



# A Comparative Analysis of Research Hotspots, Development Trends Trajectories, and Future Direction in AI-Enabled Language Education: A Bibliometric and Visualization Analysis

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## Abstract

Drawing on journal articles indexed in CNKI and the Web of Science Core Collection, this study conducts a systematic review and comparative analysis of Chinese and international research on AI-empowered foreign language and translation teaching. Specifically, 104 Chinese literature pieces published between 2020 and 2025, and 200 English literature pieces published between 2006 and 2025 were included in the survey. By adopting bibliometric methods and knowledge mapping with CiteSpace, the study examines publication trends, institutional and author collaboration networks, keyword co-occurrence, and thematic clusters to reveal the knowledge structure and developmental trajectories of the field across different academic contexts. The findings show that Chinese research has grown rapidly since 2020, with major focuses on the application of generative artificial intelligence, curriculum reform, and the integration of value-oriented education. In contrast, English-language research has developed progressively over nearly two decades and has formed more internationalized and interconnected collaboration patterns. Beyond classroom practices, it places greater emphasis on teacher development, ethical governance, and methodological innovation, reflecting stronger theoretical depth and research rigor. Overall, the two research traditions present complementary orientations, namely an application-driven approach and a structurally reflective approach. This study contributes to a clearer understanding of the global landscape of AI integration in language and translation education and provides empirical evidence for future cross-context collaboration and methodological integration.

## Subject Areas

Artificial Intelligence

## Keywords

Artificial Intelligence, Language Education, Translation Teaching, CiteSpace

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## 1. Introduction

At present, with the deepening integration of AI and education, the market demand for interdisciplinary translation professionals who are capable of using intelligent tools continues to grow. However, existing curricula still lag behind in terms of technology integration and competence development. The breakthroughs in generative artificial intelligence indicate that translation teaching is moving from a stage of tool assistance to a new phase characterized by human-machine collaboration.

Nevertheless, existing studies mainly focus on single-language contexts or individual cases, and there is still a lack of cross-context and systematic comparison based on bibliometric methods. Against the background of digital transformation in education, this study addresses the insufficient integration of technology in translator training and employs bibliometric analysis and knowledge mapping methods. Core journal articles indexed in China National Knowledge Infrastructure (CNKI) and the Web of Science (WOS) are used as data sources to conduct a systematic comparative analysis of Chinese and English studies on artificial intelligence and translation teaching from 2006 to 2025. Through a comprehensive comparison of the two bodies of literature, this study identifies differences in knowledge structures, developmental trajectories, and research hotspots across academic contexts, and provides data-based evidence and empirical references for translation education research and curriculum reform in the intelligent era.

## 2. Literature Review

### 2.1. Research on AI-Enabled Language Education in China

In core journals indexed by CNKI, research on foreign language education in the context of artificial intelligence mainly centers on three dimensions, namely technology, curriculum, and values. Scholars focus on empowering teaching tools with technology, reforming curriculum systems, and strengthening value guidance, and they have carried out systematic exploration and practical innovation.

From the perspective of technology-enabled teaching tools, these studies aim to address issues such as the insufficient provision of personalized learning, the lack of authentic intercultural communication scenarios, and the rigidity of traditional assessment methods, thereby optimizing teaching processes and improving instructional effectiveness. For example, Liu *et al.* (2025) [1], drawing on the TPACK framework, proposed a technology-integrated teaching model that highlights the central role of teachers' instructional design and the deep integration of techno-

logical affordances.

Empowered by the development of the New Liberal Arts initiative and the national strategy for educational digitalization, Chinese scholarship has moved beyond the superficial application of AI tools to more systematic reforms of foreign language curricula, forming a relatively comprehensive framework for digital curriculum transformation. For instance, Wang *et al.* (2024) [2] emphasized the full-process integration of resource digitization, data-based processes, and automated assessment. Zhai (2025) [3] advocated the deep integration of linguistics and computer science and improved the collaborative training mechanism among industry, academia, and research. These studies reveal a systematic pathway for the digital transformation of foreign language education and provide practical foundations for the sustainable development of the discipline.

In addition, Chinese literature highlights the educational mission and cultural responsibilities of foreign language education in the age of artificial intelligence. Researchers generally explore how to uphold the fundamental goal of fostering virtue while making use of technological empowerment. For example, Zhou *et al.* (2024) [4] proposed a five-layer scenario framework that employs immersive technologies to achieve multimodal integration. These studies collectively highlight the dialectical unity of technological rationality and value rationality in the Chinese context and demonstrate the distinctive emphasis of local research on educational values and pedagogical innovation.

## 2.2. International Research on AI-Enabled Language Education

A bibliometric analysis of literature in the Web of Science Core Collection shows that international research on artificial intelligence and foreign language education, with translation teaching as a central focus, has formed a framework characterized by technology, teachers, and methods.

International scholarship adopts a pathway of close integration between technology and teaching and has long traced the phased development and evolution of AI applications in language education. It clearly demonstrates a shift from tool-based assistance to systematic reconstruction. Many researchers have examined this transition. For example, Chen (2025) [5] introduced the AI platform Twee, which helps teachers generate multimodal instructional materials and improve the quality of language input. With the rise of generative artificial intelligence, these studies have further highlighted the strong response of international research to technological iteration and teaching practice.

International Research focuses on the reconstruction of teacher roles, identity transformation, agency in technology integration, and related ethical challenges, and it stresses that language teachers should develop competencies suited to the changing technological environment. For instance, Carol (2025) analyzed the new professional requirements brought by generative AI from four dimensions. Guan (2025) [6], drawing on self-determination theory and a holistic integration perspective, examined the evolving roles and professional development of EFL teach-

ers in AI-supported contexts. These studies clearly uphold the position that AI should empower rather than replace teachers and emphasize the humanistic values and essential nature of education.

In addition, international research attaches great importance to methodological innovation and the identification of emerging research trends. Scholars employ tools such as CiteSpace to conduct bibliometric and knowledge mapping analyses in order to trace the field's evolution, collaboration networks, and core knowledge structures. They also use techniques such as latent Dirichlet allocation for topic modeling and text mining to identify thematic distributions and developmental trends. For example, Zhu and Wang (2025) applied systematic reviews and topic modeling to synthesize research trends in AI and language education. Generative artificial intelligence has become a central research cluster that is closely connected with existing topics, highlighting the wide recognition of their cross-disciplinary and transformative impact within the academic community.

### **2.3. Comparative Analysis in Chinese and International Studies**

Research on foreign language education in the Chinese context emphasizes the integration of technological empowerment, curriculum reform and value guidance. The research focus is on the application of artificial intelligence, the integration of technology in moral education, and the dissemination of Chinese culture. At the same time, it pays attention to innovations with theoretical and practical value such as the reconstruction of the digital teaching system and the dynamic assessment of human-machine collaboration. Overall, these studies align closely with national educational priorities and the goal of fostering well-rounded learners, and they seek to achieve an organic integration of technological application, pedagogical reform, and value formation.

By contrast, international literature concentrates more on the exploration of human-machine collaboration mechanisms and the construction of intelligent learning environments. It emphasizes refined practices that promote the deep integration of technology and teaching, with particular attention to the roles and functions of generative AI in translation education, the optimization of human-machine collaborative learning models, and the innovative application of smart learning environments. To clarify the scope of the study and enhance the focus of the analysis, this research proposes the following three research questions based on the characteristics and developmental trends of Chinese and international studies on AI-empowered foreign language and translation education:

- 1) What are the major features of publication trends, research contributors, and research hotspots in Chinese journals in this field?
- 2) What developmental patterns characterize the knowledge structures and thematic distributions of studies published in SSCI-indexed international journals?
- 3) What commonalities and differences exist between Chinese and international research in terms of publication patterns, collaboration networks, and research hotspots?

### 3. Methodology

This study combines bibliometric analysis and knowledge mapping to compare research on AI-powered language education and translation teaching in China and internationally. Data were sourced from CNKI and Web of Science, with Chinese articles limited to Peking University Core, CSSCI, and foreign language education journals, and English articles to SSCI-indexed journals. A topic-based search was conducted on keywords such as artificial intelligence, language education, translation teaching, curriculum, teacher development, instructional innovation, and personalized learning. After multiple rounds of screening by title, abstract, keyword, and full text, duplicates and low-relevance records were removed. A total of 104 Chinese and 200 English articles were retained as valid samples.

For analysis, CiteSpace (6.4.R1) generated knowledge maps and performed co-occurrence and clustering analyses of authors, institutions, and keywords. The time span was 2006-2025 for English publications and 2020-2025 for Chinese, with one-year slices. Node selection used the g-index ( $k = 20 - 25$ ), with LRF, L/N, LB, and e thresholds applied to extract core nodes. Pathfinder and merged network pruning optimized the structure. Clustering quality was assessed via network density, Modularity Q, weighted mean Silhouette S, and Harmonic Mean to ensure reliable knowledge identification. This enabled systematic detection of research hotspots, structures, and trends in AI and language education, providing a solid basis for comparative analysis.

## 4. Results and Discussion

### 4.1. Analysis of Chinese Literature

#### 4.1.1. Annual Publication Output

This study conducts a statistical analysis of the annual number of publications on foreign language teaching in China from 2020 to 2025.

An examination of academic output in foreign language teaching during the period from 2020 to 2025 reveals a clear upward trend in annual publications. Research activity in this field began at a relatively low level in 2020 with four publications and doubled in 2021 to eight publications, followed by a slight decline to four publications in 2022. Starting in 2023, the number of publications entered a stage of rapid growth, increasing markedly from 18 articles to 26 in 2024. In 2025, the field experienced a sharp rise, reaching 44 publications.

Overall, after short-term fluctuations, academic output in foreign language teaching has shown sustained and accelerating growth. This trend is closely associated with the deep integration of technologies such as artificial intelligence into teaching practices, as well as emerging research themes including curriculum reform and the integration of value-oriented education.

#### 4.1.2. Institutional Analysis

In the field of foreign language teaching research from 2020 to 2025, several core institutions demonstrate strong academic influence, as reflected in both their pub-

lication output and research focus.

Beijing Foreign Studies University ranks first with six publications and serves as a central research hub in this field. Shanghai International Studies University follows with four publications and has made notable contributions through its affiliated laboratories and research platforms. Nanjing University of Media and Communications ranks third with three publications.

The distribution of publications shows a clear concentration of resources. Specialized foreign language universities in Beijing and Shanghai play a leading role, while local institutions have gradually begun to participate in related research activities.

#### **4.1.3. Author Group Analysis**

From 2020 to 2025, the author collaboration network in foreign language teaching research consists of 139 nodes and 69 links, with a network density of 0.0072. Several core collaborative subnetworks can be identified.

The first is a central collaboration group formed by Kong (three publications), Yu (two publications), and Guo (two publications), which mainly focuses on topics such as technology application and curriculum reform. The second network includes Hu, He, Wang, and other scholars from multiple institutions, covering areas such as teaching assessment and the integration of intelligent technologies, and reflecting cross-institutional cooperation. The third group, represented by Tang, Sun, and Fu, concentrates on the integration of moral education and the reconstruction of curriculum systems, with most members affiliated with specialized foreign language universities.

Overall, the connections among these networks remain relatively loose, and collaboration across different teams is still limited. Greater thematic coordination and resource sharing are needed to strengthen future academic cooperation.

#### **4.1.4. Keyword Temporal Distribution Analysis**

After screening and preprocessing, the resulting cooperation network contains 125 nodes ( $N = 125$ ) and 166 links ( $E = 166$ ), with a network density of 0.0214, which is consistent with the sparse characteristics of citation networks. To further optimize the network structure and highlight key knowledge paths, the Pathfinder algorithm was applied to prune redundant links.

Based on the refined network, clustering analysis was conducted using the log-likelihood ratio (LLR) algorithm to extract cluster labels. The results show that the network achieves a Modularity  $Q$  value of 0.7879 ( $Q > 0.3$ ), indicating a significant and well-defined clustering structure that can be clearly divided into several closely connected subfields. The weighted mean Silhouette  $S$  value reaches 0.9544 ( $S > 0.7$ ), suggesting high internal homogeneity and reliability within each cluster. The Harmonic Mean of clustering quality is 0.8632, which further confirms the robustness of the clustering results. These indicators demonstrate that foreign language education research from 2020 to 2025 has formed distinct and thematically concentrated core directions.

To illustrate the evolutionary trajectories of different research themes, a timeline view was generated, which visually presents the emergence, continuity, and development of major research hotspots over time.

Based on CiteSpace cluster analysis, several core clusters of foreign language education research for 2020-2025 were identified and classified into three main dimensions according to topic relevance and research logic: innovation in teaching tools and models driven by technology, curriculum systems and assessment reform within the educational ecosystem, and competence development and value-oriented integration in education. Representative studies in each dimension are described below.

Technology-driven innovation in teaching tools and models is a core driving force for the reform of foreign language and translation education. This dimension focuses on the instrumental application of technologies such as artificial intelligence and large language models, as well as the reconstruction of teaching models. Liu *et al.* (2025) developed an integrated VR-based foreign language teaching model based on the TPACK framework. Wang (2024) explored the application of artificial intelligence in Korean language teaching to support the transformation of less commonly taught languages.

Curriculum systems and assessment reform in the educational ecosystem guarantee the quality of foreign language and translation talent cultivation. Grounded in digital transformation, this line of research emphasizes curriculum reconstruction, content optimization, and innovation in assessment. Wang *et al.* (2024) proposed a framework for translation education reform driven by large language models. Zhai *et al.* (2025) advanced measures for constructing an interdisciplinary curriculum system for language intelligence programs.

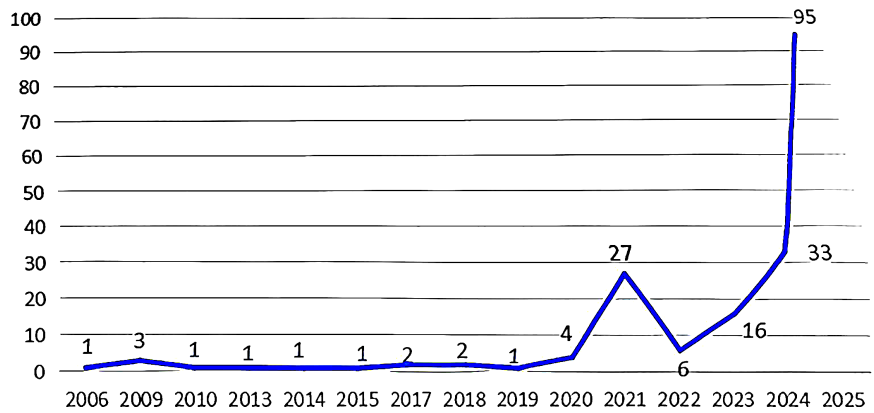
Competence development and value-oriented integration in education are core orientations of foreign language and translation teaching in the technological era. This dimension highlights the educational mission of foreign language teaching and promotes the integration of moral education with language instruction. Kong and Yang (2025) [7] proposed a dual model of AI-assisted cultural understanding and human-machine collaborative cultural narration.

The identified trends clarify the key directions of the field and provide a foundation for further exploration of sustainable mechanisms for technology integration and differentiated curriculum reform across educational stages.

## 4.2. Analysis of International Studies

### 4.2.1. Annual Publication Output

An analysis of annual publications from 2006 to 2025 presents a clear life cycle of development in this field, moving from an initial dormant stage to rapid expansion. From 2006 to 2019, the field remained in an early exploratory phase, with very low annual output. During 2020 and 2021, research activity began to increase, marking the initial stage of growth. After a brief adjustment in 2022, publications entered a period of strong expansion starting in 2023, and reached a historical peak of 95 articles in 2025 (as shown in **Figure 1**).



**Figure 1.** Annual publication trends based on the WOS database.

This growth trajectory closely corresponds to the breakthroughs and widespread application of generative AI technologies, which further confirms the driving role of disruptive technologies in stimulating academic research.

**4.2.2. National Collaboration Patterns**

The national collaboration network map reveals the global research landscape in this field. China (PEOPLES R CHINA) shows the highest centrality value of 0.64 and serves as the core hub of international collaboration. It is followed by England (centrality = 0.18) and Germany (centrality = 0.18), which function as secondary core nodes. The United States (centrality = 0.10) and Spain (centrality = 0.10) play important connecting roles within the network, while most other countries have a centrality value of 0 and remain at the periphery of the collaboration structure (as shown in **Figure 2**).

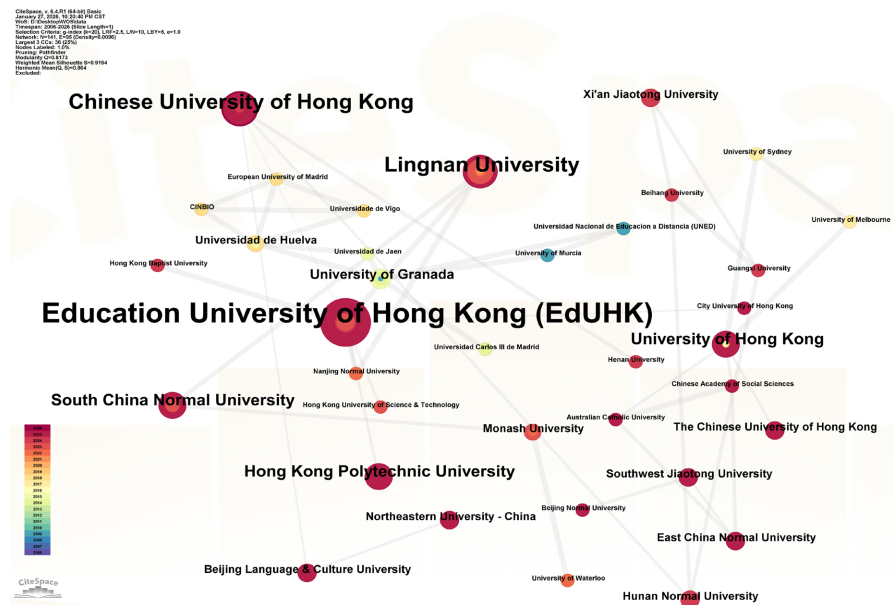
This uneven pattern of collaboration reflects, to some extent, the regional distribution of research capacity and influence in AI and translation teaching worldwide.



**Figure 2.** National collaboration network in AI and translation teaching research.

### 4.2.3. Institutional Analysis

An institutional-level analysis further confirms the geographical concentration of research capacity. The top five institutions in terms of publication output are all located in Hong Kong SAR, China, forming a clear regional research cluster. The Education University of Hong Kong ranks first with 17 publications and also shows the highest network centrality (0.02) (as shown in **Figure 3**). At the same time, other institutions such as South China Normal University (four publications) and Lancaster University (two publications) have also actively participated, indicating that research strength is gradually expanding from the core region to a broader global scope.



**Figure 3.** Institutional collaboration network in AI and translation teaching research.

### 4.2.4. Author Collaboration Network

The author collaboration network shows a “small-world” structure centered on a few productive core teams, such as Zou and Xie’s group with nine co-authored publications. Active since 2021, these teams have shaped the field’s early knowledge base (**Figure 4**). However, most authors have a betweenness centrality of 0.00, indicating limited cross-team collaboration, with ties largely confined to fixed small groups and few broader intergroup connections.

### 4.2.5. Clustering Structure and Evolutionary Trends

Over the past two decades (2006-2025), interdisciplinary research on artificial intelligence and translation teaching has developed along three major trajectories, reflecting an evolution from tool-based assistance to ecosystem reconstruction (as shown in **Figure 5**).

From the perspective of technological empowerment and instructional application, three clusters can be identified. Applied translation (cluster # 3) examines the effectiveness of AI tools in improving students’ translation competence.

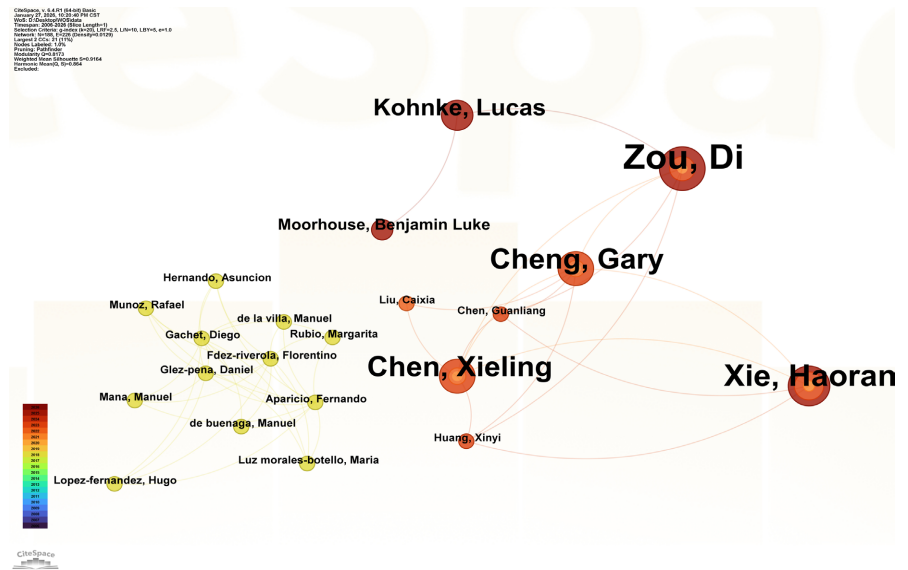


Figure 4. Author collaboration network in AI and translation teaching research.

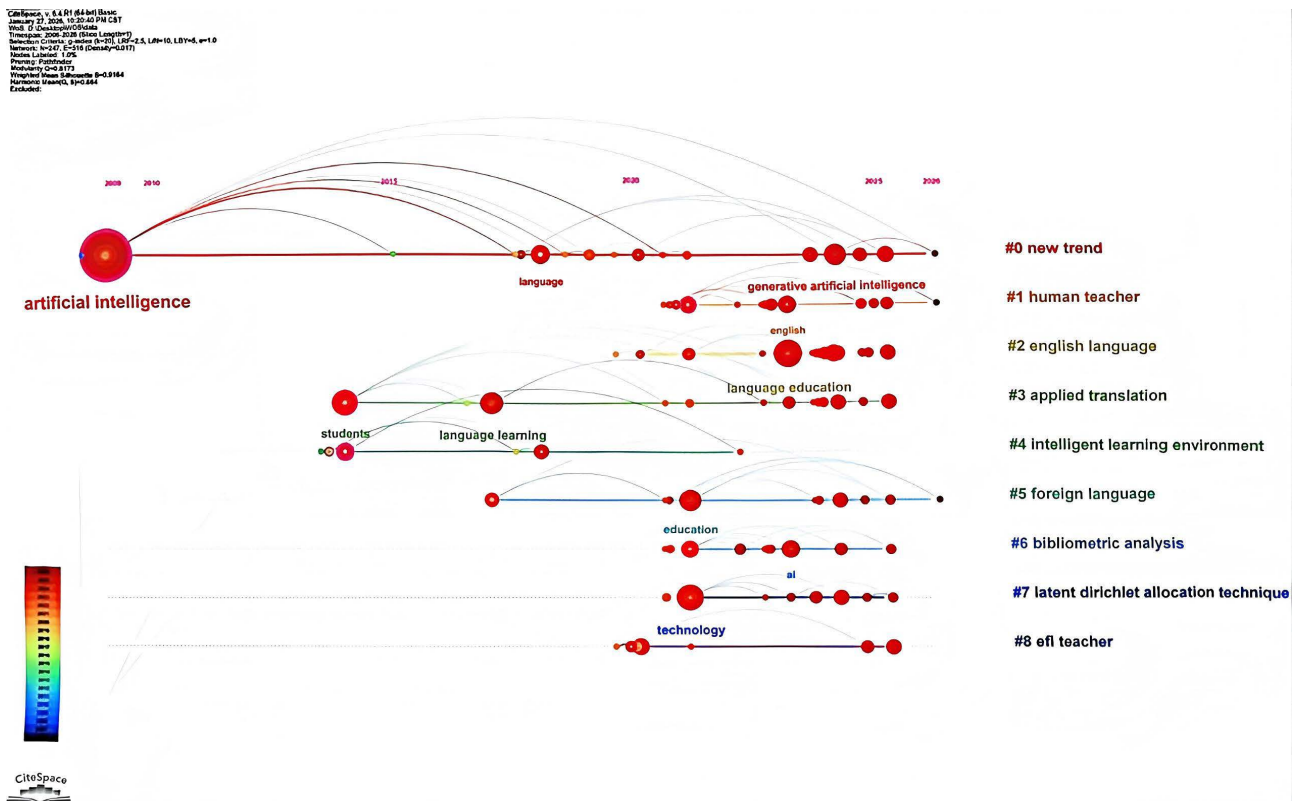


Figure 5. Timeline view of keyword clusters in AI and translation teaching research.

Intelligent learning environments (cluster # 4) focus on building integrated teaching ecosystems that combine technology, pedagogy, and learning resources. Foreign language teaching (cluster # 5) continues to explore the role of AI in developing language skills. Overall, these studies show a gradual transition from simple technology adoption to deeper pedagogical integration.

From the perspective of core elements and teacher development, research highlights key instructional roles and the linguistic foundation of teaching. Human teachers (cluster # 1) remain a central focus, with studies emphasizing their role adjustment and irreplaceability. English language teaching (cluster # 2) investigates how AI can support language competence development. EFL teachers (cluster # 8) examine the challenges and professional development pathways faced by teachers in response to technological change. This dimension balances technological empowerment with humanistic concerns and underscores that AI should assist rather than replace teachers.

From the perspective of methodological innovation and frontier exploration, bibliometric analysis (cluster # 6) and LDA techniques (cluster # 7) represent a growing trend toward using data-driven approaches to systematically examine the knowledge structure of the field. The emerging trends cluster (cluster # 0), labeled generative artificial intelligence, has risen rapidly since 2023 and shows strong connections with many earlier clusters. This indicates that generative AI is reshaping theories, teaching models, assessment practices, and the roles of teachers and students across the field of translation education.

#### **4.3. A Comparative Analysis of Chinese and International Research on AI-Empowered Foreign Language Teaching**

First, Chinese and international studies show different growth cycles: Chinese publications have increased rapidly since 2020, especially post-2023, reflecting policy-driven growth, while international research has accumulated steadily since 2006, with a second growth phase driven by generative AI, indicating that Chinese research responds quickly to emerging trends and international research reflects deeper technological iteration.

Second, significant differences can be observed in the structure of collaboration networks. The Chinese author network shows relatively low density and limited cross-team connections. Research activities are mainly concentrated in a small number of specialized foreign language universities, demonstrating a dispersed pattern of small-scale collaboration. By contrast, international studies have formed cross-national and cross-institutional collaboration networks. Hong Kong SAR, China, has developed into a prominent research cluster and connects scholars worldwide through international partnerships, exhibiting stronger network integration and knowledge exchange. This disparity suggests that international research communities may have more mature mechanisms for academic collaboration and resource sharing.

Third, differences are evident in knowledge structures and thematic clusters. Chinese research follows a practice-oriented pathway focused on technological tools, curriculum reform, and value-based education, with technology serving talent cultivation. In contrast, international research features independent clusters on teacher development, ethics, and methodology, and employs quantitative approaches like bibliometric analysis to foster theoretical reflection, highlighting a

stronger methodological awareness compared to the policy-aligned, implementation-focused nature of Chinese studies.

Overall, research on AI-empowered foreign language teaching in China and abroad exhibits two distinct development patterns: an application- and practice-oriented model and a structure- and reflection-oriented model. Chinese studies are more closely driven by policy contexts and instructional needs, whereas international studies place greater emphasis on methodological rigor and theoretical construction. Strengthening cross-context collaboration and methodological integration in future research may help the field move beyond localized experience toward more systematic and theory-informed development.

## 5. Conclusions

Based on core journal literature retrieved from CNKI and the Web of Science, this study employed bibliometric analysis and knowledge mapping with CiteSpace to conduct a systematic comparison of Chinese and international research on AI-empowered foreign language and translation teaching. Research topics mainly focus on technological applications, curriculum reform, and value-oriented education, forming a research pattern centered on specialized foreign language universities. However, collaboration among authors and institutions remains relatively loose. In contrast, international research has developed gradually over nearly two decades and demonstrates a more internationalized collaboration network. Beyond exploring instructional practices, it has also expanded to diverse orientations such as teacher development, ethical governance, and methodological innovation, reflecting more mature knowledge accumulation and academic cooperation.

From the perspective of knowledge structure, clear differences can be observed in the developmental paths and research priorities of the two bodies of literature. Chinese research places greater emphasis on the practical application of technology in instructional contexts and on the transformation of curriculum practices, showing strong problem-oriented and practice-oriented characteristics. International research, while also concerned with teaching applications, pays more attention to methodological frameworks and theoretical reflection, demonstrating higher levels of research rigor and methodological awareness. These two approaches are complementary in research orientation and academic paradigm, and together they shape a diversified and parallel development landscape in the field of AI-empowered foreign language education.

Methodologically, this study reveals publication trends, collaboration networks, and thematic evolution through bibliometric and visualization techniques, providing empirical data and structural evidence for understanding the overall research landscape in China and abroad. Future research may further expand data sources to include multilingual databases and integrate qualitative or empirical approaches, so as to gain deeper insights into the mechanisms of integrating artificial intelligence with foreign language teaching and to evaluate its pedagogical effectiveness more comprehensively.

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## Conflicts of Interest

The authors declare no conflicts of interest.

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