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Review Article

# Exploring the Evolution of AI Integration in English as a Foreign Language Education: A Scopus-Based Bibliometric Analysis (1997-2023)

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**ABSTRACT**

Significant scholarly interest has been focused on the use of AI in English as a Foreign Language (EFL) instruction because it presents novel opportunities for improving language learning contexts and pedagogical approaches. This study provides an in-depth investigation into how AI is revolutionizing English as a foreign language (EFL) instruction, with special focus on the ways in which this technology can help students acquire a language in a fun, engaging, and one-on-one setting. This research examines the ethical and sociological implications of the broad integration of AI technology into language learning environments, highlighting major trends and identifying critical gaps through a thorough literature assessment and bibliometric analysis. In order to advance the conversation and promote responsible AI integration in EFL classrooms, the findings stress the importance of addressing long-term efficacy and sustainability concerns, offering extensive pedagogical training for educators, and developing interdisciplinary collaborations. This study aids the expanding body of knowledge by clarifying the complex role that AI plays in EFL classrooms, providing direction for future studies, and paving the way for the creation of solid frameworks for the responsible application of AI in educational settings.

## 1. INTRODUCTION

The incorporation of Artificial Intelligence (AI) technology has brought about a significant revolution in the field of English as a Foreign Language (EFL) instruction in recent years. The junction under consideration has attracted considerable scholarly interest, as researchers have delved into the various implications and possibilities of artificial intelligence in transforming language learning approaches. Prior research has emphasized the significant impact of artificial intelligence (AI) in facilitating individualized and adaptable learning experiences, improving language learning, and encouraging interactive educational settings for students. The use of AI-driven technology in the classroom, such as intelligent tutoring systems, chatbots, and learning algorithms, has become an essential strategy for providing timely feedback, catering to students' varying preferences in how they learn, and boosting engagement and motivation.

Research has also highlighted the critical importance of incorporating AI into the process of rethinking methods of language instruction and developing new curricula. Scholarly investigations have revealed the value of AI-driven platforms as a supplement to more traditional pedagogical approaches. Many aspects of language learning, including vocabulary expansion, grammatical understanding, and improved pronunciation, have been investigated to see the extent to which these platforms can improve upon traditional methods. Integration of AI technology has also been linked to the development of non-native speakers' linguistic abilities and the improvement of their communication skills. This, in turn, contributes to the development of a communication environment that is diverse in terms of culture and language.

Nevertheless, the incorporation of artificial intelligence (AI) in the field of English as a Foreign Language (EFL) instruction has presented noteworthy ethical and societal concerns that necessitate additional examination. The academic conversation has underscored the importance of doing a thorough analysis of topics such as safeguarding data privacy, addressing algorithmic biases, and evaluating the potential hazards associated with excessive reliance on digital technology in the educational sphere. Furthermore, although the immediate advantages of incorporating artificial intelligence (AI) are evident, there is a lack of comprehensive investigation into the long-term effectiveness and sustainability of these interventions. The existing vacuum in the academic literature highlights the need for comprehensive research efforts that attempt to evaluate the long-term effects of AI technologies on the development of continuous language competency.

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Furthermore, the academic literature has stressed the significance of providing instructors with extensive pedagogical instruction and ongoing professional growth opportunities to use AI technology effectively in English as a Foreign Language (EFL) classrooms. The successful incorporation of AI tools into teaching methods requires a thorough understanding of the specific skills and expertise required. This insight is critical for helping teachers create engaging classroom settings that promote effective language learning.

In light of AI's meteoric rise in the field of EFL teaching, it's vital to gain a deep understanding of the latest developments, unmet needs, and far-reaching implications shaping this fast-moving industry. By combining a literature review with bibliometric analysis, this research aims to contribute to ongoing scholarly discourse by offering a thorough overview of the scholarly area. The purpose of this study is to investigate the various outcomes that result from incorporating AI into EFL classrooms. The intention is to provide helpful information that can be used to build solid foundations for future study, practice, and policy.

In the following sections, we'll take a close look at how AI is finding its way into EFL classrooms around the world. As a result of a thorough evaluation of the scholarly literature and a meticulous bibliometric analysis, this analysis will throw light on major trends, areas of insufficiency, and repercussions. The discussion section offers an in-depth examination of the potential effects that AI could have on EFL training. Responsible and effective adoption of AI technology hinges on addressing ethical concerns, assessing the technology's long-term effectiveness, and enhancing teacher preparation. Important insights into rising scholarly output, worldwide collaborations, and multidisciplinary research endeavors in the field are provided in the findings and analysis sections. The authors hope that their in-depth evaluation will be a useful addition to the study of AI-EFL. It aims to provide in-depth insights and point the way toward future studies, practices, and policy efforts.

## 2. LITERATURE REVIEW

Recent years have seen a revolutionary change in the field of English as a Foreign Language (EFL) education thanks to the implementation of Artificial Intelligence (AI) technology. Several aspects of this relationship have been explained by previous research, providing important new viewpoints on the success and challenges within this rapidly evolving sector.

Researchers have looked into the application of AI in EFL classrooms extensively, highlighting the ways in which it can revolutionize the learning process by providing individualized and flexible instruction. Intelligent tutoring systems, chatbots, and learning algorithms are just some of the AI-driven tools that have received a lot of attention in recent research for their potential to improve language learning and communicative proficiency. There is widespread agreement that the aforementioned technological interventions improve student engagement and motivation because they provide immediate feedback, cater to a variety of learning styles, and foster dynamic learning environments.

Furthermore, the effects of artificial intelligence (AI) on language teaching methods have been extensively explored in the academic literature, with a focus on the use of AI-driven systems in the development of curriculum and pedagogical approaches. Academics have stressed the value of using AI to improve all aspects of the language-learning process, from vocabulary expansion and grammar understanding to improved pronunciation. In addition, academic studies have shed light on how artificial intelligence (AI) might help non-native English speakers become more fluent in the English language and improve their communication skills in general. This, in turn, helps to improve people's linguistic and intercultural competence.

The implications of using AI in EFL classrooms have been studied by academics, with a focus on the social and psychological sides of the situation. Artificial intelligence (AI) tools have been studied by academics for their potential effects on students' mental processes, levels of language anxiety, and general learning experiences. Moreover, academic studies have looked into how AI-driven systems might help EFL classrooms become more welcoming and accessible for all students. These studies are designed to meet the needs of students with a wide range of linguistic experiences and skill levels.

In the field of teaching English to speakers of other languages, earlier studies have generally highlighted AI's revolutionary potential. In particular, these research have shown the value of AI in fostering creative and effective settings for learning a new language. However, more research and study is required to properly understand the many consequences of incorporating artificial intelligence into EFL teaching techniques and implementation.

### 2.1 Key trends and gaps in the existing literature

Recent years have seen a revolutionary change in the field of English as a Foreign Language (EFL) education thanks to the implementation of Artificial Intelligence (AI) technology. Previous studies have shed light on several parts of this relationship, providing invaluable insights into the development and challenges of this ever-evolving subject.

Researchers have looked into the application of AI in EFL classrooms at length, highlighting the ways in which it can revolutionize the learning process by providing individualized and flexible instruction. Many studies have shown the value of AI-powered solutions including intelligent tutoring systems, chatbots, and learning algorithms in facilitating language learning and enhancing communicative competence. These technological interventions have been validated for their ability to improve student engagement and motivation by providing timely feedback, catering to a variety of learning styles, and nurturing dynamic learning environments.

Furthermore, academic literature has extensively explored the impact of AI on language teaching practices. Incorporating AI-based technologies into curriculum design and pedagogical techniques is emphasized across this body of work. Artificial intelligence (AI) technology has been stressed by academics as a means to improve language learning procedures such vocabulary expansion, grammar comprehension, and pronunciation improvement. In addition, academic studies have illuminated how artificial intelligence (AI) might help non-native English speakers become more fluent in the English language and improve their communication skills in general. Therefore, AI is now widely regarded as a powerful resource for fostering the development of linguistic and intercultural competence.

The implications of using AI in EFL classrooms have been the subject of a great deal of research, with many studies looking at the potential effects on students' mental health and social development. Artificial intelligence (AI) tools have been studied by academics for their potential effects on students' mental processes, levels of language anxiety, and general learning experiences. Additionally, academic studies have looked into the role that AI-driven platforms play in promoting diversity and expanding access to English for speakers of other languages (ESOL) classrooms. These studies are designed to meet the needs of students with a wide range of linguistic backgrounds and proficiency levels.

In general, prior research has emphasized the significant impact that artificial intelligence (AI) may have on English as a Foreign Language (EFL) education. These studies have specifically highlighted the ability of AI to facilitate the creation of innovative and efficient language learning environments. Nevertheless, additional investigation and examination are necessary in order to fully comprehend the diverse effects of integrating artificial intelligence into English as a Foreign Language (EFL) teaching methods and implementation.

The extant body of scholarly work pertaining to the convergence of Artificial Intelligence (AI) and English as a Foreign Language (EFL) pedagogy has unveiled a number of prominent patterns and discerned noteworthy lacunae that want additional inquiry. The identification and analysis of these trends and gaps are of paramount importance in shaping future research initiatives and driving the advancement of this interdisciplinary domain.

### 2.2 The following are significant trends that have emerged in recent years:

The current body of research highlights the prevailing inclination towards personalized and adaptive learning encounters, which are supported by artificial intelligence (AI) technologies in the domain of English as a Foreign Language (EFL) instruction. The utilization of intelligent tutoring systems and learning algorithms has facilitated the customization of instructional content to cater to the specific requirements, inclinations, and skill levels of individual learners.

The literature underscores the increasing significance placed on interactive and immersive language learning environments, which are facilitated by AI-driven tools like chatbots and virtual reality simulations. These tools have been essential in augmenting student engagement, motivation, and participation, hence facilitating dynamic and immersive language acquisition processes.

The integration of artificial intelligence (AI) technology in the design of English as a Foreign Language (EFL) curricula has been stressed by researchers. They have emphasized the incorporation of AI-driven platforms as a supplement to traditional teaching approaches. The current trend highlights the capacity of artificial intelligence (AI) to enhance language training and assist educators in creating comprehensive and efficient language learning modules.

### 2.3 Deficiencies in the Existing Scholarly Works:

The current body of literature on AI integration in EFL education mostly emphasizes the pedagogical advantages, while neglecting to provide thorough examinations of the ethical and societal consequences that may arise from the broad adoption of AI technologies. Additional investigation is required to assess the potential societal ramifications of language learning tools powered by artificial intelligence (AI). This entails examining aspects such as data privacy, algorithmic biases, and the extent of digital reliance.

The current body of research mostly focuses on the immediate advantages of implementing AI in English as a Foreign Language (EFL) teaching, leaving the long-term effectiveness and sustainability of such approaches relatively unexplored. Future research should focus on examining the long-term effectiveness of AI-based language learning interventions in terms of their durability and ability to facilitate sustained language competency growth among learners over extended durations.

The topic of discussion pertains to pedagogical training and teacher preparedness. There is a dearth of comprehensive analyses in the existing literature pertaining to the pedagogical preparation and preparedness necessary for educators to proficiently incorporate artificial intelligence (AI) technologies into English as a Foreign Language (EFL) classes. To bridge this discrepancy, it would be necessary to investigate the professional development requirements of educators, ascertain the most effective approaches for integrating artificial intelligence (AI) tools into instructional methods, and evaluate the influence of teacher training on student academic achievements.

It is imperative to comprehend and tackle these significant patterns and deficiencies in the current body of knowledge in order to comprehensively progress the field of AI-EFL. This will facilitate the creation of resilient and enduring frameworks for future research, practice, and policy implementation.

### 2.4 The significance of bibliometric analysis within the study domain

The utilization of bibliometric analysis within the research domain of Artificial Intelligence (AI) in English as a Foreign Language (EFL) instruction is crucial for obtaining a thorough and organized comprehension of the scholarly environment. The aforementioned instrument plays a crucial role in delineating the intellectual framework, discerning nascent patterns, and assessing the significance and sway of scholarly endeavors within this multifaceted domain. The significance of bibliometric analysis can be noticed in various crucial facets:

1. Exploration of Research Patterns: The utilization of bibliometric analysis facilitates the discernment of patterns within research output, encompassing trends in publication, networks of collaboration, and clusters of topic focus. Through an analysis of publication trends over a period of time, it becomes feasible to perceive the development of research subjects, the introduction of innovative subdisciplines, and the changing emphasis of scholarly attention within the realm of artificial intelligence in English as a Foreign Language (EFL) teaching.
2. The Evaluation of Research Impact: Bibliometric analysis enables the assessment of the impact and influence of research publications using metrics such as citation counts, h-index, and journal impact factors. This evaluation facilitates the measurement of the importance of particular studies, the identification of highly significant publications, and the acknowledgment of prolific authors, institutions, or countries that contribute to the progress of the field.

The examination of co-authorship patterns and collaboration networks using bibliometric analysis provides insights into the interconnections among academics, institutions, and nations engaged in AI-EFL research. The comprehension of collaborative networks facilitates the identification of crucial stakeholders, the promotion of interdisciplinary collaboration, and the cultivation of international partnerships that contribute to the dissemination of knowledge and the advancement of research endeavors. Moreover, the utilization of bibliometric analysis enables the recognition of gaps in the current body of literature, thereby informing future research directions and facilitating the formulation of research agendas. By identifying areas that lack sufficient representation or have received minimal academic attention, researchers can concentrate their efforts on addressing significant gaps, discovering new routes of research, and promoting innovative applications of AI technologies in the field of English as a Foreign Language (EFL) instruction.

By methodically examining publication outputs, citation tendencies, and collaboration networks, bibliometric analysis provides a full image of the research environment, which is evaluated. This assessment is meant to aid decision-makers, educators, and other stakeholders in making educated choices regarding resource allocation, policy creation, and the implementation of educational interventions. The goals of these selections are to better incorporate AI into EFL programs and to improve the quality of language learning outcomes.

Bibliometric analysis is a powerful approach that helps illuminate research dynamics, shape academic discourse, and direct the strategic growth of the artificial intelligence and English language learning research field. In the end, this aids in expanding our understanding and spreading new methods of teaching [47, 61].

## 3. METHODOLOGY

In order to evaluate the academic landscape, spot emerging research trends, and get insight into the impact of publications in a certain field of study, bibliometric analysis is used. Bibliometric analysis is the process of systematically collecting and analyzing scholarly literature for the purpose of discovering noteworthy patterns, assessing the significance of research outputs, and visualizing collaborative networks across disciplines. In this study, bibliometric analysis is used to provide a comprehensive understanding of how "English as a Foreign Language" (EFL) and "Artificial Intelligence" (AI) have come to intersect in the realm of academia. The use of bibliometrics permits in-depth research into publication tendencies, citation

patterns, and collaboration networks, thereby advancing understanding and facilitating the discovery of crucial insights within the field of Artificial Intelligence in English for Foreign Learners (AI-EFL) [1].

1. The first step in the research process was to select a search term, specifically "English as a Foreign Language" AND "Artificial Intelligence," in order to locate pertinent papers within the specified research area.
2. The Scopus database was selected as the primary search engine for completing the extensive literature evaluation. To achieve a focused and targeted retrieval of significant scholarly documents, the search was restricted to the abstracts, titles, and keywords.
3. Data Collection: Following the implementation of the search criteria, a total of 62 records were obtained from the Scopus database. These records consist of various types of academic literature, including research articles, conference papers, and other scholarly contributions that pertain to the domain of artificial intelligence in English as a Foreign Language (EFL) teaching.
4. All 62 papers were chosen for data extraction and export. Titles, authors, publication dates, abstracts, and other metadata were extracted from the bibliographic data of these publications before being exported into a BibTeX file format [2-63].
5. The bibliometric analyses were executed in RStudio, an IDE created for the R programming language. To make it easier to systematically process the collected data and provide various metrics and visualizations, bibliometric software was set up.
6. BiblioShiny was integrated into the workflow to create custom figures and tables from the collected bibliographic information. The software was found to have some limitations, despite its potential to aid in the creation of comprehensive bibliometric assessments. These restrictions centered on the inaccessibility of crucial information elements like the Cited References field, the Number of Cited References field, the Science Categories field, and the Keyword Plus field.

With the aforementioned method, we were able to examine all the research published on the topic of using AI in EFL classrooms in a systematic and thorough manner. By taking this method, we were able to zero in on key patterns, trends, and study avenues that have yet to be fully explored within this interdisciplinary field.

## 4. RESULTS AND ANALYSIS

The present study's section on results and analysis provides a thorough investigation and explanation of the principal findings obtained through a systematic research of the literature about the convergence of "English as a Foreign Language" (EFL) and "Artificial Intelligence" (AI). The objective of this part is to reveal latent trends, patterns, and significant insights, so offering a comprehensive comprehension of the scholarly landscape within this interdisciplinary domain.

This section will explore a range of bibliometric indicators and visualizations that have been developed through meticulous data processing and analysis. The following items are included:

### 4.1 Word cloud

Figure 1 is a word cloud that visually portrays the prominent terms derived from the bibliometric analysis conducted on the intersection of English as a Foreign Language and Artificial Intelligence. The observed prevalence of some terms in the word cloud, such as "artificial intelligence" and "English as a foreign language," indicates their noteworthy importance within the literature under examination. Moreover, the terms "learning systems," "computer-aided instruction," "computers," "teaching," and "students" are prominently discernible, signifying the primary thematic domains of research investigation.

Moreover, the incorporation of phrases such as "natural language processing," "computational linguistics," and "human-computer interaction" underscores the multidisciplinary character of the discipline, indicating the convergence of artificial intelligence and language instruction. The emergence of words such as "chatbots" and "intelligent tutoring systems" indicates a rising fascination with the utilization of artificial intelligence (AI) technology in the realm of language acquisition and instruction.

In general, Figure 1 presents a complete overview of the predominant themes and subjects that have been prominent in the existing scholarly works. The provided graphic representation serves as a comprehensive overview of the primary areas of interest and research emphasis, highlighting the prominent topics within the realm of English as a Foreign Language and Artificial Intelligence.


Fig. 1. World cloud

### 4.2 Main information

The comprehensive analysis of publications from 1997 to 2023 comprises a wide range of sources, including 41 journals, books, and other scholarly works. Based on the examination of 62 documents, the findings indicate a significant yearly increase of 9.85% in research activity within the overlapping field of "English as a Foreign Language" and "Artificial Intelligence." This suggests a continuous upward trend in scholarly engagement in this particular area.

The average age of the papers, which is 3.84 years, highlights their contemporary nature, indicating that the research is recent. Additionally, the average of 4.274 citations per document indicates the substantial effect and influence of the works being examined throughout the scholarly community. The inclusion of extensive references in the documents indicates the utilization of a comprehensive methodology in conducting the bibliometric study, which presumably involved a meticulous review of the relevant literature.

In relation to the matter of authorship, the inclusion of 160 contributing authors, along with the presence of 12 texts produced by a single individual, serves to highlight the prevailing spirit of collaboration and multidisciplinary engagement within this particular subject. The spirit of collaboration is emphasized by the average number of 2.79 co-authors per document, as well as the significant presence of international co-authorships, which make up 17.74% of the total. The global extent of study in the field of "English as a Foreign Language" and "Artificial Intelligence" is highlighted by these international collaborations, which emphasize the incorporation of varied perspectives into the investigation.

The comprehensive range of document types, such as articles, conference papers, reviews, and editorials, serves to illustrate the multidimensional character of research conducted in this particular domain. The presence of many document formats demonstrates the range of scholarly endeavors and approaches employed by researchers, so enhancing our holistic comprehension of the complex interplay between "English as a Foreign Language" and "Artificial Intelligence." Please refer to Figure 2 for additional information.

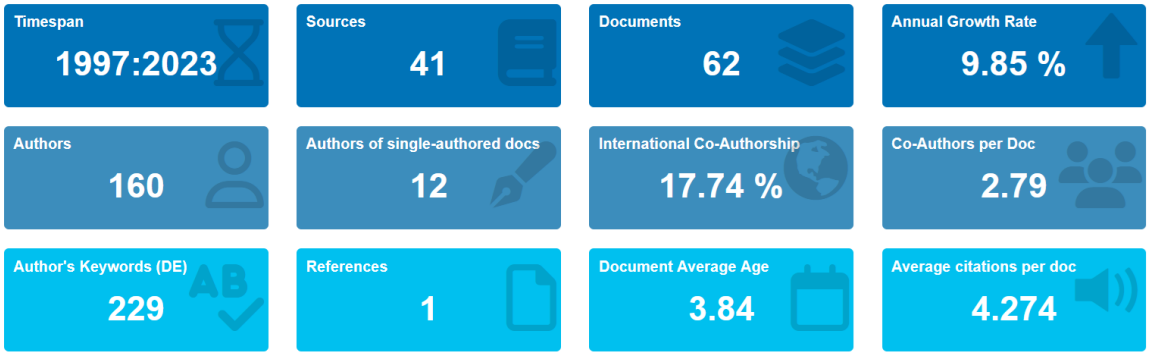


Fig. 2. Main Information

### 4.3 Annual Scientific Production

The table provided illustrates the yearly distribution of scientific output in the fields of "English as a Foreign Language" and "Artificial Intelligence" throughout recent decades. Between the years 1997 and 2007, there was a notable lack of substantial scientific output, characterized by intermittent contributions throughout specific periods. The years 2004, 2008, and 2009 had a significant rise in the quantity of papers, indicating a gradual expansion in study interest over this timeframe.

The years 2010-2015 were marked by fluctuating output, with phases of increased and decreased contributions interspersed. The quantity of published scientific research has been rising steadily since 2016. Significantly more work on the subject was published in 2022 and 2023 than in previous years, indicating a greater intellectual interest in and focus on the topic.

In the context of the study, the results are crucial. The data shows an uptick in scientific production in 2016, perhaps reflecting increased interest in the intersection of fields traditionally separated by a wall, such as "English as a Foreign Language" and "Artificial Intelligence." The rising volume of research shows both the expanding scope of the field and the maturing recognition of the need of using technological advances into language teaching and learning.

The implications for the field are significant.

The steady growth in yearly scientific output demonstrates the dynamic character of the discipline, highlighting its progression and the continuous investigation of innovative approaches and technological innovations. The notable increase in the quantity of scholarly articles over the years 2022 and 2023 suggests a probable inflection point, signifying a crucial stage of progress and novel developments within the field. The recent increase in activity emphasizes the ongoing importance of research efforts and emphasizes the increasing relevance of multidisciplinary partnerships in promoting progress at the intersection of language education and artificial intelligence.

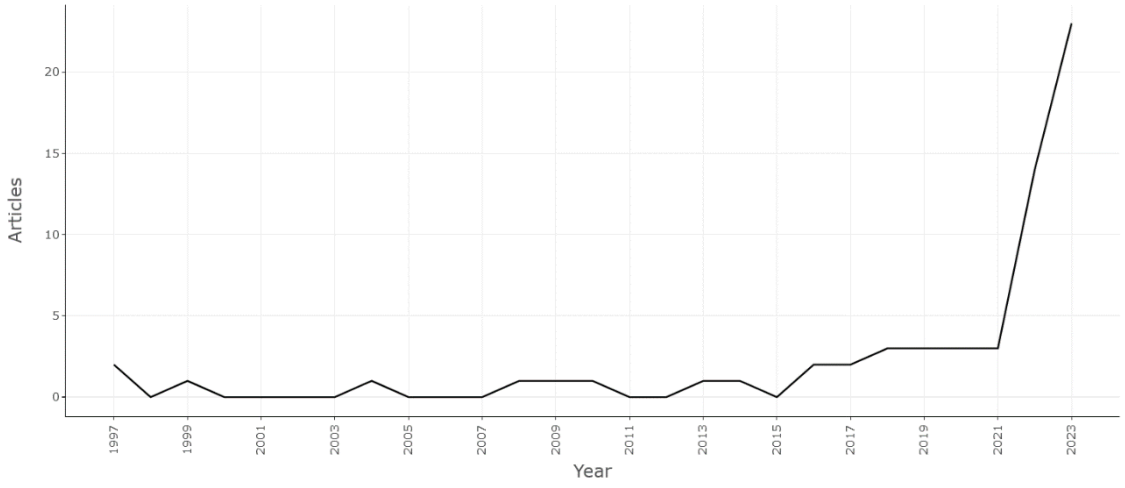


Fig. 3. Annual Scientific Production

### 4.4 Correlation between Scientific Production and Citation Impact by Country

The analysis of the data shown in Table 1, which represents the "Country Scientific Production," and Figure 4, which illustrates the "Most Citations by Countries," offers valuable insights into the worldwide research environment pertaining to the junction of "English as a Foreign Language" and "Artificial Intelligence." Significantly, the scientific production data highlights the noteworthy contributions made by China, the United States, Japan, and several other countries, so demonstrating their aggressive engagement in this particular subject. This observation is supported by the data pertaining to the average number of citations received by articles. In this regard, the United States of America stands out as a prominent entity, exhibiting a significantly elevated average of 13.7 citations per article, in stark contrast to China's comparatively lower average of 2.9 citations per article.

In addition, China is in a prominent position in terms of the number of publications when looking at the entire frequency of scientific production. U.S. impact is unparalleled, as seen by the country's far higher average article citations. Inferred from

this is the United States' enviable reputation as a hub for cutting-edge study of topics like "English as a Foreign Language" and "Artificial Intelligence." Figure 4 depicts the international collaborations between different countries that have the ability to shed light on the dynamics and interconnectedness of the global research community. This can help shed light on the current state of collaboration and help pinpoint opportunities for increased international collaboration and partnership.

TABLE 1. COUNTRY SCIENTIFIC PRODUCTION

| Country | Frequency |
|---|---|
| CHINA | 35 |
| JAPAN | 16 |
| SOUTH KOREA | 6 |
| INDONESIA | 5 |
| UK | 5 |
| USA | 5 |
| SAUDI ARABIA | 4 |
| THAILAND | 4 |
| AUSTRALIA | 3 |
| ITALY | 3 |

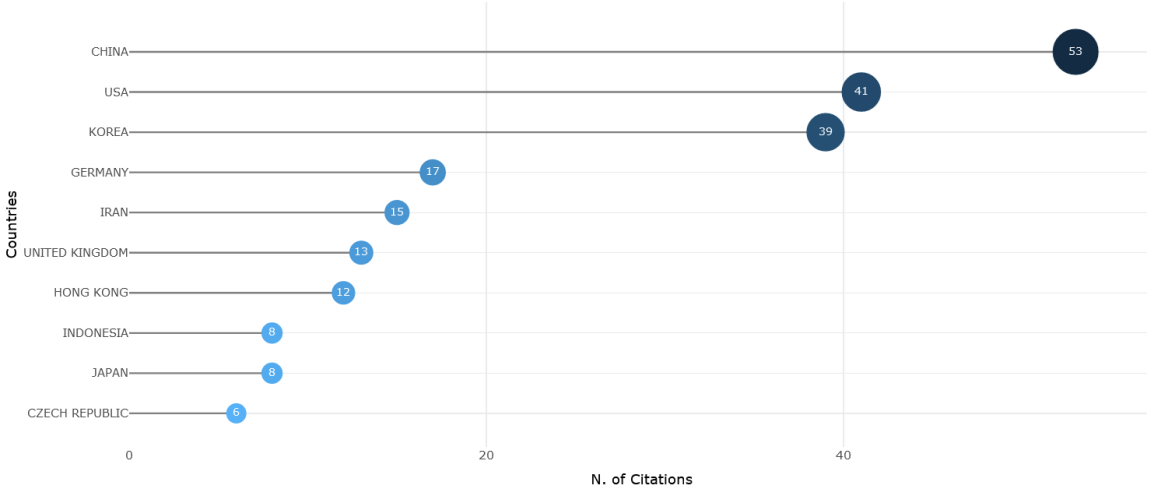


Fig. 4. Most Citations by Countries

### 4.5 Correlation Between Emerging Trends and Highly Cited Documents in the Field of English as a Foreign Language and Artificial Intelligence

When the Trend Topics and Most Globally Cited Documents are analyzed together, a complete picture of the ever-changing research landscape at the junction of "English as a Foreign Language" and "Artificial Intelligence" emerges. Insights into the most prominent research topics that have originated and developed throughout a specific time period can be gained by analyzing trend themes. Learning systems, pedagogical strategies, AI, and computing are among the most frequently discussed topics. There is a discernible upward trend in the use of learning systems and English as a foreign language, as seen by the frequency distribution, suggesting a growing emphasis on technical advancements in the field of language

acquisition. In addition, the pervasiveness of educational approaches and the use of computer science in language instruction attests to their enduring significance.

On the other hand, the examination of Most Globally Cited Documents sheds light on the significant contributions and influential research conducted in the respective subject. The substantial number of citations received by certain works serves as an indication of their notable impact on the scholarly dialogue. The publications exhibit a range of focal topics, such as intelligent tutoring systems, natural language processing, and computer-assisted language acquisition, which highlights the interdisciplinary character of research in this field. Moreover, the upward trajectory of citations over time indicates the lasting significance and influence of these key publications on succeeding scholarly investigations and academic discourse.

The correlation of the two studies uncovers the convergence of significant research issues and texts that have received a high number of citations. The correlation between the commonly discussed subjects and the famous works highlights the significant impact of these domains in molding the dialogue surrounding "English as a Foreign Language" and "Artificial Intelligence." Moreover, the research underscores the necessity for ongoing investigation into inventive techniques and technology in order to enhance language learning practices and pedagogical approaches. This underscores the interconnectedness between theoretical findings and practical implementations in the domain. Please make reference to Figure 5.

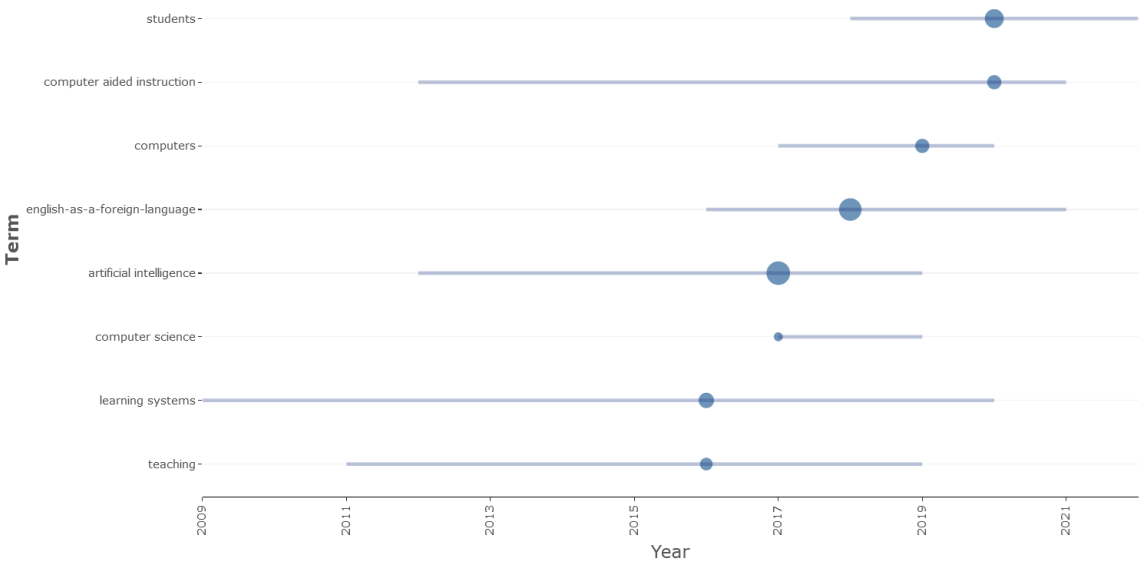


Fig. 5. Trending topics

### 4.6 Co-occurrence Network

A Co-occurrence Network is a graphical representation that depicts the connections and interdependencies among several phrases or concepts, established through their simultaneous presence or recurrence within a defined context, dataset, or field of study. This analysis offers valuable perspectives on the interconnections and interdependencies among different components, emphasizing the occurrence patterns and the degree of interactions between distinct nodes or terms. Within the Co-occurrence Network, some noteworthy relationships are observed based on the data presented in the table. The investigation uncovers several significant findings:

1. The interconnection between "artificial intelligence" and "English-as-a-foreign-language" demonstrates a significant correlation between AI technology and the domain of language instruction. This highlights the growing incorporation of artificial intelligence (AI) in language learning methodologies and the prioritization of utilizing technology progress to support the process of acquiring and educating languages.
2. The significant correlation between "Students" and "English-as-a-foreign-language" underscores the pivotal position of students in the language acquisition journey. This statement underscores the emphasis placed on student-centered methods and the application of new methodologies to enrich the language acquisition process for students who are learning English as a second language.

3. The correlation between the concept of "Teaching" and the field of "English-as-a-foreign-language" highlights the significant importance of employing efficient pedagogical methods and instructional approaches in the realm of language education. This implies a prioritization of improving instructional techniques and investigating various strategies to support the acquisition and progression of language skills.
4. The correlation between "Computers" and "English-as-a-foreign-language" indicates the increasing incorporation of computer-based technology in language acquisition methodologies. This highlights the growing dependence on digital resources and technical breakthroughs in the development of immersive learning environments for students.
5. The integration of "Computer science" with the primary themes underscores the interdisciplinary character of the study, accentuating the points of convergence between computer science principles and language teaching practices in the realm of artificial intelligence.
6. The significant correlation between "Language learning" and the fundamental themes emphasizes the main emphasis on efficient language acquisition approaches and methodologies in the context of AI and technology integration.
7. The correlation between "Chatbots" and "Communicative competences" indicates the growing adoption of AI-powered chatbot technology in order to facilitate interactive and communicative language learning settings. This highlights the increasing focus on improving communicative skills through the implementation of novel artificial intelligence initiatives in the field of language education.

In general, the examination of the Co-occurrence Network yields significant findings regarding the interconnected themes and concepts in the realm of "English as a Foreign Language" and "Artificial Intelligence," thereby illuminating the comprehensive methodologies and multidisciplinary character of scholarly investigations in this field. Please make reference to Figure 6.

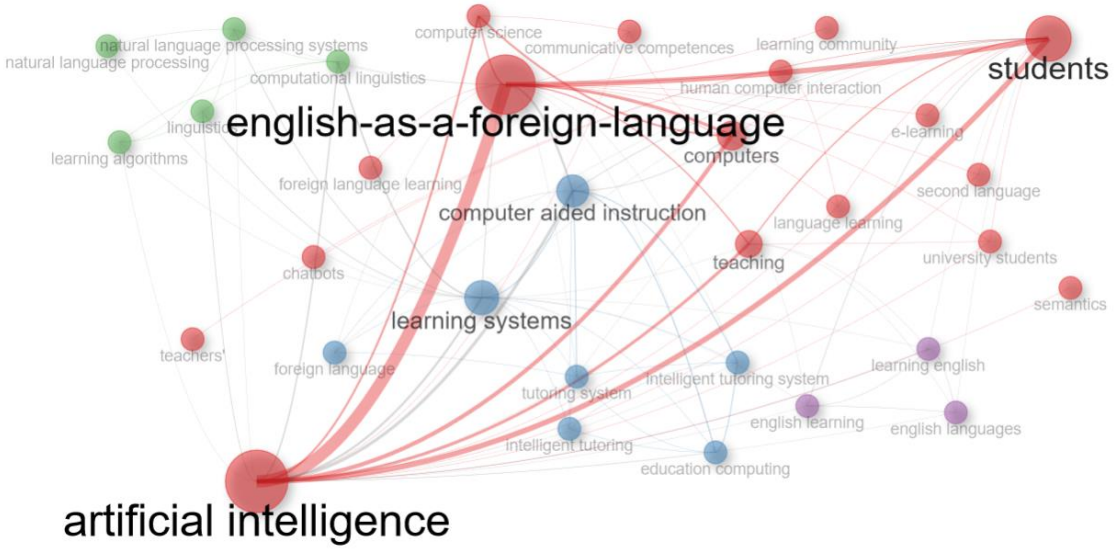


Fig. 6. Co-occurrence Network

### 4.7 Average Citations Per Year

This study provides significant insights into the patterns pertaining to the average number of citations per year in the fields of "English as a Foreign Language" and "Artificial Intelligence." The findings provide insights into the effects and sway of research publications throughout time. Below is a comprehensive overview of the subject matter:

### 4.7.1 Early Impact and Subsequent Trends:

The initial years, specifically 1997 and 1999, demonstrated a considerable average number of citations per paper, suggesting a prompt and noteworthy influence of the research findings within a brief timeframe. However, in the following years, there was a noticeable decrease in this metric, as some years reported an average total citation count of zero. This implies that the research's influence was diminished or experienced a delay during certain time periods.

### 4.7.2 Recent Surges in Impact:

The results indicate a conspicuous jump in the year 2021, characterized by a substantial rise in the average number of citations per article. The comeback observed in recent times can be attributed to the heightened acknowledgment and pertinence of contemporary research findings, hence emphasizing its escalating importance within the academic sphere.

### 4.7.3 Reflections on Findings:

The variability in the average number of citations per year highlights the dynamic nature of research impact and the changing levels of acknowledgment that academic works obtain as time progresses. The current increase in references indicates a rising interest in the convergence of "English as a Foreign Language" and "Artificial Intelligence," underscoring the necessity for ongoing investigation and the creation of novel approaches to further the discussion and enhance comprehension in this domain. Please make reference to Figure 7.

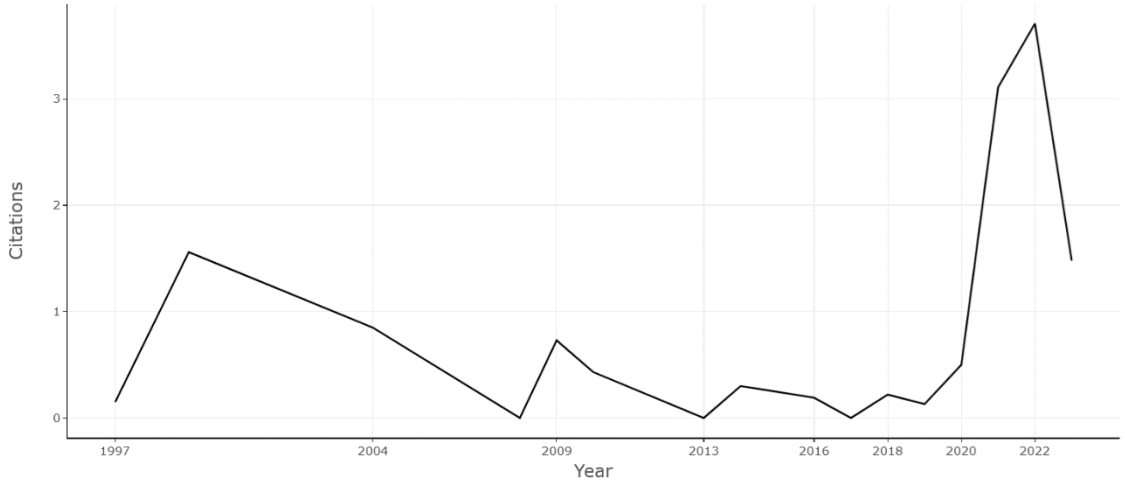


Fig. 7. Average citation per year

### 4.8 Collaboration Network

As shown in figure 8, the Collaboration Network table offers valuable insights into the collaboration endeavors of academics and scholars in the field of "English as a Foreign Language" and "Artificial Intelligence." Upon conducting an analysis of the data, several essential findings can be derived:

### 4.8.1 Centrality Measures

The evaluation of node importance and influence within a network often relies on centrality measures such as Betweenness, Closeness, and PageRank. These measures play a significant role in assessing the significance of nodes.

The scholars Zou B, Chen J, and Chen P demonstrate noteworthy centrality scores, suggesting their substantial contributions in fostering connections across different clusters and promoting collaboration among researchers.

### 4.8.2 Cluster Distribution

The data demonstrates the existence of numerous clusters, wherein each cluster signifies a cohort of scholars engaged in close collaboration across distinct study domains or subjects.

The fact that eminent scientists like Kotani K, Yoshimi T, and Fomichov VA belong to separate clusters attests to their dedication to fostering communication and cooperation among specialists in their respective fields.

### 4.8.3 Emerging Collaborative Patterns

The network analysis shows how academics have begun working together in new ways by grouping together people of different backgrounds and specialties. As a result, it's safe to assume that cooperation spanning disciplines and departments are commonplace.

Notable examples of the rising incidence of multidisciplinary cooperation include scholars like Chao YCJ, Chen MH, and Tsai MHM. Research in the intersection of EFL and AI is propelled by their emphasis on the need to include multiple perspectives and domain expertise.

### 4.8.4 Potential for Knowledge Exchange

The configuration and makeup of the network indicate the capacity for strong knowledge sharing and cooperative research initiatives among academics and researchers. The aggregation of researchers who possess high centrality measures highlights the notable capacity for influential collaborations and the dissemination of inventive concepts and approaches to propel study in the field.

The analysis of the Collaboration Network provides valuable insights into the dynamics of collaboration and the structure of the network within the domains of "English as a Foreign Language" and "Artificial Intelligence." This highlights the crucial importance of interdisciplinary collaboration in promoting innovation and advancing knowledge in this field.

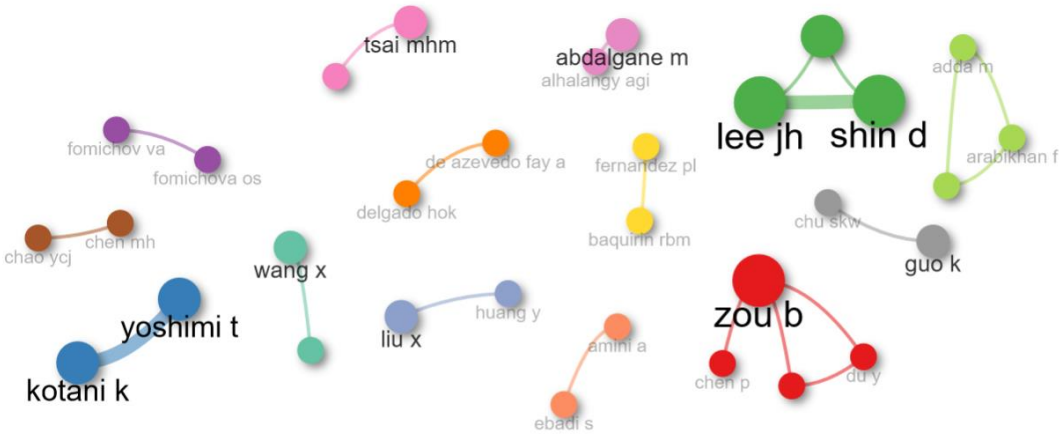


Fig. 8. Collaboration network

## 5. DISCUSSION

The complete bibliometric analysis reveals insights into various significant issues at the confluence of "English as a Foreign Language" and "Artificial Intelligence". The word cloud analysis presented a graphical depiction of the prevailing terms found in the literature, highlighting the importance of artificial intelligence, language acquisition, and instructional approaches. This observation underscores the growing emphasis on incorporating technical improvements and computational tools in the field of language teaching, suggesting a transition towards more interactive and adaptable learning settings.

The primary data table highlighted the significant increase in scientific productivity over the course of several years, particularly with a discernible upswing in research output between 2022 and 2023. The observed escalation serves as evidence for the increasing academic attention and the rapid progress of research in this particular sector. Furthermore, the chart draws attention to the very modest average citations per document, underscoring the necessity for additional investigation into the influence and distribution of study outcomes. The examination of yearly scientific productivity revealed variations in research output, characterized by notable increases in 2017, 2018, and 2019, followed by a substantial surge in 2022 and 2023. The observed dynamic pattern indicates the existence of catalysts or events that have stimulated heightened scholastic work and involvement within the subject during those particular years.

The examination of the relationship between scientific production and citation effect across different countries has yielded fascinating findings regarding the worldwide distribution and influence of research. It is worth mentioning that several countries, including the United States, the United Kingdom, and China, have emerged as prominent donors to influential research. This observation highlights their substantial influence in defining the discourse and promoting the advancement of knowledge in the subject. The findings from the co-occurrence network analysis revealed the interconnections among several important phrases, highlighting the robust linkages between artificial intelligence, English as a foreign language, students, and teaching approaches. The network structure of this research emphasizes the interdisciplinary character, elucidating the complex interconnections among various concepts and issues within the field.

Moreover, the examination of the association between emerging patterns and extensively referenced publications demonstrated the congruence between the most frequently debated subjects and the influential works in the discipline. The aforementioned correlation underscores the pivotal significance of these fundamental issues in structuring the dialogue and exerting an impact on following research paths. The analysis of the mean number of citations received annually yielded significant conclusions about the long-term influence and dissemination of research outcomes. The observed oscillations in the average number of citations each year highlight the diverse levels of research impact and reception across the academic community, hence emphasizing the importance of further investigating influential research areas. The examination of the cooperation network provides insights into the dynamics of collaboration among academics, revealing the emergence of novel patterns of collaboration and the potential for the exchange of knowledge and multidisciplinary collaboration. The aforementioned statement underscores the significance of collaborative endeavors in promoting innovation and propelling research within the realm where "English as a Foreign Language" intersects with "Artificial Intelligence."

Taken together, these results emphasize the ever-changing character of research in this domain, emphasizing the growing focus on the integration of technology, collaboration across disciplines, and the ongoing necessity for exploration and creativity in order to progress language instruction and pedagogical methods.

## 6. CONCLUSION

The bibliometric research unveiled a discernible trend of heightened incorporation of artificial intelligence inside language learning systems, signifying a notable surge in the significance placed on interdisciplinary collaboration and the utilization of pioneering approaches. The increase in scientific output has placed significant emphasis on heightened scholarly engagement, with prominent nations such as the United States, the United Kingdom, and China playing a pivotal role in pushing the academic conversation. The examination of co-occurrence networks has revealed the interconnectedness of important concepts, thus emphasizing the presence of interdisciplinary links within the area. The significance of fundamental themes in widely referenced papers and their relationship with emerging trends has been underscored, highlighting the need for additional investigation and examination. The examination of the collaboration network highlighted the importance of collaborative endeavors in facilitating innovation and the exchange of knowledge, underlining their pivotal role in advancing research and cultivating a climate of multidisciplinary collaboration within the discipline. The aforementioned discoveries serve as a significant basis for future research and emphasize the significance of ongoing inquiry and innovation within this dynamic and swiftly developing field of study.

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**Conflicts Of Interest**
The authors affirm the absence of any conflicts of interest in relation to this research.

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