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## Bibliometric and Systematic Analysis of Artificial Intelligence Chatbots' Use for Language Education

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### Abstract

This research aimed to comprehensively analyze the use of chatbots in language education and its potential for advancing educational development. Through a bibliometric and systematic approach, the study identified influential authors, references, organizations, and countries in the field of chatbot application in language education using VOSviewer. A total of 26 peer-reviewed publications were selected for a systematic review. The findings of the study indicated that chatbots have a positive impact on language learning, although they are limited in terms of facilitating listening and writing practice. The study extended the Human-Organization-Technology (HOT) fit framework for chatbots' use for language education and discussed the factors that frustrate learners' use of chatbots for language education from human, organization, and technology dimensions. Furthermore, the author further discussed the suggestions for chatbots' better application for language education based on the three dimensions.

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## **Introduction**

The chatbot is a form of artificial intelligence (AI) designed to engage in turn-by-turn conversations with human users (Guo et al., 2022). It has become a critical application for language education and has developed into an active field with increasing literature available (Chen et al., 2023). The public release of ChatGPT represents a significant step forward in chatbots' use (Jeon & Lee, 2023). The implementation of chatbots could help students and teachers with both educational questions and routine tasks (Chocarro et al., 2023). Therefore, chatbots' use, especially the development of generative AI chatbots, promises to revolutionize education with its ability to engage learners, support educators, and provide personalized learning patterns (Kuhail et al., 2023).

However, previous studies focused on the single chatbot's use and the single aspect of language learning. For example, some researchers conducted studies about foreign language speaking, like speech-related anxiety (Bao, 2019), speaking practice (Hsu et al., 2021), and French pronunciation (Peura et al., 2023). Vocabulary learning is always important in any language as the basics. Researchers studied chatbots' use for Chinese vocabulary learning (Chen et al., 2020) and Japanese grammar and vocabulary learning (Haristiani et al., 2022). There was also research on writing and reading, like EFL students' argumentative writing (Guo et al., 2022), impact on their interest in reading (Liu et al., 2022), punctuation concreteness (Vazquez-Cano et al., 2021).

Considering the various kinds of use of chatbots for language education, the authors thought it is necessary to conduct a comprehensive study about chatbots' situation of application in different language learning tasks. Besides, the authors also considered the users' feelings about employing chatbots in the learning and teaching process, thus exploring the factors that may influence users' use of chatbots for language learning. In this research, therefore, the bibliometric analysis could help future researchers have explicit knowledge of the recent developments, dominant researchers, and articles in the research about chatbots' use for language education. The systematic review would aid the authors in viewing chatbots' influence on language education and factors frustrating learners' use of chatbots from a more holistic perspective. Therefore, this research aims to contribute to future research about generative AI chatbots' use in language education and to facilitate better use of chatbots in future language education.

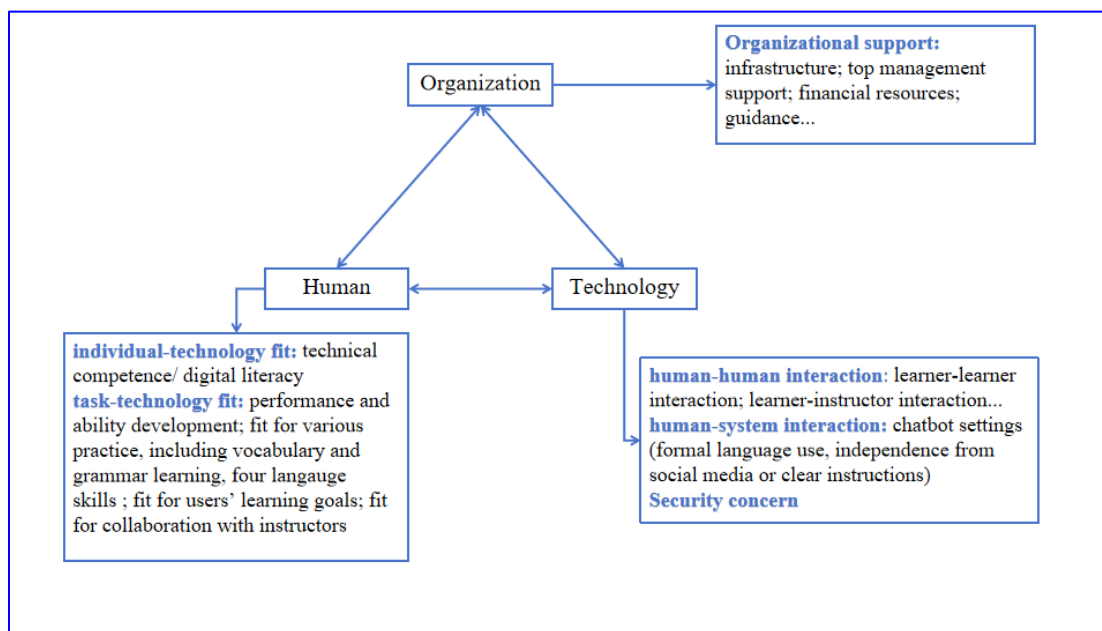
## **Theoretical Framework**

Through a thorough review of previous related theories, this study was conducted based on the human-organization-technology (HOT) fit framework developed by Xu and Lu (2022) for information technology adoption. A number of theories or models were exploring the information system (IS)/ information technology (IT) implementation, including the diffusion of innovation (DoI) theory, the technology acceptance model (TAM), the adaptive structuration theory (AST), the technology-organization-environment (TOE) framework, the technology affordance theory (TAT), and the task-technology fit (T-T fit) model. However, all of these theories ignored the essence of humans in IT/IS adoption, and mainly focused on subjective beliefs and specific actions (Xu & Lu, 2022). The HOT fit framework takes full consideration of technology, human, organization, and their relationships. Based on that, the authors tried to apply the HOT

framework in the research about IS/IT's use in the educational field to seek a breakthrough in the related research. We extended this theoretical framework by involving influencing factors to consider when integrating IS/IT into language education (see Figure 1).

**Figure 1**

*An Extended HOT Fit Framework for Chatbots' Use for Language Education*



According to the framework proposed by Xu & Lu (2022), the HOT-fit framework included three dimensions and focused on the relationship between those three factors. Therefore, the further extending of the framework focused on the influencing factors to consider when integrating IS/IT into language education in three dimensions. In the human dimension, human factors include individual-technology fit and task-technology fit (Cheng, 2021). Individual-technology fit refers to users' ability to perform the technology (Ghasemaghaei et al., 2017), and task-technology fit refers to the technology's ability to assist the users in performing tasks (Wu & Chen, 2017). The organization dimension should consider organizational support (Cheng, 2021). Organizational support refers to the extent to which top and middle management allocates adequate resources to help employees achieve organizational goals, including guidance, purposive instruction, and assistance for IS/IT usage (Lee et al., 2011). The technology factors include security concerns, human-human interaction, and human-technology interaction. Data security should be taken into consideration first (Ahmadi et al., 2017). Human-human interaction refers to the degree to which learners believe that they can easily communicate with others via interacting with the function of the e-learning platform, and the human-system interaction refers to the degree to which learners believe that they can easily take and study the learning contents via interacting with the function of the e-learning platform (Chen et al., 2018).

# Literature Review

## Previous Review and Bibliometric Analysis

There were already several reviews about chatbots' use for language education. However, they focused on different aspects, such as chatbots' technological affordance, speech-recognition chatbots, collaboration between humans and chatbots, and the potential of the newly released ChatGPT. For example, In Huang et al.'s (2022) review of chatbot-supported language education, they revealed technological affordances and pedagogical uses of chatbots. Jeon et al. (2023) focused on a single type of chatbot, speech-recognition chatbots for language learning. There was also a discussion about chatbots' collaboration with human teachers (Ji et al., 2023). The release of ChatGPT attracted many researchers' attention, and many researchers were concerned with ChatGPT's use in language education. The review of ChatGPT indicated that the use of ChatGPT is still in its early stage and the learning system was one of the main concerns (Baber et al., 2023). Barrot (2023) discussed the pitfalls and potentials of ChatGPT's use in L2 writing. Few reviews provide information about chatbots' use for specific education or discuss chatbots' influence from the standpoint of four language skills.

Previous relevant bibliometric analyses were mostly about chatbot-supported education or precision education. The results all presented that chatbots have been widely used in different subject areas, including early education, medicine, nursing, healthcare education, and language education (Chen et al., 2023; Lin & Yu, 2023). Therefore, the authors could find that language education is a main and critical part that chatbots use for education. However, the authors found few bibliometric analyses of chatbots' specific use in language education. The bibliometric analysis could help the authors explore and analyze a large number of related research rigorously (Donthu et al., 2021). With the aid of VOSviewer, the authors could explore the emerging topics, most cited authors, references, organizations, and sources in the field, thus analyzing the related researchers with a bird's view and finding the most important information and main research focuses.

## Previous Empirical Studies of Chatbot-supported Language Education

The existing chatbots and relevant research about chatbots' use for language education mainly focused on second language or foreign language learning and teaching. Conversational partner was the most common role of chatbots, and most of the studies focused on participants' perceptions of chatbots (Jeon et al., 2023). The second language or foreign language studied most were English and Chinese. The studies focused on different chatbots effectiveness in improving users' performance, including speaking (Bao, 2019; Tai & Chen, 2023; Ye et al., 2022), vocabulary learning (Chen et al., 2020; Jeon, 2021; Polyzi & Moussiades, 2023), writing (Su et al., 2023; Yan, 2023; Zhang et al., 2023a, 2023b), reading (Liu et al., 2022), and grammar learning (Haristiani et al., 2022). Some researchers may also focus on multiple languages at the same time. For example, (Alm & Nkomo, 2020) focused on four second languages. The language studied was limited to the chatbot setting to some extent.

Researchers also discussed the chatbots of different types and functions. The storytelling chatbots were always related to reading comprehension (Bailey et al., 2021). Speaking practice applied the speech-recognition chatbot without a doubt (Bao, 2019). The newly released

ChatGPT was mainly researched and used for writing practice in the language education area (Barrot, 2023). Chatbots were mainly used for vocabulary learning, like research on Chinese vocabulary learning (Chen et al., 2020) and English vocabulary acquisition (Jeon, 2021).

Chatbots were promised to provide an immersive foreign or second-language learning environment. It showed that chatbots the learners' sense of immersion and presence (Wang et al., 2017). Chatbots could provide naturalistic conversational interactions with learners, thus facilitating comprehensive foreign language acquisition (Divekar et al., 2022). Learners could incorporate into real-world text-based communication, thus mastering more idiomatic expressions for a more natural and local practice with partners (Bailey et al., 2021).

Previous researchers have conducted a detailed survey about teachers' and students' attitudes and acceptance of chatbots' use in language education. In most studies, participants were very willing to interact with chatbots (Kohnke, 2023; Vazquez-Cano et al., 2021; Ye et al., 2022). Language learners enjoyed the interaction with chatbots both in and out of the class (Kohnke, 2023), and the chatbots' use could improve learners' subjective satisfaction in the learning process (Kuhail et al., 2023). TAM (Technology Acceptance Model) was the most common model used for the survey about participants' acceptance of chatbots' use for language education. Participants' intentions were predicted by the perceived usefulness but could not be predicted by ease of use (Chen et al., 2020). Perceived easiness and perceived usefulness led to greater acceptance of chatbots (Chocarro et al., 2023).

## **Research Questions**

To present a clearer map of current chatbots' use and research, the authors conducted a systematic and bibliometric analysis of chatbots' use for language education to address the following research questions:

RQ1: What is the trend in publication and citation frequency for literature on the use of chatbots in language education?

RQ2: What are the current highly discussed topics in the field of chatbot use for language education?

RQ3: Which authors, organizations, countries, references, and sources are most cited in studies focusing on the use of chatbots in language education?

RQ4: How do chatbots impact language education in terms of different learning tasks?

RQ5: What factors influence the utilization of chatbots for language education among students and teachers?

## **Methods**

In this research, the authors combined the systematic review and bibliometric analysis to explore chatbots' use for language education. The bibliometric analysis helps the authors analyze the current research situation and grasp the emerging topics. Based on the results of bibliometric analysis, the authors could identify the collected literature quickly and analyze the article more systematically and logically. The former analyzes the related articles with a broad view and the latter explores the articles in a more detailed way. Therefore, the combined use of

bibliometric analysis and systematic review are complementary to each other, thus helping the authors obtain more comprehensive research results. The systematic review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol (Page et al., 2021). This study mainly included four steps. Firstly, the authors collected the related literature from the online database for systematic review and bibliometric analysis. Then, the VOSviewer was the main tool used to obtain information about the heated topics and the influential researchers, organizations, countries, references, and literature sources in the related research field. Thirdly, the authors selected the obtained literature according to strict inclusion and exclusion criteria. Finally, the authors had a closer reading of the selected literature and answered the research questions.

The authors collected the literature from Web of Science and Scopus on August 5, 2023, for the first time. By keying in “chatbot\*” (Topic) and “language\*” (Topic) and “learn\* OR educat\* OR teach\*” (Topic) in Web of Science, and keying in (KEY (chatbot\*) AND KEY (language\*) AND KEY (learn\* OR educat\* OR teach\*)) in Scopus, the authors obtained totally 1750 pieces of literature finally by March 21, 2024, including 880 from Web of Science, and 870 from Scopus. The documents types of the searched literature were mainly conference papers and articles. The updated literature included nearly 900 conference papers, over 700 articles, about 120 review papers, and a few book chapters, letters, notes, short surveys, editorial materials, books, news items, and data papers. In this step, the authors obtained the publication trend and citation frequency trend of the searched literature, thus answering the first research question with Web of Science’s analysis settings.

In the second step, the authors applied the VOSviewer to analyze the collected literature and answered the second and third research questions. VOSviewer was an effective tool used for the bibliometric analysis of literature. The term in the circle of the biggest size indicates this term possessed the highest discussion heat, and the lines’ thickness shows readers the relevancy between two terms connected by the line (van Eck & Waltman, 2017). The authors obtained the heated topics about chatbots’ use for language education by visualizing the co-occurrence of author keywords. After that, the authors visualized the top ten publication authors, organizations, countries, and top ten cited references, sources, and authors by setting different units of analysis and types of analysis. This information assisted the authors in obtaining the influential and dominant literature in relevant research.

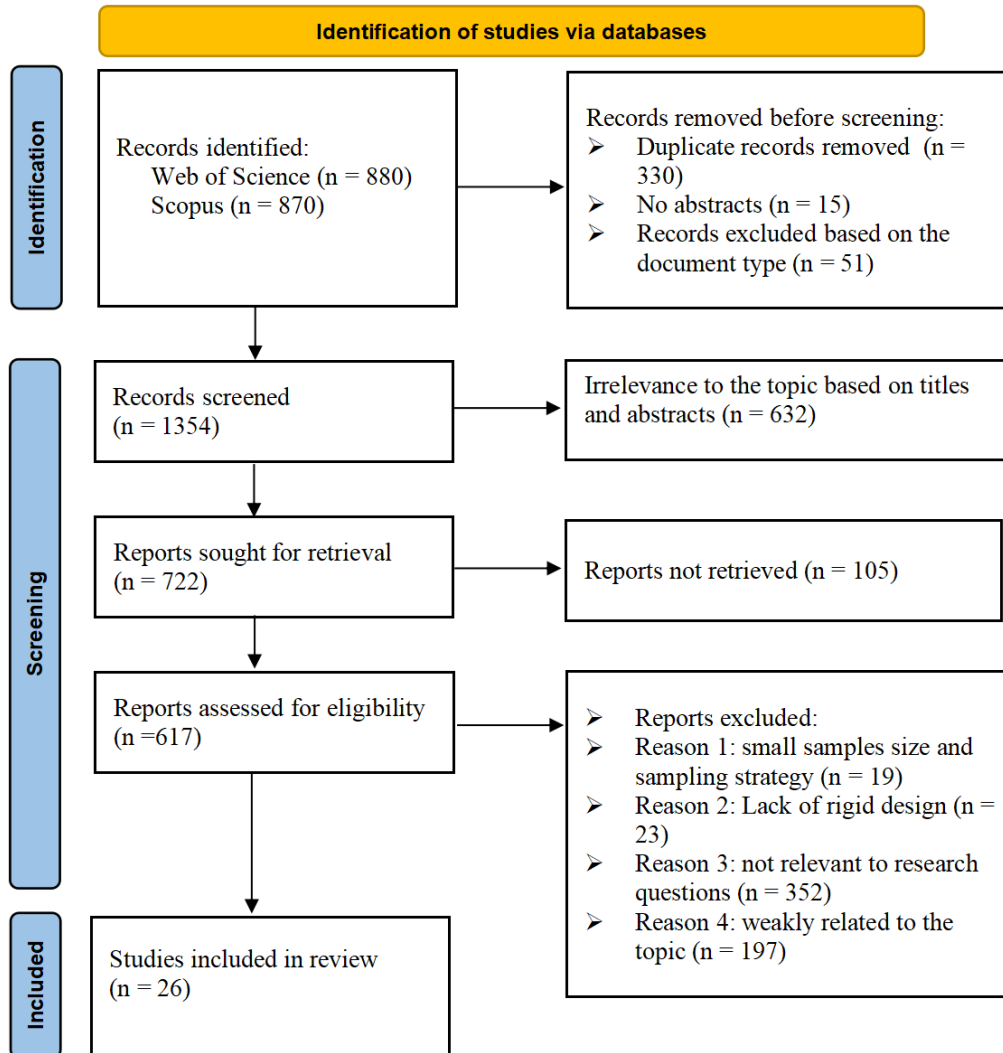
In the selection process of literature, the authors obeyed the Preferred Reporting Items for Systematic Review and Meta-analysis Protocol (PRISMA-P) (Shamseer et al., 2015). After removing 330 pieces of duplicate literature, the authors selected 26 peer-reviewed literature for systematic review from the 1420 pieces of literature according to strict and reasonable inclusion and exclusion criteria (see supplementary Material: Selection of 1420 Literature). Two authors participated in the main work of literature selection, and the third researcher assisted in the decision of the literature when the two participants held different opinions. The kappa data reached .783 (see supplementary Material: Kappadata), showing high inter-rater reliability of the two authors’ decision of literature. Therefore, we could say that the authors’ decision was reliable and reasonable. Literature would be included if it was (1) highly related to the topic, (2) conducted based on rigorous research design, (3) presented in scientific evidence, (4) and written in English. The literature will be excluded if they were (1) duplicates, (2) weakly related to the topic, (3) not relevant to the research questions, (4) not full texts, and (5) had no profound research design. The selection process is shown in

Figure 2 presents detailed information on the selection process of the 26 reviewed literature.

**Figure 2**

*A flow chart of the literature inclusion based on PRISMA-P.*

PRISMA 2020 flow diagram for new systematic reviews which included searches of **databases and registers** only



## Results

In this section, the authors answered the research questions one by one. It should be mentioned that the authors analyzed the publication trend and citation trend only with the literature from Web of Science to avoid the influence of duplicate literature in Web of Science and Scopus. The authors also checked the trends of Scopus, which showed a similar tendency to the Web of Science. Besides, in the analysis of the highly discussed topics, most cited authors, organizations, countries, references, and sources, the results also presented the data obtained from the analysis of literature updated in Web of Science, because the VOS viewer failed to analyze the files of Web of Science and Scopus together. However, the authors also

analyzed the literature updated in Scopus and compared the results with those obtained by Web of Science. They showed similar results.

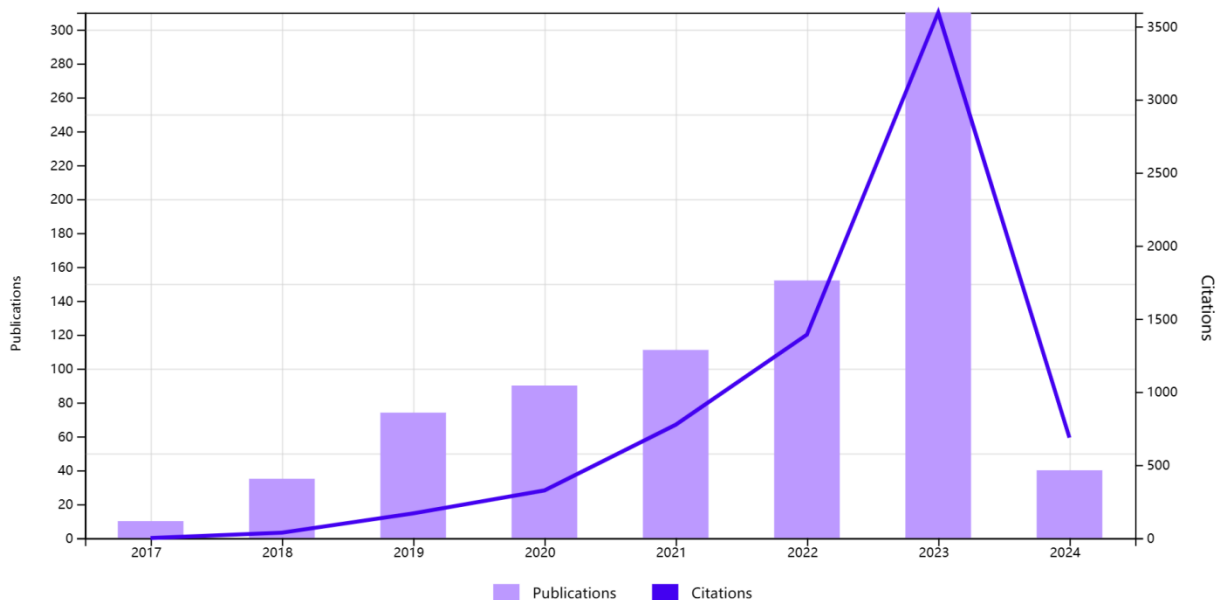
### The Publication Trend and Citation Frequency Trend of the Literature

Both the citation frequency and publication of literature on chatbot use for language education showed a considerable increase in recent years. Although the literature search involved literature from 1975 to 2024, the citation and publication of related literature were rare before 2017. Therefore,

Figure 3 only presents the citation frequency trend and publication trend of related literature from 2017 to 2024. From the figure, the authors could see clearly that the publication and frequency of citations boosted in 2023, which were almost twice as many as those in 2022. The publication number in 2023 reached 325, and the citation frequency reached 3706 in 2023. The publications and citation frequency showed a burgeoning trend in recent years. The publications in 2022 and 2023 were updated and visualized through the VOSviewer separately. From the analysis results, the authors could find that the main difference between two years' heated topics was between the ChatGPT and COVID-19. "COVID-19" failed to keep being a highly discussed topic in 2023, but the "ChatGPT" appeared as a new discussed topic. Therefore, the authors could see that ChatGPT's appearance attracted so much attention from researchers and has taken the discussion about chatbots' use and problems in a new direction.

**Figure 3**

*The publication trend and citation frequency trend of the literature*



### The Heated Topics Related to Chatbot Use for Language Education

The authors got the current highly discussed topics in the field of chatbot use for language education by visualizing the author keywords through VOSviewer. The type of analysis was co-

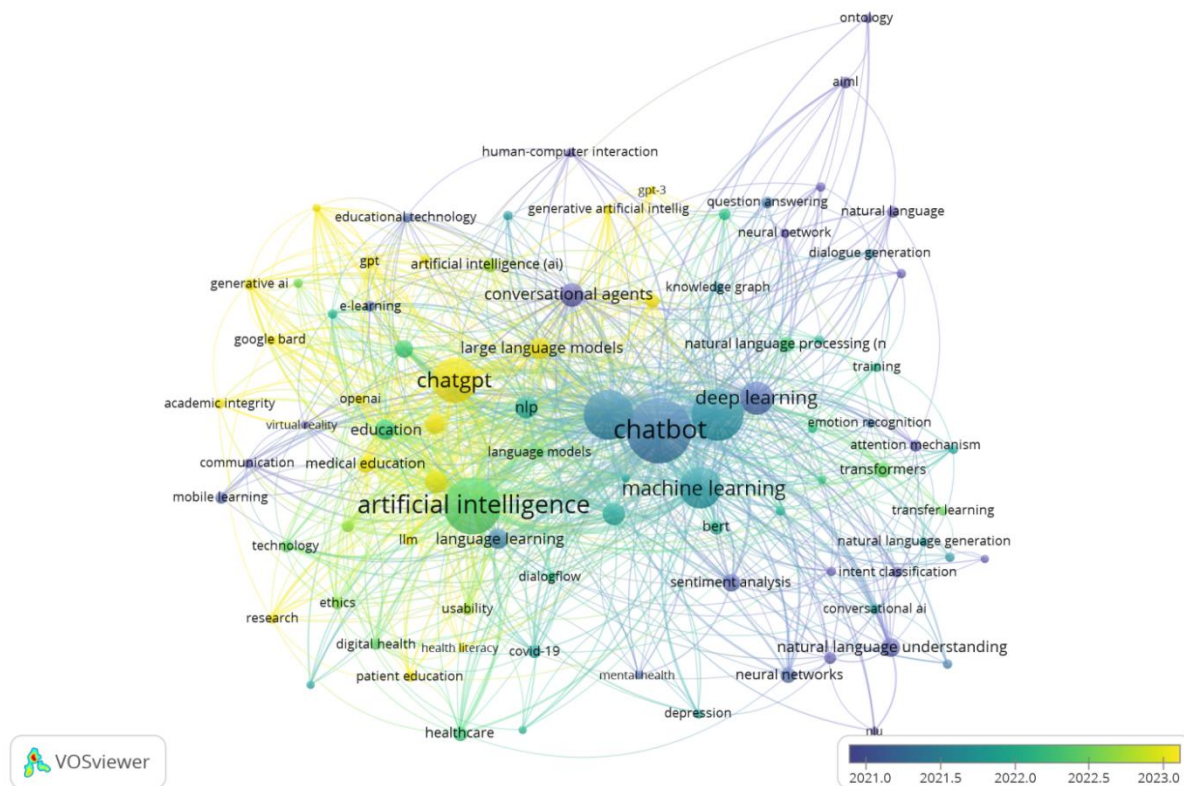


occurrence, and the unit of analysis was author keywords. Full counting rather than fractional counting was the counting method. When the authors set the minimum number of occurrences of a keyword as five, 89 met the threshold of the 2394 keywords. related to chatbots' use for language education. They are always the main concern and important issues researchers must pay attention to in the process of exploring the questions about chatbots' use for language education.

Figure 4 presents a map of the 89 keywords. 89 keywords were divided into eight clusters. The items of the same color belong to the same cluster. For each of the 89 keywords, the total strength of the co-occurrence links with other keywords was calculated, and the keywords with the greatest total link strength were selected. The top ten author keywords with the greatest total link strength were: artificial intelligence (N=210, Link Strength=621), chatbot (N=274, Link Strength=611), natural language processing (N=172, Link Strength=454), ChatGPT (N=129, Link Strength=397), chatbots (N=160, Link Strength=346), machine learning (N=112, Link Strength=320), deep learning (N=71, Link Strength=174), AI (N=35, Link Strength=157), NPL (N=32, Link Strength=122), and conversational agent (N=33, Link Strength=120). The top ten keywords represented the heated topics related to chatbots' use for language education. They are always the main concern and important issues researchers must pay attention to in the process of exploring the questions about chatbots' use for language education.

**Figure 4**

*A clustering map of author keywords*



## **The Top Ten Publication Authors, Organizations, and Countries**

The authors utilized VOSviewer to visualize the top ten authors, organizations, and countries in terms of publications. This analysis can provide valuable insights into which authors, organizations, and countries are actively engaged in research on chatbot use for language education, and have made significant contributions to the field. By employing co-authorship analysis with full counting as the counting method, the authors focused on authors, organizations, and countries as the units of analysis to identify the top ten in each category. This approach enabled the researchers to gather rich and extensive literature information on the utilization of chatbots for language education.

In the bibliometric analysis of the top ten publication authors, 39 authors meet the threshold of the 3088 authors when the authors set the minimum number of documents of an author as three. From the analysis result, the authors here chose to report the top eight authors because only the top eight authors possessed relatively higher total link strength. They were Jang Ho Lee (Citation=33, Link Strength=10), Dongkwang Shin (Citation=33, Link Strength=10), Heyoung Kim (Citation=33, Link Strength=9), Hyejin Yang (Citation=33, Link Strength=9), Azreen Azman (Citation=28, Link Strength=9), Khairul Azhar Kasmiran (Citation=28, Link Strength=9), Kulothunkan Palasundram (Citation=28, Link Strength=9), Nurfadhlina Mohd Sharef (Citation=28, Link Strength=9). The document numbers of the 37 authors were all around three. The author with the most publications was Jaeho Jeon, who has seven documents but his total link strength was only five, indicating a relatively lower relationship with the searched topics than many other authors. Therefore, the authors could conclude that although chatbots' use for language education attracted many researchers' attention and was highly discussed, the related research was still at an early age.

In the bibliometric analysis of the top ten publication organizations, the authors set the minimum number of documents of an organization as five and the minimum number of citations of an organization as zero. 30 organizations met the threshold of the 1343 organizations. According to the total link strength calculated by VOSviewer, the top ten organizations were The University of Hong Kong (Citation=508, Link Strength=11), Tsinghua University (Citation=138, Link Strength=9), Stanford University (Citation=141, Link Strength=6), The Chinese University of Hong Kong (Citation=30, Link Strength=6), Kyushu Sangyo University (Citation=384, Link Strength=5), City University of Hong Kong (Citation=72, Link Strength=5) University of Cambridge (Citation=127, Link Strength=4), Chung-Ang University (Citation=33, Link Strength=4), Gwangju National University of Education (Citation=33, Link Strength=4), University of York (Citation = 19, Link strength = 4). Therefore, the authors could see that the above universities or institutions paid more attention to the related research. Four universities in China ranked among the top six publication organizations, and three of the four were in China's Hong Kong. This indicated that researchers in China's Hong Kong were in a higher discussion of chatbots' use for language education and the application of chatbots was also more concerned than the other regions of the world. Researchers will pay more attention to the research in China's Hong Kong in the future.

In the bibliometric analysis of the top ten publication countries or regions, the authors set the minimum number of documents of a country or a region as five and the minimum number of citations of a country or a region as zero. There were 47 countries and regions that met the

threshold of 86 countries and regions. The top ten countries or regions were the USA (Citation=1613, Link Strength=109), China (Citation=1529, Link Strength=63), England (Citation=743, Link Strength=60), Canada (Citation=428, Link Strength=34), India (Citation=701, Link Strength=30), Australia (Citation=546, Link Strength=34), Italy (Citation=221, Link Strength=26), Netherlands (Citation=116, Link Strength=25), Germany (Citation=269, Link Strength=24), and Singapore (Citation=328, Link Strength=22). Whether it is documents, citations, or total link strength, the USA is the first place and is much higher than the second country. Therefore, the authors can see that both chatbots' application in the language education field and the USA's research regarding the chatbots' use for language education are far ahead the other countries. Researchers could obtain more information and the latest news about the application and research findings about chatbots' use for language education from the USA.

### **The Top Ten Cited References, Sources, and Authors**

The authors used VOSviewer to visualize the top ten cited references, sources, and authors in studies focusing on the use of chatbots in language education. The high citation number could show authors the most influential publications, journals, and authors. Thus, researchers could find valuable information from this information and know the chatbot use for language education quickly. The authors used co-citation as the type of analysis and used cited references, cited sources, and cited authors as the unit of analysis. Full counting was the counting method.

In the bibliometric analysis of the top ten cited references, 50 references met the threshold of the 27979 cited references when the authors set the minimum number of citations of a cited reference as 20. The top ten cited references were

(Weizenbaum, 1966) (Citation=104, Link Strength=301), (Fryer et al., 2019) (Citation=49, Link Strength=195), (Vaswani et al., 2017) (Citation=67, Link Strength=178), (Fryer et al., 2017) (Citation=67, Link Strength=178), (Papineni, 2002) (Citation=44, Link Strength=150), (Fryer & Carpenter, 2006) (Citation=50, Link Strength=148), (Huang et al., 2022) (Citation=45, Link Strength=144), (Devlin et al., 2019) (Citation=42, Link Strength=136), (Smutny & Schreiberova, 2020) (Citation=36, Link Strength=134), (Adamopoulou & Moussiades, 2020) (Citation=37, Link Strength=130). As chatbots are a new technology in rapid development, researchers would pay more attention to the latest applications of chatbots and new emerging problems. However, the top cited reference reminded the authors that many classic references about the technology's application, or education issues.

In the bibliometric analysis of the top ten cited sources, 103 sources met the threshold of 14320 sources when the authors set the minimum number of citations of a cited source as 20. The top ten cited sources were arXiv (Citation=1555, Link Strength=42147), the 57th Annual Meeting of the Association for Computational Linguistics (ACL 2019) (Citation=158, Link Strength=19093), AAAI Conference on Artificial Intelligence (Citation=253, Link Strength=14273), Proceedings of the 2020 Conference on Empirical Methods in Natural Language Processing (EMNLP) (Citation=70, Link Strength=14005), 58th annual Meeting of the Association for Computational Linguistics (ACL 2020) (Citation=85, Link Strength=13095), Journal Medical Internet Research (Citation=305, Link Strength=9299), Computers in Human Behavior (Citation=303, Link Strength=8020), Lecture Notes in Computer Science (Citation=304, Link Strength=7490),

Nature (Citation=235, Link Strength=7084), and Computers & Education (Citation=258, Link Strength=6550). The authors found that nearly half of the top ten cited sources were conference meetings in recent years. It indicated that the related research was in a period of rapid development and related topics were important and highly discussed in the recent related conferences. This would remind researchers of the significance of paying attention to the related conference meetings.

In the bibliometric analysis of the top ten cited authors, 95 authors met the threshold of the 20820 cited authors when the authors set the minimum number of citations of a cited author as 20. The top ten cited authors were LK Fryer (Citation=154, Link Strength=1362), J Weizenbaum (Citation=119, Link Strength=768), J Devin (Citation=127, Link Strength=715), IV Serban (Citation=71, Link Strength=665), Open AI (Citation=105, Link Strength=617), Kim Na-Young (Citation=62, Link Strength=609), J Jeon (Citation=47, Link Strength=561), T Mikolovt (Citation=73, Link Strength=520), A Vaswani (Citation=89, Link Strength=512), and E Adamopoulou (Citation=70, Link Strength=496). It is worth noting that Open AI appeared as an author and ranked among the best. The authors also visualized the literature published in 2023 and 2024, the Open AI even ranked first place. Therefore, the authors could see the huge influence of ChatGPT's release.

### **Chatbot's Impacts on Language Education in Terms of Different Learning Tasks**

Because of the different designs of various chatbots for language education, different chatbots fit different tasks in language education. After a systematic review of the literature about chatbots' use for language education, the authors found that many of the current chatbots facilitate and assist students' language learning in speaking, reading, writing, vocabulary, and grammar learning to some extent. However, in the four language skills, including listening, speaking, reading, and writing, chatbots were rarely used for listening practice tasks, and the writing practice task was limited to students' argumentative writing.

Chatbots are fit for learners' speaking practice tasks well and facilitate students' speaking ability greatly. Chatbots' use shows benefits in developing learners' intelligibility, increasing confidence, and addressing speaking anxiety (Vancová, 2023). Users would show higher engagement in interacting with chatbots (Ruan et al., 2021). The speech-related anxiety was an important factor impeding the foreign or second language speaking. Luckily, studies (Bao, 2019; Hsu et al., 2021) showed that chatbots had a significant promise in reducing learners' speech-related anxiety about speaking foreign languages because the chatbots appeared as non-threatening interlocutors for practice. Chatbots enhance students' communicative confidence and encourage them to use a foreign language for real and meaningful communication (Tai & Chen, 2023). They helped students engage in the conversation by improving their curiosity and willingness for language learning (Alm & Nkomo, 2020). Besides, chatbots could aid students' pronunciation and grammar accuracy, and students enjoy the process of practicing speaking with chatbots (Peura et al., 2023; Ye et al., 2022).

Based on all of the searched literature, the authors found rare articles about chatbots' use for language listening practice. The authors discussed that chatbots' rare use for listening practice could be due to the reason that the listening practice does not need much interaction. Listening to the record and checking themselves by reading the audio script was the common listening

practice way (Yu & Duan, 2024). Learners do not need the chatbots to correct errors and what the learner has heard could not be obtained by the outside world easily (Yu, 2023). Besides, the listening practice was a part of the speaking practice. Chatbots showed great benefits in relieving learners' speaking anxiety in the speaking practice because the chatbots were not real people and they provided more chances for interactive practice for learners as discussed in the last paragraph. Some of the speaking anxiety arises from learners' anxiety of worrying that he/she can not hear others clearly (Xiaomeng Li, 2024). Therefore, in the process of speaking practice with chatbots, the authors have the reason to infer that the learners' listening anxiety would also be relieved. Overall, chatbots' use showed a positive influence on online speaking practice experience (Luo et al., 2023).

In terms of the fit between writing practice tasks and chatbots, it is found that chatbots could facilitate students' argumentative writing process by interacting with students as writing peers. The integration of chatbots would not affect students' learning outcomes and the blended use of chatbots' feedback and tutor feedback was suggested (Escalante et al., 2023). Interaction with peers benefits students' argumentative writing, while it's difficult to find a suitable peer always, and providing detailed feedback is also much more time-consuming for teachers (Su et al., 2023). Chatbots appeared as a very promising solution (Guo et al., 2022). Chatbots' use could maximize students' writing efficiency (Yan, 2023) and improve students' punctuation correctness (Vazquez-Cano et al., 2021). Students were positive about the chatbot use in the writing process because of the greater companionship, interaction, feedback, and less limitation of time and space (Vazquez-Cano et al., 2021). It could greatly improve students' motivation (Zhang et al., 2023a). However, chatbot training on logical fallacies might also reduce writing self-efficacy (Zhang et al., 2023b), and it is less slightly effective than website learning (Zhang et al., 2023a).

The storybots could boost students' reading comprehension ability, thus chatbots are fit with the reading practice tasks. In the process of using storybots in the class, the interaction with chatbots needs a high degree of reading comprehension, thus practicing the reading comprehension ability greatly (Bailey et al., 2021). Survey results (Bailey et al., 2021) also showed that students held positive opinions about chatbots' ability to help them achieve their learning goals. Interaction with chatbots helps students maintain a stable level of interest for a comparatively long time reading a book, and students could perceive a high level of social connection with chatbots (Liu et al., 2022).

In the tasks about vocabulary and grammar learning, chatbots also perform well and can significantly improve students' learning achievement in vocabulary and grammar learning. Chatbots could interact with learners with fewer time and space limitations, and learners' autonomy and independent learning abilities were fully practiced (Haristiani et al., 2022). Studies have proved chatbot's benefits for Chinese vocabulary learning (Chen et al., 2020). In Japanese grammar and vocabulary learning, the chatbot was useful in enhancing students' basic grammar and vocabulary mastery (Haristiani et al., 2022). Besides, chatbots could provide diagnostic information concerning vocabulary learning situations (Jeon, 2021). Students were more enjoyable and performed better when they used chatbots to learn vocabulary than when applying the traditional learning methods

## **Factors that Influence the Utilization of Chatbots for Language Education among Students and Teachers**

The primary factor must be the task-technology fit and the individual-technology fit in the human dimension. Overall, participants could always enjoy the interaction with chatbots both in and out of class and perceive that their language skills are improved (Kohnke, 2023). It is important whether chatbots can fit different tasks in language education thus facilitating students' learning performance and ability development. In the first place, students' willingness to use chatbots may be frustrated when they find the content could not correspond to students' learning goals perfectly (Alm & Nkomo, 2020). Besides, the excellent performance of chatbots may also have a negative influence on learners' language education and ability development in the long term. Chatbots, such as ChatGPT, could provide rapid and accurate answers, but the researcher was hesitant that this hinders students' development of critical thinking and reinforces biases or misinformation (Mohamed, 2023). As for the individual-technology fit, people should realize the need for users' technical competence. The newly developed technology always came across the problems of the requirement for digital literacy (Hockly, 2023).

In the technology dimension, human-system interaction and security concerns are also important factors that may cause problems or influence students' and teachers' willingness to use chatbots. Users' need for additional support beyond those offered by the chatbot is a challenge for the interaction between users and chatbots (Guo et al., 2023). The security concern was a major barrier to the adoption of IS/IT (Ahmadi et al., 2017). Academic honesty and educational equity also met challenges because of the chatbots' use (Yan, 2023). Some chatbot settings like language use and integration with social media affected the human-system interaction, thus influencing learners' and instructors' use of chatbots for language education (Chocarro et al., 2023). Some chatbots were not individual applications because they could be integrated into social media, which may cause some practical confusion and problems in the use process (Haristiani et al., 2022).

In the aspect of organizational factors, it shows that organizational support is necessary for the successful implementation of chatbots for language education. The payment issues and discontinuation of services were problems influencing students' and teachers' use of chatbots (Alm & Nkomo, 2020). According to the IS innovation adoption, IS infrastructure was one of the most frequent factors that affected the adoption process, and adequate financial resources were also associated with the IS adoption and implementation (Ahmadi et al., 2017). Organizational support also includes the top manager's support, which means whether or not the top managers understand the nature and functions of IS technology and therefore fully support the development of it (Lian et al., 2014).

## **Discussion**

Based on the results of the systematic review and bibliometric analysis, the authors discussed chatbots' application problems and provided suggestions for the improvement of chatbots from the three dimensions based on the HOT fit framework. The three dimensions are not independent of each other but support each other. The improvement of factors in one dimension could achieve an influence on different dimensions. Once the chatbots' use could achieve the fit between humans, technology, and organization, could the implication of chatbots for language

education achieve better effectiveness both inside and outside the language education classroom.

### **The Technology Dimension**

The present chatbot applications showed differences in personal use and in-class use. Although the results showed that the chatbots could assist in many language learning tasks, they were nearly all about the learner-chatbot interaction. However, fluent human-human interaction was suggested in the future because learners' use of chatbots needs teachers' supervision, despite the independent learning outside of the class. Learners could not rely on the chatbots too much. Providing accurate answers immediately is one of the greatest advantages of chatbots. However, when students obtain the correct answers easily, they rely on the use of chatbots and lack reflection and critical thinking, and they may also easily receive some biased information (Mohamed, 2023). Besides, the accuracy of chatbots may not always be one hundred percent, especially in language education. Chatbots could provide grammatically correct answers easily, but it would be much more complex when considering the meaning in language. The accuracy of chatbots would drop when the meaning is taken into consideration (Coniam, 2014).

The present chatbots for language learning are mostly about self-learning, but not for class teaching. The teacher-AI collaboration in the classroom would call for more requirements for human-system interaction in the technology dimension. Both researchers and chatbot designers should pay attention to the difference between chatbots for teacher-AI collaboration and chatbots for learners' independent learning. Chatbots were expected to help decrease human teachers' workload, but researchers found limited evidence for collaboration between chatbots and human teachers (Ji et al., 2023). Teachers should make good use of the chatbots' features to refine their teaching methods, and instruct the students in a more adaptive way (Yuan, 2023). Some chatbots' use had better effects on learners' achievement in the one-on-one environment than in a one-on-many classroom (Chen et al., 2020). Chatbots concerning independent learning should pay more attention to different learners' characteristics. Suitable learning patterns for learners are expected to contribute to learners' motivation and attitude (Jung et al., 2022). By chatting with chatbots, learners could get differentiated instructions as a supplement to in-class learning (Kohnke, 2022).

For the human-system interaction and security concerns, the chatbots should mainly improved from the designer aspect. The research findings showed that the chatbot settings caused differences in the fluency of human-system interaction. Based on that chatbots are suggested to try to apply the formal language. The formal language use of chatbots could make the human-system interaction smoother, thus being conducive to users' intentions of applying them in the learning process (Chocarro et al., 2023). For the chatbots integrated into social media, authors suggest that they could be independent of social media or provide enough clear instructions for a better human-system interaction. In terms of the security concern, both users and designers considered the ethical issues, especially the learner data collection, and surveillance (Hockly, 2023). Users' improvement of security awareness needs to be improved. Teachers and designers are supposed to spare some energy on the popularization of security questions and the policy newly developed for chatbots.

## **The Human Dimension**

According to the research findings, chatbots play well in many different language learning tasks, including speaking, reading, and writing practice and vocabulary and grammar learning. However, the use of chatbots inside the classroom calls for a higher task-technology fit in the human dimension. The results indicated that the task-technology fit was a primary factor that influenced chatbots' use. Therefore, the wider use of chatbots in classroom called for a better fit between the chatbots and teachers' teaching tasks, so that chatbots could assist teachers in accomplishing the teaching tasks better. In the first place, the chatbot's content design was suggested to show more options on the integration with curriculum or textbooks' contents. It has been shown that language practice would be more effective if the practice content could be aligned with vocabulary or tasks in textbooks in school settings (Qian et al., 2023).

The collaboration between chatbots and teachers in the classroom not only requires cooperation in content but also needs a good integration of advanced technology and traditional methods. Although teachers theoretically know the latest devices used for language education, they can not practically use them in their education process (Klimova et al., 2023). Teachers need some training and pedagogical guidance (Klimova et al., 2023) and People should consider teachers' pedagogical expertise (Jeon & Lee, 2023). Chatbots were valuable tools to serve as a supplement to traditional methods (Mohamed, 2023), and some traditional learning methods were also helpful in improving the effects of chatbots. Lin and Mubaro's (2021) research has proved that mind map-guided chatbots were more effective in enhancing learners' learning performance than traditional chatbots. The design and utilization of chatbots were supposed to account for the classroom environment (Jung et al., 2022).

## **The Organization Dimension**

Based on the HOT framework, organizational support is a necessary factor for the successful use of chatbots for language education inside the classroom. Organizations, including schools and language education institutions, should consider providing necessary support for the use of chatbots. Organizations could offer support like corresponding IT/IS infrastructure, top management support, financial resources, and guidance for chatbot use for language education. The guidance provided for instructors and learners would be a good facilitator to the individual-technology fit and human-human interaction. Besides, the top management support was demonstrated to be the main linkage between individual and organizational IS adoption (Jeyaraj et al., 2006). The organizational support could facilitate the individual-technology fit, thus smoothing the learner-learner interaction and learner-instructor interaction.

## **Conclusion**

### **Major Findings**

Firstly, the authors conducted a bibliometric analysis of chatbots' use for language education, providing a holistic map of the related research. The authors obtained detailed information about the research trend, highly discussed topics, and critical and dominant researchers, organizations, countries, references, and literature sources. Secondly, in the systematic review of chatbot-supported language education, 26 peer-reviewed literature were selected, and the



authors concluded chatbot use on different language learning tasks. Chatbots have limited use in learners' listening practice tasks, and the writing practice tasks were limited to argumentative writing. Thirdly, the authors explored the factors influencing chatbots' use for language education based on the HOT fit framework. The factors include the individual-technology fit, task-technology fit in the human dimension, organizational support in the organization dimension, human-human interaction, human-system interaction, and security concern in the technology dimension.

Based on the extended HOT fit framework for chatbots' use for language education, chatbots' use for language education is supposed to pay attention to the following factors from three dimensions. In the human dimension, advanced chatbots' use should look for more integration with traditional teaching methods to accomplish the teaching tasks better and try to integrate different language learning tasks to achieve more comprehensive language learning performance. In the technology dimension, the authors suggested the improvement of chatbots from chatbot settings like formal language use and being independent of social media. Chatbots are also suggested to provide opportunities for smoother human-human interaction for the application inside the classroom. In the organization dimension, organizational support is necessary for the application of chatbots for language education inside the classroom, including corresponding IS infrastructures, top management support, financial resources, and guidance for using chatbots.

### **Limitations**

Although the authors have made the best effort to make a comprehensive review and bibliometric analysis of the related literature, there were still some limitations in this research. Firstly, the authors only searched the literature in the database Web of Science and Scopus, and the reviewed literature was limited to articles in English. Some literature must have been neglected because there are no records on the Web of Science or they were published in other languages. Secondly, the last update of searched literature was on March 21, 2023, and the authors found that the publication trend of the related research is rising quickly. Some excellent literature may have been published during this period and would be missed in this research. Thirdly, the results were all concluded based on previous literature and this article lacks an empirical study. The authors hope an empirical study in the future so that the results could be more persuasive.

### **Implications for Future Research**

Firstly, through the bibliometric analysis of collected literature, the authors demonstrated the publication trend and influential information in research on chatbots' use for language education. The results show that chatbots are developing at a high speed, and they are attracting increasing attention from researchers. Therefore, both chatbot designers and users are facing a great number of challenges. The current research about chatbot-supported language education focuses on single aspects of language learning. The authors suggest that future studies could pay more attention to the integrated learning of language's different aspects. It would be significant to find a way to present an immersive foreign language learning environment with chatbots.

Secondly, through the systematic review of 26 peer-reviewed literature, the authors reviewed chatbots' influence on language learners' different tasks. Chatbots' use still has obvious limitations on language writing practice and listening practice. Future research could focus on chatbots' better use for listening practice and different types of writing. Besides, chatbots' use inside the classroom needs more fit between technology and teaching tasks, and some traditional learning skills and teaching methods have been proven to be effective in enhancing chatbots' positive influence on language learning performance. Therefore, future researchers should explore more possibilities for the integration of traditional teaching methods and newly developed chatbots to achieve better performance.

Thirdly, the authors extended the HOT fit framework for language education, which was mainly used for the hospital IS/IT implementation previously. The authors have explored some factors in the three dimensions and the specific manifestation of those factors in the present framework based on previous studies with bibliometric and systematic analysis. Future research may need some empirical studies to have further insight into each factor in the framework and more theoretical explorations about a more comprehensive knowledge of the factors that influence chatbots' use for language education.

### **Conflict of Interest**

The authors disclose that they have no actual or perceived conflicts of interest. The authors disclose that they have not received any funding for this manuscript beyond resourcing for academic time at their university.

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