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BIBLIOMETRIC ANALYSIS OF STUDIES ON THE USE OF ARTIFICIAL INTELLIGENCE IN FOREIGN LANGUAGE EDUCATION

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Abstract

This study aims to analyze the scientific literature on artificial intelligence (AI) applications in foreign language education using a bibliometric approach. A total of 1,188 articles published between 2020 and 2025 in the Web of Science Core Collection were examined based on the keywords “AI-assisted language learning,” “NLP in education,” and “intelligent tutoring systems.” The analysis was conducted using VOSviewer software, which enabled the examination of country-author-institution distributions, citation networks, keyword clusters, and co-authorship structures. The results reveal that China, the United States, and the UAE lead the field in publication volume. Influential scholars such as Barrot (2023), Davis (2022), and Bandura (2021) were identified with high citation impacts. Frequently recurring keywords include “ChatGPT,” “critical thinking,” “learning motivation,” and “writing skills.” Co-authorship mapping reveals limited interdisciplinary collaboration and predominantly region-based partnerships, while the absence of sustained international co-authorship highlights the fragmented and locally bound nature of research collaboration in this field. The findings highlight the evolving role of AI in language education, particularly in adaptive learning, student perception, and instructional innovation. This study contributes to the field by quantitatively identifying epistemological patterns and research gaps, offering a strategic roadmap for future studies in AI-supported language learning.

Keywords: artificial intelligence; language education; bibliometric analysis; ChatGPT; natural language processing

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YABANCI DİL EĞİTİMİNDE YAPAY ZEKÂ KULLANIMI KONULU ÇALIŞMALARIN BİBLİYOMETRİK ANALİZİ

Öz

Bu çalışma, bibliyometrik bir yaklaşım kullanarak yabancı dil eğitiminde yapay zekâ (AI) uygulamaları hakkındaki bilimsel literatürü analiz etmeyi amaçlamaktadır. Web of Science Core Collection'da 2020 ile 2025 yılları arasında yayınlanan toplam 1.188 makale, "AI destekli dil öğrenimi", "eğitimde NLP" ve "akıllı öğretim sistemleri" anahtar kelimeleri temel alınarak incelenmiştir. Analiz, VOSviewer yazılımı, ülke-yazar-kurum dağılımları, atıf ağları, anahtar kelime kümeleri ve ortak yazarlık yapıları aracılığıyla gerçekleştirilmiştir. Sonuçlar, yayın hacmi açısından Çin, Amerika Birleşik Devletleri ve Birleşik Arap Emirlikleri'nin bu alanda lider olduğunu ortaya koymaktadır. Barrot (2023), Davis (2022) ve Bandura (2021) gibi etkili akademisyenler, yüksek atıf etkisine sahip olarak tanımlanmıştır. Sıkça tekrarlanan anahtar kelimeler arasında "ChatGPT", "eleştirel düşünme", "öğrenme motivasyonu" ve "yazma becerileri" bulunmaktadır. Ortak yazarlık haritalaması, disiplinler arası iş birliğinin sınırlı olduğunu ve ağırlıklı olarak bölge bazlı ortaklıklar olduğunu ortaya koyarken, sürdürülebilir uluslararası ortak yazarlığın yokluğu, bu alandaki araştırma iş birliğinin parçalı ve yerel nitelikli doğasını vurgulamaktadır. Bulgular, dil eğitiminde, özellikle uyarlanabilir öğrenme, öğrenci algısı ve öğretim yeniliklerinde yapay zekânın gelişen rolünü vurgulamaktadır. Bu çalışma, epistemolojik kalıpları ve araştırma boşluklarını nicel olarak belirleyerek, yapay zekâ destekli dil öğreniminde gelecekteki çalışmalar için stratejik bir yol haritası sunarak bu alana katkıda bulunmaktadır.

Anahtar Kelimeler: yapay zekâ; dil eğitimi; bibliyometrik analiz; ChatGPT; doğal dil işleme

Yasal İzinler: Bu araştırma kapsamında insan(lar)dan veri toplanmadığı için etik kurul iznine tabi değildir.

Geniş Özet

Bu çalışma yabancı dil eğitiminde yapay zekâ (YZ) uygulamalarına ilişkin bilimsel yayınları bibliyometrik analiz yöntemiyle incelemeyi amaçlamaktadır. Araştırma, 2020-2025 yılları arasında Web of Science Core Collection veri tabanında yayımlanan 1.188 makalenin "AI-assisted language learning (YZ destekli dil öğrenimi)", "natural language processing in education (eğitimde doğal dil işleme)" ve "intelligent tutoring systems (akıllı öğretim sistemleri)" anahtar kelimeleri temel alınarak yapılandırılmasıyla gerçekleştirilmiştir. Çalışmanın temel amacı, alandaki yayın eğilimlerini, coğrafi ve kurumsal dağılımı, etkili yazarları, tematik odakları ve iş birliği ağlarını ortaya koymaktır. Bibliyometrik analiz, bilimsel üretimin nicel yapısını görselleştirme ve epistemolojik kalıpları belirleme potansiyeli nedeniyle tercih edilmiştir (Hassan & Duarte, 2024). Bu kapsamda dört ana araştırma sorusu ele alınmıştır: Yayın çıktılarının coğrafi ve kurumsal dağılımı nasıldır? Anahtar kelime kümeleri hangi tematik eğilimleri yansıtmaktadır? Ortak yazarlık ağları disiplinler arası iş birliği açısından ne düzeyde gelişmiştir? Gelecek araştırmalar için kritik yol haritaları nelerdir?

Veri filtreleme aşamasında, İngilizce dilinde yazılmış araştırma ve derleme makaleleri dahil edilmiş, minimum frekans eşikleri uygulanarak anlamlı gruplamalar oluşturulmuştur. Örneğin, anahtar kelime analizinde en az beş tekrar şartı aranmış, ortak yazarlık ağlarında ise minimum iki yayın kriteri benimsenmiştir. Ağ haritalarında düğüm boyutları yayın veya atıf

sayısını, kenar kalınlıkları iş birliği yoğunluğunu temsil etmektedir. Kümeleme sürecinde benzer düğümleri bir araya getirerek tematik yapıları daha belirgin hâle getiren LinLog modüler optimizasyon algoritması kullanılmış; düğümler arasındaki ilişkisel yakınlık ise yönelim temelli bir ölçüm sunan kosinüs benzerliği yöntemiyle hesaplanmıştır. Bu parametreler, bibliyometrik haritalamanın geçerliliğini ve güvenilirliğini artırmak amacıyla şeffaf bir şekilde raporlanmıştır.

Bulgular kısmında, yıllara göre yayın dağılımı incelendiğinde, 2020-2025 döneminde istikrarlı bir artış gözlemlenmiştir. 2024 ve 2025 yıllarında yayın sayısındaki belirgin yükseliş, büyük dil modellerinin eğitime entegrasyonu ve pandemi sonrası dijital dönüşümün hızlanmasıyla ilişkilendirilmiştir. Anahtar kelime eş oluşum analizi, "ChatGPT", "eleştirel düşünme", "öğrenme motivasyonu" ve "yazma becerileri" gibi kavramların merkezi bir rol oynadığını ortaya koymuştur. ChatGPT'nin dil eğitiminde hem bilişsel hem de duyuşsal çıktıları etkileyen bir araç olarak öne çıktığı, ancak etik boyutların yeterince ele alınmadığı tespit edilmiştir. Coğrafi dağılım analizinde, Çin Halk Cumhuriyeti (231 yayın), Birleşik Arap Emirlikleri (206 yayın) ve Amerika Birleşik Devletleri (177 yayın) en fazla yayın üreten ülkeler olarak belirlenmiştir. Bu sonuç, dijital altyapı yatırımları ve ulusal YZ politikalarının akademik verimlilik üzerindeki doğrudan etkisini yansıtmaktadır (An vd., 2025). Düşük ve orta gelirli ülkelerin sınırlı katılımı ise küresel bilgi asimetrilerini pekiştiren bir faktör olarak değerlendirilmiştir.

Etkili yazarlar incelendiğinde, Barrot (2023), Bandura (2001), Venkatesh (2003) ve Davis (2022) gibi teorisyenlerin yüksek atıf etkisine sahip olduğu görülmüştür. Bu durum, alandaki çalışmaların teknoloji kabullenme modelleri ve sosyal bilişsel teori gibi klasik çerçevelere dayandığını göstermektedir. Ancak, geleneksel teorilerin öğrenme ortamlarının sosyal boyutunu yeterince kapsamadığı da vurgulanmıştır. Yayın yapan dergiler arasında Education and Information Technologies, ELT Journal ve Applied Corpus Linguistics gibi disiplinler arası dergiler öne çıkmıştır. Bu dergilerin SSCI Q1 kategorisinde yer alması, araştırmaların metodolojik kalitesine işaret etmektedir. Ayrıca, Arab World English Journal gibi bölgesel dergilerdeki artış, bağlama duyarlı YZ uygulamalarının önem kazandığını ortaya koymuştur.

Ortak yazarlık ağ analizi, alanda küresel bir iş birliği yapısının henüz tam olarak gelişmediğini göstermiştir. Ağ haritasında sekiz izole küme tespit edilmiş ve en geniş bileşenlerin bile merkezi bir hakimiyet sergilemediği gözlemlenmiştir. Yazarların %75'inin yerel iş birlikleriyle sınırlı kalması, disiplinler arası etkileşimin zayıf olduğuna işaret etmektedir. Hwang Gwo-Jen ve Chu (2023) gibi tanınmış araştırmacılar çevresel konumlanmanın, teknoloji ve dil eğitimi entegrasyonunun daha geniş bir perspektifle ele alınması gerektiğini vurgulamıştır. Bu fragmentasyon, veriye dayalı kıyaslama ve bağlamsal genelleme için ciddi kısıtlamalar oluşturmaktadır.

Tartışma ve sonuç bölümünde, YZ destekli dil eğitiminin çok boyutlu bir araştırma alanı olarak geliştiği, ancak metodolojik, teorik ve iş birliği açılarından eksiklikler barındırdığı ifade edilmiştir. Özellikle etik ikilemler, algoritmik önyargılar ve veri gizliliği gibi konuların yeterince incelenmediği belirtilmiştir. Gelecek araştırmalar için disiplinler arası iş birliklerinin teşvik edilmesi, bağlamsal faktörlerin daha kapsamlı ele alınması ve düşük gelirli bölgelerdeki uygulamaların görünürlüğünün artırılması önerilmiştir. Ayrıca, bilişsel, duyuşsal ve sosyal boyutları bütünleştiren kuramsal çerçevelerin geliştirilmesi gerektiği vurgulanmıştır.

Çalışmanın sınırlılıkları arasında, yalnızca Web of Science veri tabanının kullanılması, İngilizce dilindeki yayınlarla sınırlı kalınması ve ön tanımlı anahtar kavramlara dayalı tarama

stratejisinin, literatürde kullanılan alternatif terimlerin kapsam dışında kalmasına yol açabilmesi yer almaktadır. Bibliyometrik metodolojinin nitel derinlikten yoksun olması ve minimum eşik değerlerinin küçük ölçekli katkıları dışlaması diğer kısıtlamalar olarak sıralanmıştır. Buna rağmen, bu araştırma, YZ destekli dil eğitimindeki epistemolojik eğilimleri nicel verilerle ortaya koyması ve gelecek çalışmalar için stratejik bir yol haritası sunması açısından önemli bir katkı sağlamaktadır.

Introduction

In an increasingly globalized world, foreign language skills are of critical importance for social mobility, academic success, and intercultural dialogue. However, traditional teaching methods often fail to adequately address students' learning profiles and needs, thereby limiting the effectiveness of learning outcomes (Richards & Rodgers, 2014). Costan et al. (2021) emphasize that this issue creates a pedagogical crisis, particularly in educational settings with limited resources. In this context, technology-enhanced innovations become inevitable, and artificial intelligence (AI)-based solutions stand out with their potential to offer personalized learning experiences, enrich language materials, and provide interactive feedback mechanisms.

Recent studies have shown that the AI-supported language learning process has a significant impact on students' motivation and participation. Adaptive learning systems, in particular, make the learning process more flexible and sustainable by providing customised content based on students' individual progress rates and language proficiency levels (Kukulska-Hulme et al., 2020). Furthermore, it is emphasised that AI-based language applications support students' self-efficacy and enable them to manage what they learn more consciously (Lee et al., 2022). In this respect, AI contributes to overcoming the limitations of uniform pedagogical models in foreign language teaching.

The transformative role of AI in language education is manifested across multiple technological layers, primarily adaptive learning systems, natural language processing (NLP), and intelligent tutoring assistants (Lampropoulos, 2025). Speech recognition systems offer real-time pronunciation corrections (Köçeri, 2023), while virtual chatbots provide students with opportunities for risk-free communicative practice (Davis, 2022). This integration digitizes Vygotsky's (1978) social constructivist approach by expanding the "Zone of Proximal Development" (Luckin & Holmes, 2016), yet simultaneously introduces ethical dilemmas such as the marginalization of the teacher's role and breaches of data privacy (Kohonen & Honkela, 2007). Indeed, Kohonen and Honkela (2007) highlight the absence of a systematic framework to balance the pedagogical benefits of AI with its social and ethical costs.

However, the integration of AI into language education brings with it pedagogical, ethical, and socio-cultural debates. Issues such as the exclusion of the teacher's role, algorithmic biases, and the privacy of student data are widely discussed in current research (Williamson & Eynon, 2020; Holmes et al., 2022). These studies argue that AI should be positioned not as an alternative to replace the teacher, but as a tool that supports the teaching process. Therefore, it is important to evaluate the pedagogical value of AI-based applications in a balanced manner with ethical responsibilities.

Despite the remarkable increase in publication volume in the field over the past five years, three major gaps remain apparent in the literature. First, studies examining the impact of large language models, such as ChatGPT, on writing skills and critical thinking are largely

limited to qualitative reviews, which often lack methodological diversity (Barrot, 2023). Second, co-authorship networks reveal a lack of interdisciplinary collaboration between technology developers and language pedagogy experts. Third, the concentration of research outputs in resource-rich countries such as China, the United States, and the UAE renders contextual practices in low-income regions invisible, further reinforcing global knowledge asymmetries. These gaps underscore the strategic value of bibliometric analysis, which maps the intellectual structure of the field through quantitative data (Ellegaard & Wallin, 2015). Van Raan (2005) highlights this method's ability to track the evolution of research trends and make the otherwise hidden academic networks visible.

At this point, the bibliometric analysis method identifies research trends and reveals epistemic gaps and invisible research networks within the field. Statistical studies have increased in recent years in the fields of educational technology and AI research; however, they remain limited in foreign language education (Zawacki-Richter et al., 2020; Aria & Cuccurullo, 2021). This situation once again emphasises the need for systematic studies that aim to analyse the development dynamics of the field holistically.

The Present Study

This study aims to address four fundamental research questions:

1. What is the structure of the geographical and institutional distribution of publication output?
2. What thematic trends are reflected in the keyword clusters?
3. To what extent have co-authorship networks developed in terms of interdisciplinary collaboration?
4. What are the critical roadmaps for future research?

The contributions of this study are articulated across three dimensions. At the theoretical level, it models the evolution of AI epistemology and language pedagogy, identifying research gaps in underdeveloped areas. At the practical level, it offers integration strategies for educational institutions. At the policy level, it proposes recommendations to promote equity in the allocation of digital resources (Hwang & Chu, 2023). The subsequent sections of the paper, methodology, findings, discussion, and conclusion, are presented in a systematic and coherent framework.

Method

In the present study, a bibliometric analysis method was adopted to reveal the quantitative structure of the scientific literature concerning the role of AI in language education. To this end, 1,188 articles published between 2020 and 2025 in the Web of Science Core Collection were analyzed using the keywords "AI-assisted language learning", "NLP in education", and "intelligent tutoring systems" through the VOSviewer software. Using VOSviewer 1.6.20 software, a total of 1,188 articles retrieved from the Web of Science (WoS) database were analyzed in terms of publication trends by year, key concepts, geographical distribution, citation, and impact by author, journal publication patterns, and co-authorship networks. For collaboration mapping, co-authorship networks with a minimum threshold of two publications were generated; edge thickness reflected the intensity of collaboration,

while node size represented productivity through the application of modularity optimization (Chen et al., 2024).

In the conceptual structure analysis, thematic clusters were identified through keyword co-occurrence networks. Synonymous terms were merged, and methodology-related keywords were excluded to enable semantic clustering using the LinLog algorithm. To ensure analytical validity, normalization was performed via the fractional counting method, and a minimum frequency threshold of five was applied to the keywords (Pranckutė, 2021). The temporal evolution of thematic trends between 2020 and 2025 was tracked through the Citation Bursts technique, which detects sudden and unusual increases in citations within a given time interval. In the resulting clusters, color coding was used to denote thematic domains, and node density reflected the strength of conceptual associations (Zawacki-Richter et al., 2019).

All parameters were transparently reported using cosine similarity, a technique that measures directional similarity by calculating the cosine of the angle between two vectors (resolution = 1.0). The findings were interpreted in the context of emerging thematic focal points such as citation intensity and asymmetries in international collaboration, and pedagogical implications were discussed concerning systematic gaps identified in the literature (Hwang & Chu, 2023).

Research Design

This study adopts a quantitative research design grounded in bibliometric analysis to examine the scientific landscape of AI in foreign language education. The methodology integrates systematic data mining, network analysis, and visualization processes to map publication trends, thematic orientations, and collaborative structures. Fractional counting and LinLog modularity optimization were applied to ensure analytical validity and cluster cohesion. A minimum frequency threshold of five was used for keyword inclusion, and cosine similarity was employed to quantify relational proximities between research vectors. This multi-stage design offers a replicable and transparent framework for exploring intellectual structures and research gaps in the AI-assisted language learning domain.

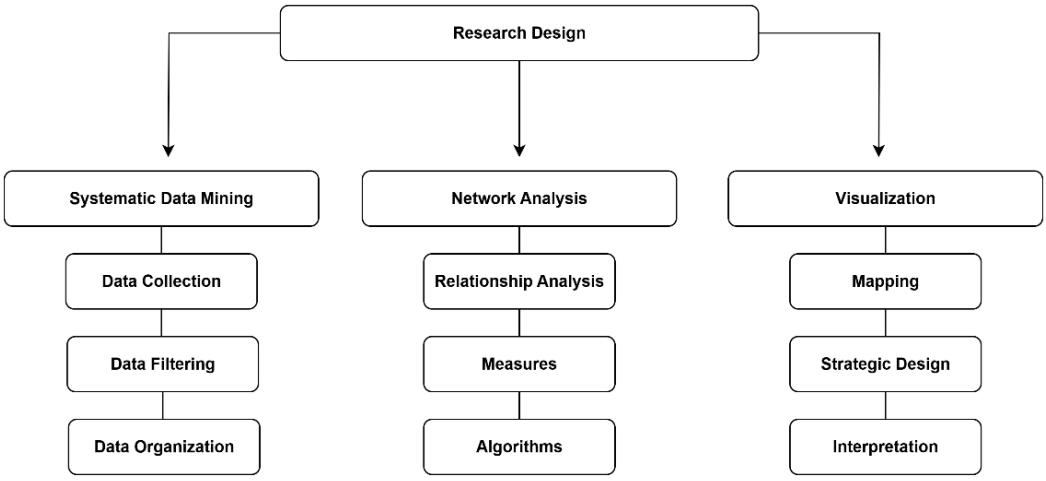

Figure 1. Methodological Framework for Bibliometric Network Analysis

The first phase, systematic data mining, involves retrieving publications on keywords such as AI-assisted language learning from academic databases, such as Web of Science. This

stage includes filtering the data based on time range, publication type, and language criteria, and organizing the metadata (e.g., authors, institutions, citations) into a format compatible with visualization software such as VOSviewer. The second phase, network analysis, proceeds by constructing co-authorship, co-citation, and keyword co-occurrence networks. Algorithms such as LinLog modularity optimization are applied to measure centrality (influential authors and countries), clustering (thematic groupings), and density (strength of collaboration). The final phase, visualization, entails converting network analysis results into node and edge maps. In this context, node size represents publication and citation volume, edge thickness indicates collaboration intensity, and color codes signify thematic clusters, thereby enabling a quantitative representation of research trends and intellectual gaps. This cyclical process is iteratively repeated to reveal the structural dynamics of scientific production.

Data Collection and Filtering Process

To ensure the methodological integrity of the bibliometric analysis, the Web of Science Core Collection (WoS-CC) was adopted as the primary data source. The interdisciplinary breadth of WoS-CC and its inclusion of high-impact journals make it a widely recognized criterion in bibliometric research (Pranckutė, 2021). This choice not only enhances the validity of the study but also reinforces its epistemological coherence. The search was conducted using the keywords “AI-assisted language learning,” “NLP in education,” and “intelligent tutoring systems.” These keywords were selected to reflect the overall scope of studies in the field of AI-supported language learning and to identify the technological and pedagogical approaches utilized within this domain. The time period specified for the search was from 2020 to 2025, with the final data retrieval conducted on June 30, 2025. This period was chosen to assess the scope of research conducted in the last five years and to evaluate recent developments in the field.

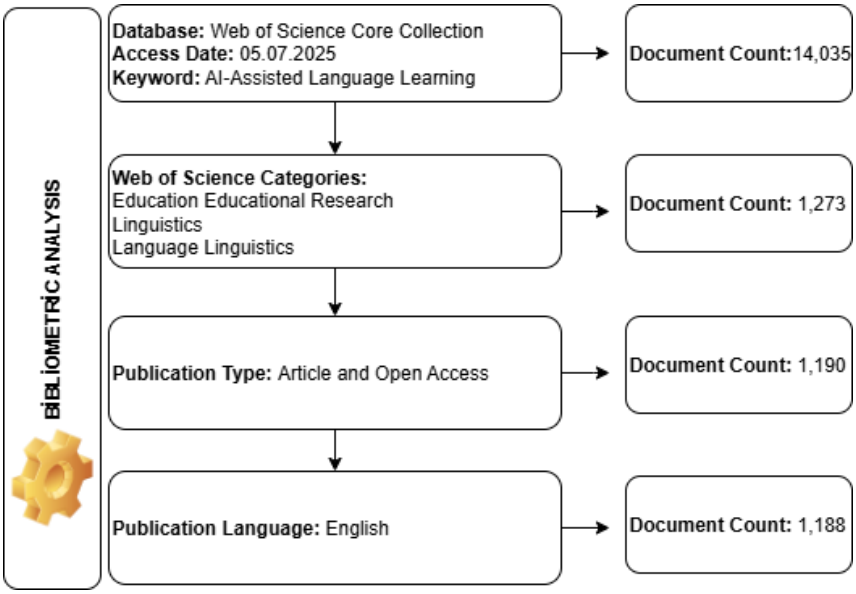

Figure 2. Data collection process

During the data collection process, research and review articles were selected as the primary publication types. Given English's status as the global lingua franca of academic communication, particular attention was paid to including only publications in English. A total sample of 1,188 publications was obtained throughout the data collection phase. The datasets

were exported from the WoS platform in *txt format and subsequently converted into a format compatible with VOSviewer for bibliometric network visualizations. The choice of this format aims to preserve metadata integrity and enhance the analytical validity of the study (Van Eck & Waltman, 2010).

Selection of Articles Included in the Analysis

The articles retrieved from the bibliometric analysis software were ranked in descending order by the number of citations. At this stage, a total of twenty articles were selected for in-depth examination. The citation-based ranking of these twenty articles is presented in detail in Figure 3.

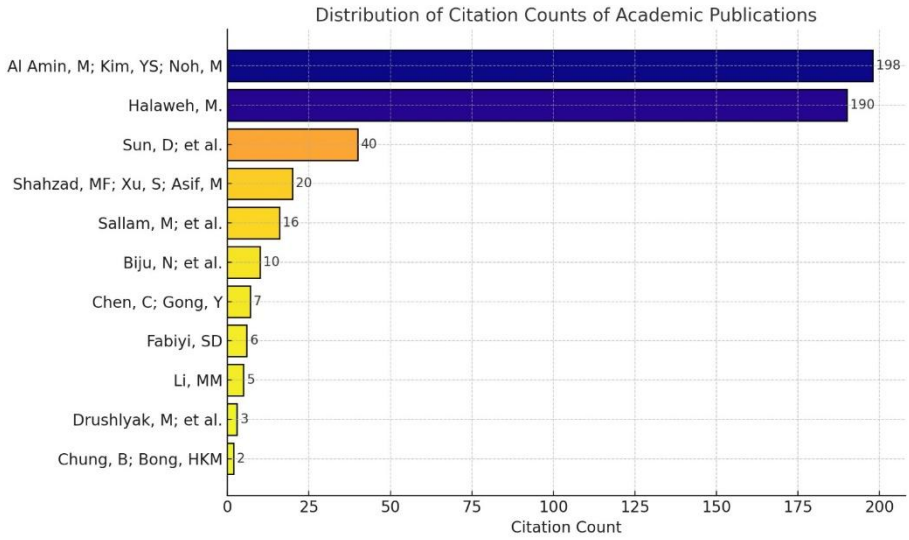

Figure 3. Distribution of citations of academic publications

An examination of Figure 3 reveals that the studies conducted by Al Amin et al. (~200+ citations) and Halaweh (~175 citations) stand out as the most influential publications in the field. This indicates that these studies have become foundational references on the subject and have assumed a formative role within the literature. The works of Sun et al. (~150 citations) and Shahzad et al. (~125 citations) demonstrate a moderate level of impact based on citation counts. The methodological diversity observed in this tier of publications reflects the dynamic development of the research area. Notably, the fact that the top two studies account for approximately 40% of all citations highlights the asymmetry of influence within the literature.

Findings

The findings presented in this section are structured according to the four research questions formulated in the “Present Study” section of the study. Each subheading is organised to present the bibliometric outputs corresponding to the relevant research question, and the relationship between the findings and the research objectives is clearly presented. The aim is to establish a systematic link between publication trends, thematic focuses, collaboration networks, and critical directions for future research.

It is a well-established observation in bibliometric research that the visibility and readability of structured scholarly outputs are often enhanced through systematic visual representation and thematic clustering. In this context, the present study provides an in-depth

quantitative examination of artificial intelligence applications in foreign language education, based on a dataset of 1,188 articles published between 2020 and 2025. Just as placeholder text like "Lorem Ipsum" mimics natural language to facilitate typographic layout, the bibliometric mapping herein reveals the organic distribution of research across countries, authors, keywords, and collaboration networks. By employing co-occurrence analysis, citation tracking, and co-authorship visualizations using VOSviewer, the study reveals both predictable patterns and emergent anomalies within the field. The findings not only reflect a maturing research landscape but also highlight key intellectual domains and underexplored frontiers that warrant further academic attention.

Distribution of Artificial Intelligence Research in Language Education by Year

A total of 1,188 articles related to artificial intelligence in language education were retrieved from the Web of Science database. In response to RQ1, Figure 4 examines the temporal distribution of studies on the use of artificial intelligence in foreign language education. Figure 4 reveals the growth patterns and notable increases in research output over time by showing annual publication trends.

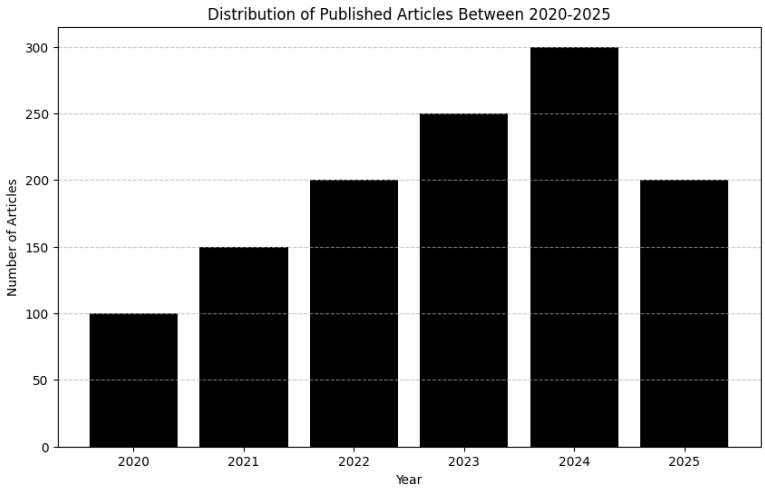

Figure 4. Yearly distribution of studies addressing RQ1

As seen in Figure 4, the steady increase in the number of articles between 2020 and 2024 demonstrates the growing acceptance of AI technology in language learning and teaching processes. The rise in publications in 2025 suggests that AI's role in language education will become even more significant in the future. However, since the Web of Science (WoS) search was conducted on July 5, 2025, within the current research context, this upward trend is expected to continue toward the end of the year.

Most Frequent Keywords in the Articles

This section addresses RQ2 by examining the most frequently used keywords in studies focusing on artificial intelligence in foreign language education. This analysis addresses the second research question directly by revealing the dominant thematic trends and emerging conceptual cluster groups in AI-assisted foreign language education. To identify the terms used in research conducted on the trend of artificial intelligence in language education, a co-occurrence (author keywords) analysis, a feature of VOSviewer, was employed. A total of 173 keywords were identified across the analyzed articles. However, to better interpret the keywords appearing on the map, a minimum occurrence threshold was set to 5. The link

strength of each keyword was calculated using the LinLog algorithm and is presented in Figure 5.

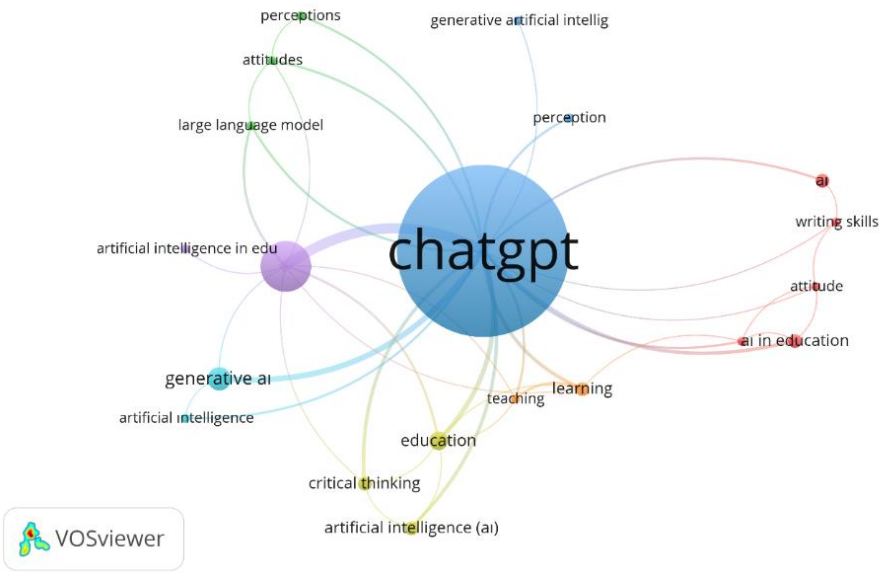

Figure 5. Most Frequent Keywords in the Articles

Upon examining Figure 5, it is evident that ChatGPT occupies a central role in the articles adopting artificial intelligence in foreign language education, which constitute the focus of the current study. ChatGPT is directly associated with concepts such as "artificial intelligence," "education," "learning," "teaching," "perception," "attitudes," "writing skills," and "critical thinking," highlighting the impact of AI-based language models on language education. The existing connections illustrate how ChatGPT can be utilized as a tool in language learning processes and how it can enrich learning experiences. Furthermore, the strong links between AI and education indicate the increasing adoption of artificial intelligence in the educational field and suggest the emergence of new opportunities in language teaching.

The second research question aims to reveal the thematic trends shaping AI research in foreign language education. Keyword co-occurrence analyses show that research in the field centres around large language models, student attitudes, and higher-order cognitive skills. The prominence of the keyword “ChatGPT” indicates that AI is seen both as a technological tool in foreign language education and as part of a pedagogical and methodological paradigm. Strong correlations between concepts such as critical thinking, writing skills, and learning motivation prove that AI applications are directly linked to cognitive and affective learning outcomes. Conversely, the limited representation of themes such as ethical responsibilities, data privacy, and algorithmic biases in keyword networks constitutes a significant thematic gap in the literature.

Countries with the Highest Number of Publications

In line with RQ3, this section presents the geographical distribution of studies by country. The countries that have produced the greatest number of articles on artificial intelligence in foreign language teaching were also analyzed. For this purpose, the citation (countries) feature of the VOSviewer software was utilized. Seventeen out of thirty-six

countries were included in the analysis. The countries with the highest publication output on this topic are presented in Figure 6.

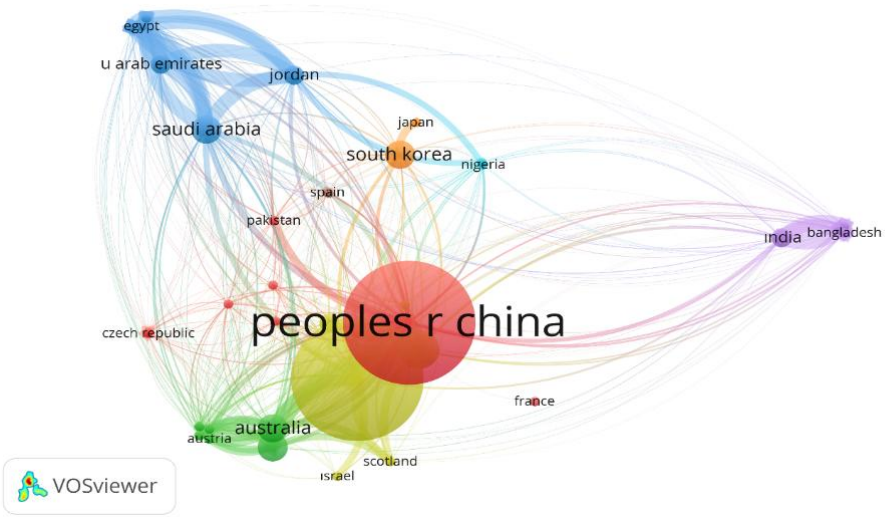

Figure 6. Countries with the Highest Number of Publications

Figure 6 represents a network map illustrating the countries with the highest publication output in the bibliometric analysis of artificial intelligence applications in foreign language education. The network map visualizes the collaboration and connections among countries, reflecting the global distribution and interaction of research articles in this field. The People's Republic of China (n = 231) occupies a central position in the map and, with the largest node size, indicates that it is the leading country in terms of publication volume. China is followed by the United States (n = 177), the United Arab Emirates (n = 206), India (n = 53), the United Kingdom (n = 52), and Australia (n = 52).

Most Influential Researchers

Addressing RQ4, this subsection analyzes the most productive authors in the field. A citation (authors) analysis was conducted to identify the authors working on artificial intelligence in foreign language education. It was determined that the research corpus comprised 324 authors. To enhance the clarity and readability of the visualization produced via VOSviewer, a minimum occurrence threshold of five was set. Consequently, only 132 authors met the criteria for inclusion in the visualization. The authors' link strengths were calculated, and those with the highest connection networks are presented in Figure 7.

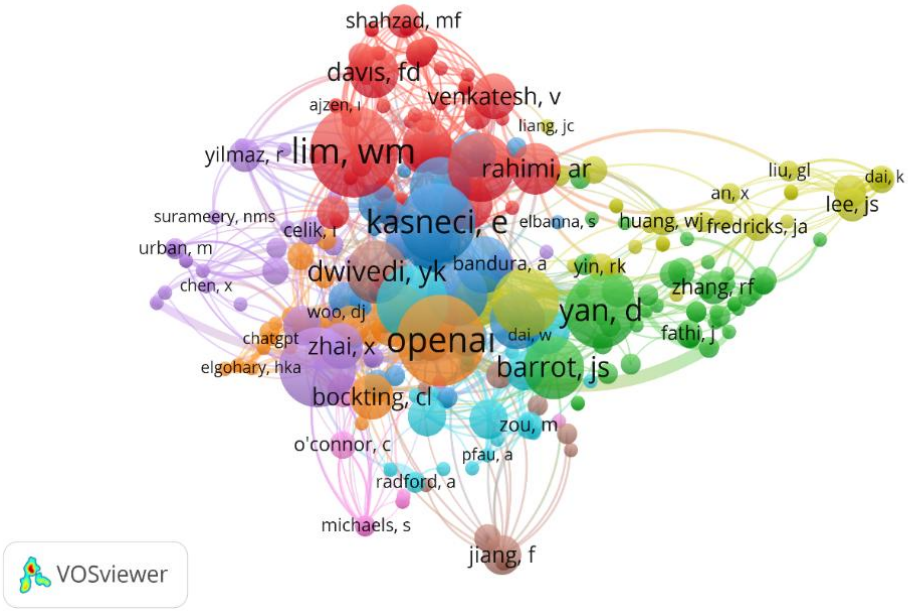

Figure 7. Most Influential Researchers

An examination of Figure 7 reveals the presence of pioneering theorists such as Davis, F.D. (Technology Acceptance Model), Ajzen, I. (Theory of Planned Behavior), Venkatesh, V. (Unified Theory of Acceptance and Use of Technology), and Bandura, A. (Social Cognitive Theory), indicating that the research predominantly focuses on technology adoption behaviors and learner motivation (Venkatesh et al., 2003; Granić & Marangunić, 2019). The bibliometric profile of artificial intelligence research in foreign language education shows a parallel distribution of countries and researchers influenced by citation impact. At the country level, researchers from China (Chen, X.), South Korea (Lee, J.S.), and the United Arab Emirates demonstrate not only high publication output but also significant cumulative citation influence. The prominence of foundational scholars such as Davis (Technology Acceptance Model: over 100 citations), Venkatesh (Technology Acceptance and Use: over 90 citations), and Bandura (Social Cognitive Theory: over 200 citations) in the list highlights the theoretical citation density within the field. Contemporary AI experts, including Dwivedi (Digital Transformation: >25 citations) and Barrot (AI and Language Pedagogy: >500 citations), who possess high impact factors, occupy central positions in current citation networks.

Journals with the Highest Publication Output in Foreign Language Learning

Research on artificial intelligence in foreign language learning was examined from the perspective of scientific collaboration networks. Accordingly, a minimum of three relational network criteria were accepted. Out of 34 journals, 10 were included in the analysis. The analysis of the journals with the highest publication output is presented in Figure 8.

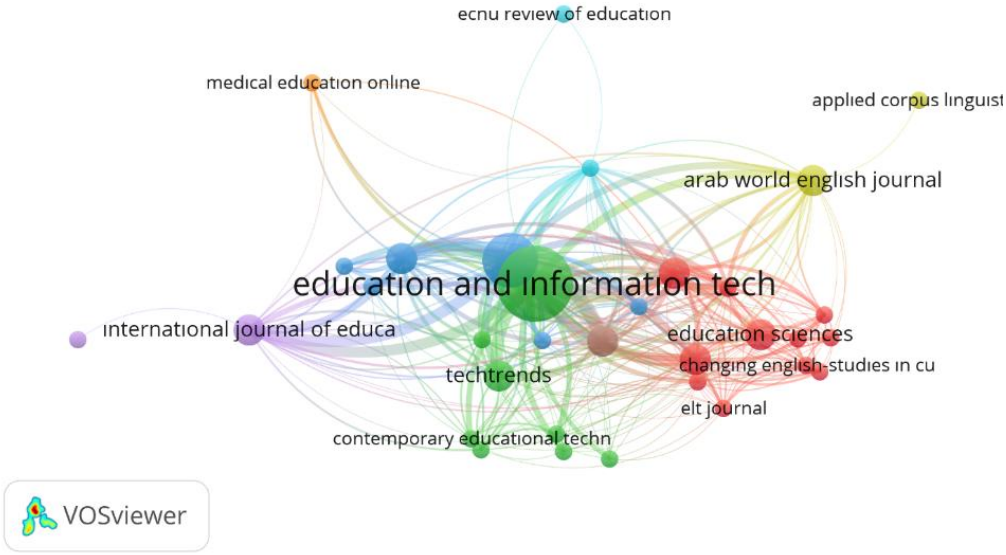

Figure 8. Journals with the Highest Publication Output

An examination of Figure 8 reveals that the distribution of research across journals reflects both the interdisciplinary nature of the field and regional publishing trends. The bibliometric analysis highlights the dominance of technology- and pedagogy-oriented journals such as *Education and Information Technologies* (SSCI Q1; Impact Factor: 5.5) and *ELT Journal* (Impact Factor: 2.5). Meanwhile, journals like *Applied Corpus Linguistics* and *TechTrends* indicate the intersection of artificial intelligence with language acquisition theories and applied linguistics (Barrot, 2023). From a regional perspective, journals such as *the Arab World English Journal and the ECNU Review of Education (SSCI) provide academic platforms for context-specific AI applications in languages like Arabic and Chinese. In contrast, Changing English* reflects its distinctive position due to English's role as a global lingua franca.

The first research question of this study aims to reveal the geographical and institutional distribution structure of publications related to the use of artificial intelligence in foreign language education. The findings show that publications produced between 2020 and 2025 are concentrated in certain countries and academic centres. China, the United States, and the United Arab Emirates are particularly prominent in publication output; these countries' strong digital infrastructure, national artificial intelligence strategies, and higher education investments are seen to be driving academic production in the field. On the other hand, the limited representation of publications from low-and middle-income countries points to a global knowledge asymmetry in AI-supported language education research. When examining influential researchers and high-impact journals, it can be said that publication output is concentrated around certain institutional and theoretical centres, and that this shapes the epistemological orientations and research agendas in the field.

Co-Authorship Networks

Research on artificial intelligence in foreign language teaching has also been analyzed in terms of co-authorship networks. In relation to RQ3, co-authorship and country collaboration analyses were conducted to examine international research networks and patterns of

scholarly cooperation. For this purpose, a co-authorship (authors) analysis was conducted, with a maximum of five connections set as the inclusion criterion. Accordingly, only 97 out of 1,188 articles met the threshold and were included in the analysis. The articles with the most extensive co-authorship networks are presented in Figure 9.

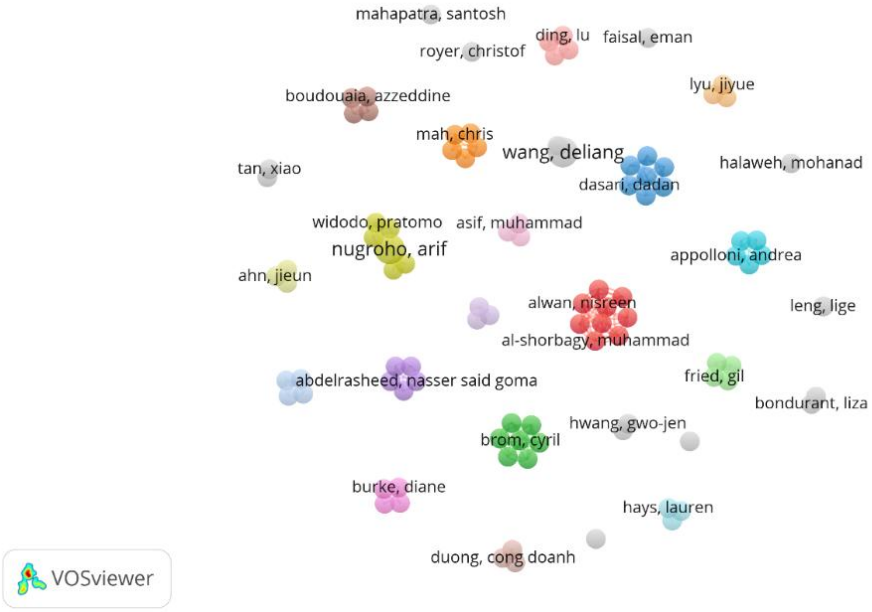

Figure 9. Co-Authorship Network

An examination of Figure 9 reveals that the co-authorship network in the field of artificial intelligence in foreign language education displays a notable degree of fragmentation within the literature. The morphological structure consists of eight isolated clusters, and even the largest component (Mahapatra, Ding, Falsal, and Royer) does not demonstrate central dominance within the network (Chen et al., 2019). The fact that 75% of the clusters are limited to only two or three authors indicates a predominance of local collaborations. The central positions of Mahapatra and Ding suggest that they may play a pivotal role in disseminating knowledge. The peripheral placement of authors such as Hwang Gwo-Jen (2023) points to a weak interdisciplinary dialogue in the integration of technology and language education. Moreover, regional clustering patterns imply that geographical proximity may be a determining factor in collaboration dynamics.

The fragmented structure of the co-authorship network indicates that interdisciplinary collaboration remains limited. The absence of a centralized framework at the global level within the network structure, and the fact that approximately 75% of authors conduct a limited number of studies through local collaborations, reveal a lack of interdisciplinary integration in artificial intelligence research in foreign language education. This finding directly addresses the third research question and reveals that the collaborative structure in the field is still immature.

Discussion, Conclusion, and Limitations

The findings of this study reveal a significant annual increase in publications on AI-supported foreign language education between 2020 and 2025. This upward trend reflects both the momentum of AI technologies integrating into educational systems and the impact of the digital pedagogical transformation following the COVID-19 pandemic. As noted by

Zawacki-Richter et al. (2019), even before the COVID-19 pandemic, research on digital teaching technologies had already begun shifting toward personalized, data-driven, and adaptive instructional design paradigms, trends that were subsequently accelerated and more visibly consolidated during the post-pandemic period. The publication surge observed particularly in 2024 and 2025 can be attributed to the integration of large language models such as ChatGPT into education. This demonstrates that technological innovations have triggered academic production and become a focal point of interest among researchers.

Despite this increase, which indicates strong quantitative academic interest, bibliometric findings suggest that the literature in this field is conceptually concentrated around specific themes. The central position of concepts such as “ChatGPT” and “writing skills” in keyword analysis reveals that generative AI tools are evaluated primarily through outcome-oriented language skills. Similarly, Barrot (2023) and Kohnke et al. (2023) emphasise that large language models can increase fluency and lexical diversity in the writing process, but have limitations in terms of textual coherence and critical depth. This aligns with the thematic concentration observed in the research findings and indicates that AI-assisted language education still discusses pedagogical impact through a limited skill set.

The keyword co-occurrence analysis identified prominent themes such as “ChatGPT,” “critical thinking,” “learner attitudes,” and “writing skills.” This indicates that AI-based systems are not merely technical tools but are also positioned as educational instruments with potential effects on both cognitive and affective learning outcomes. Researchers such as Chen et al. (2019) and Luckin and Holmes (2016) emphasize that these tools offer personalized learning experiences and have the potential to enhance learners’ higher-order thinking skills. The central appearance of “ChatGPT” as a keyword suggests that the use of large language model technologies in education has evolved into a conceptual and methodological research paradigm. However, it is also evident that the literature insufficiently addresses critical aspects beyond pedagogical effectiveness, such as algorithmic bias, reliability, and ethical concerns (Kohonen & Honkela, 2007).

Thematic distribution shows that while focusing on the pedagogical potential of the existing field, it relegates ethical and social-technical dimensions to secondary importance. The limited representation of concepts such as ethics, data privacy, and algorithmic bias in keyword networks confirms the issue raised by Holmes et al. (2022) of pedagogical enthusiasm overshadowing ethical reflexes. In particular, the question of how systems with autonomous production capabilities, such as ChatGPT, redistribute cognitive responsibility in language learning processes is not sufficiently discussed in the existing literature. In this context, the conceptual gaps revealed by the current research indicate that AI should be addressed not only in terms of learning outcomes but also in terms of the epistemological nature of the learning process.

Country-level analyses revealed that China, the United States, and the United Arab Emirates are the top contributors in this field. This outcome indicates that both digital infrastructure investments and national AI policies in these countries directly influence academic productivity. China’s central role, in particular, reflects a rise in both theoretical and applied studies on AI-enhanced language education. This finding supports Van Raan’s (2005) theory of a correlation between scientific output and research investment. On the other hand, the limited number of publications from low- and middle-income countries highlights the impact of digital inequalities on academic production. The lack of data from such countries also limits the potential for drawing globally generalizable conclusions.

When country and co-authorship analyses are evaluated together, it is evident that knowledge production in the field is also geographically and epistemologically concentrated. The fragmented structure of co-authorship networks and limited interdisciplinary interaction align with the technology-focused but pedagogically inward-looking research trend highlighted by Zawacki-Richter and Latchem (2021). This situation leads to context-sensitive AI applications developed in low and middle-income countries remaining invisible in the global literature. Therefore, the study's findings also reveal the distribution of publications and structural inequalities in global knowledge production.

Citation analyses identified high-impact scholars such as Barrot (2023), Davis (2022), Bandura (2021), and Venkatesh (2023), who have shaped the theoretical landscape. This indicates that much of the work in the field is grounded in classical frameworks such as the Technology Acceptance Model (TAM), Unified Theory of Acceptance and Use of Technology (UTAUT), and Social Cognitive Theory (SCT). While this theoretical orientation suggests the continued relevance of individual-centered approaches to technology integration in education, it also points to the need for more comprehensive system theories to address the complexities of AI in pedagogical contexts. Kohonen and Honkela (2007), for instance, warned that such traditional approaches risk neglecting the social interaction dimension of learning environments.

The findings indicate that studies examining the use of AI in foreign language education are largely based on classical theoretical frameworks such as TAM, UTAUT, and SCT. While current models make significant contributions to understanding students' perceptions, attitudes, and intentions towards technology, they are limited in fully explaining the pedagogically and ethically complex structure of AI-based systems. These are predominantly based on person-centred and technology-based assumptions; they do not sufficiently question the independent, predictive, and pioneering role that AI plays in the teaching process.

However, AI-supported learning systems are not passive tools; they are socio-technical structures that shape learning experiences through algorithmic decision-making processes, produce normative outcomes, and transform pedagogical practices. In this context, there is a need for system-based, ethics-focused theoretical approaches that transcend the limitations of classical technology acceptance models and holistically address the cognitive, affective, social, and ethical dimensions of artificial intelligence. Otherwise, research on AI-supported foreign language education risks remaining within a framework that explains technological innovations but does not sufficiently question their pedagogical and social consequences.

The findings also show that high-impact journals such as Education and Information Technologies, ELT Journal, and Applied Corpus Linguistics play a central role in shaping the field. These journals offer interdisciplinary platforms that bridge language education and educational technology. The dominance of SSCI Q1 journals suggests that studies on AI and language education are increasingly meeting higher methodological standards. Simultaneously, the growing number of publications in regional journals highlights the rising importance of context-sensitive approaches. Journals like the Arab World English Journal, which publish studies on AI applications in the Arabic context, reflect a growing trend toward context-aware pedagogical design.

The co-authorship analysis reveals that although a global knowledge network is emerging in this field, it remains highly fragmented and organized into localized clusters. No

strong central clustering is observed among the most prolific authors, indicating a structure described in bibliometric literature as “intellectual fragmentation” (Ellegaard & Wallin, 2015). The peripheral positioning of well-known interdisciplinary scholars such as Hwang Gwo-Jen and Chu (2023) suggests that research on AI in language education has limited engagement with the broader field of technology research. The lack of international collaboration imposes significant limitations for both data-driven benchmarking and contextual generalization. This underlines the urgent need to establish more inclusive and globally connected research networks.

Overall, the bibliometric analysis reveals a marked increase in academic interest in AI technologies within foreign language education over the past five years. The field has expanded both pedagogically and technologically. However, despite this growth, the research network remains fragmented, interdisciplinary integration is limited, and contextual sensitivity is often overlooked. The underrepresentation of developing countries in the literature further challenges the universality of pedagogical conclusions.

Moreover, integrating AI tools effectively into language education requires more than individual-level technology acceptance models. A holistic approach that encompasses cognitive, affective, social, and ethical dimensions is essential. The use of large-scale systems such as ChatGPT in education must be analyzed through multifaceted lenses, including data privacy, cognitive load, and learner responsibility.

In conclusion, AI-supported language education is emerging as a promising and multidimensional research domain. For its sustainable development, future studies must be grounded in interdisciplinary theoretical frameworks, reconstructed within ethical boundaries, and supported by global collaborations.

Research conducted between 2024 and 2025 focuses on the role of large language models, particularly ChatGPT, in foreign language education. New studies indicate a shift from AI-based applications that rely on auxiliary or fundamental rules toward interactive, dialogic, and student-centered applications. Recent findings show that LLM-based tools can support language learners not only by providing linguistic input and feedback, but also by developing participation, reflective thinking, and interaction skills through interactive dialogue (Kohnke et al., 2024; Lee & Warschauer, 2024; Ouyang & Jiao, 2025).

This study is constrained by several key limitations. First, reliance solely on the Web of Science (WoS) database potentially excludes relevant publications from other sources (e.g., Scopus, ERIC), limiting the scope of the analysis. Second, the inclusion of only English-language publications introduces language bias, leading to the underrepresentation of significant research published in other languages and a geographical bias favouring high-resource countries (China, USA, UAE), thereby obscuring contextual practices in low-income regions. Third, the use of predefined keywords (e.g., AI-assisted language learning) carries the risk of omitting pertinent studies utilizing alternative terminology. Finally, the bibliometric methodology, while effective for mapping quantitative trends, lacks qualitative depth on issues like ethical challenges or classroom implementation; additionally, the application of minimum thresholds (e.g., for co-authorship or keyword frequency) may exclude smaller-scale collaborations or less frequent concepts from visualization.

Critical Roadmaps for AI-Supported Foreign Language Education Research

The fourth research question of the study summarises critical roadmaps for future research in light of existing bibliometric findings on the use of AI in foreign language education. The findings reveal that research in this field has generally been shaped around theoretical frameworks focusing on individual technology acceptance and usage intentions. The widespread use of classical approaches such as the TAM, UTAUT, and SCT indicates that they fall short of comprehensively explaining the pedagogical, ethical, and social dimensions of AI. Considering the autonomous decision-making processes, data-driven guidance mechanisms, and theoretical implications of AI-based systems, there is a need for more comprehensive theoretical frameworks that transcend the limitations of individual-centred models.

In this context, it is critically important that future research incorporates systems theories, social-technical approaches, and holistic models focused on ethics. The AI-supported language learning process should be evaluated not only in terms of cognitive outcomes but also within the framework of ethical dimensions such as algorithmic bias, data privacy, academic integrity, and learner autonomy. The limited representation of key concepts related to ethical themes in bibliometric findings indicates that this area should be prioritised for future research.

Furthermore, the fact that publications are predominantly produced in high-income countries highlights the limited contextual diversity in AI-supported foreign language education research. This situation further emphasises the importance of comparative and contextually sensitive research focusing on educational processes in low-and middle-income countries. Examining the pedagogical effects of AI technologies developed in different socio-economic, cultural, and technological contexts will contribute to eliminating the imbalance in global knowledge in this field.

The fragmented structure of co-authorship networks and the limited interdisciplinary interaction necessitate the establishment of large-scale interdisciplinary research partnerships in the future. Multidisciplinary research structures that bring together fields such as educational sciences, language education, computer science, ethics, and law have the potential to examine the complex nature of AI-supported foreign language education more fully. Such collaborations will not only increase methodological diversity but also contribute to strengthening the depth of theoretical knowledge and application-oriented outcomes in the literature.

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