject:"machine learning" OR subject:"automated tutor" OR
subject:"personal tutor" OR subject:"intelligent agent" OR subject:"expert system" OR
subject:"neural network" OR subject:"natural language processing" OR
subject:"chatbot" OR subject:"intelligent system" OR subject:"intelligent tutor" OR
subject:"AI"

The following 11 fields were requested for each of the records: id, description, subject, publicationdateyear, title, author, educationlevel, publicationtype, source, identifiersgeo, iescited.

Scopus API query

Records were retrieved from:

https://api.elsevier.com/content/search/scopus (authenticated with the institutional API key in the X-ELS-APIKey header). Query combined the AI terms, the ELT terms, and an "English" filter, and was issued once per year:

(TITLE-ABS-KEY("artificial intelligence") OR TITLE-ABS-KEY("machine intelligence")
OR TITLE-ABS-KEY("intelligent support") OR TITLE-ABS-KEY("intelligent virtual reality")
OR TITLE-ABS-KEY("chat bot") OR TITLE-ABS-KEY("machine learning")
OR TITLE-ABS-KEY("automated tutor") OR TITLE-ABS-KEY("personal tutor")
OR TITLE-ABS-KEY("intelligent agent") OR TITLE-ABS-KEY("expert system")
OR TITLE-ABS-KEY("neural network") OR TITLE-ABS-KEY("natural language processing")

OR TITLE-ABS-KEY("chatbot") OR TITLE-ABS-KEY("intelligent system")
OR TITLE-ABS-KEY("intelligent tutor") OR TITLE-ABS-KEY("AI"))
AND (TITLE-ABS-KEY("Second Language Learning") OR … OR TITLE-ABS-KEY("ESP"))
AND TITLE-ABS-KEY("English")
AND PUBYEAR = <year>

To overcome the Elsevier API's 5,000-result limit, retrieval was done year by year; for any year exceeding the limit, the query was further partitioned by document type (DOCTYPE). Only records with subtype_description = "Article" were retained.

ELT keyword set

The ELT terms used in the Scopus query and in the post-retrieval filter were:

Second Language Learning, Reading Skills, Reading Instruction, Grammar, Writing Instruction, Second Language Instruction, English Instruction, Academic Language, English Language Learners, Language Skills, Bilingualism, Linguistic Competence, Second Languages, Phonemic Awareness, Writing Exercises, Vocabulary Skills, Communicative Competence, Listening Comprehension Tests, English for Science and Technology, English for Academic Purposes, Listening Comprehension, Content and Language Integrated Learning, English Teachers, Listening Skills, English for Special Purposes, Language Aptitude, Bilingual Instructional Materials, English language teaching, English as a second language, English as a foreign language, English for specific purposes, English as an additional language, English as a lingua franca, ELT, ESL, EFL, ELL, ELF, EAP, ESP.

ELT filtering regular expression

After the retrieval, records were retained only if the following regular expression matched the title or the abstract/description:

\b(Second Language Learning|Reading Skills|Reading Instruction|Grammar|Writing Instruction|Second Language Instruction|English Instruction|Academic Language|English Language Learners|Language Skills|Bilingualism|Linguistic Competence|Second Languages|Phonemic Awareness|Writing Exercises|Vocabulary Skills|Communicative Competence|Listening Comprehension Tests|English for Science and Technology|English for Academic Purposes|Listening Comprehension|Content and Language Integrated Learning|English Teachers|Listening Skills|English for Special Purposes|Language Aptitude|Bilingual Instructional Materials|English language teaching|English as a second language|English as a foreign language|English for specific purposes|English as an additional language|English as a lingua franca|ELT|ESL|EFL|ELL|ELF|EAP|ESP)\b.

Appendix 2

LDA topics over all 856 papers.

Topic	Size	Top_Terms
2	205	writing, chatgpt, feedback, efl, teachers, tool, teacher, writing_skills, participants, university
0	196	efl, chatgpt, teachers, perceptions, tools, writing, foreign, generative, assisted, exploring
5	140	chatbot, efl, chatbots, speaking, pronunciation, writing, speaking_skills, foreign, technology, interaction
1	126	teachers, efl, engagement, teacher, strategies, support, technology, knowledge, test, generative

Topic	Size	Top_Terms
3	103	chatgpt, writing, teachers, efl, tools, genai, potential, tool, participants, process
4	86	reading, efl, second, vocabulary, chatgpt, development, esl, perceptions, questions, test

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