Using Chatbots for Language Learning: A Bibliometric Analysis

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Abstract

The integration of chatbots into language learning has garnered significant attention due to their potential to revolutionize language acquisition processes. These intelligent conversational agents, powered by artificial intelligence and natural language processing technologies, offer unique opportunities for interactive and personalized language learning experiences. Chatbots can enhance learner engagement, motivation, and proficiency by providing immediate feedback, engaging learners in authentic conversations, and offering language practice opportunities. This paper presents a comprehensive bibliometric analysis using multiple publication databases and indexing services. By examining a wide range of scholarly publications, including journals, conference papers, and books, this analysis aims to gain valuable insights into using chatbots for language learning. The selected database and indexing services ensure the inclusiveness and comprehensiveness of the analysis, covering a diverse range of research publications. The analysis explores key research themes and trends in chatbot-based language learning. It identifies influential authors and research groups, highlighting their contributions and impact on the development of this domain. The analysis uncovers collaborative relationships and knowledge-sharing patterns among researchers by examining co-authorship networks, fostering potential collaborations and advancements within the field. Furthermore, the analysis investigates the interconnections between concepts in chatbot-based language learning. The study identifies the central concepts and their relationships by examining co-occurrence networks, providing an overview of the research landscape. This information helps identify prominent focus areas and potential research gaps, guiding future investigations and developing innovative approaches.
The findings of this bibliometric analysis contribute to the current state of research on chatbots in language learning. They provide valuable insights into existing knowledge, research trends, and collaborative networks in this rapidly evolving field. Researchers, practitioners, and policymakers can benefit from these insights by understanding the current landscape more deeply, identifying potential research directions, and fostering collaborations.

Keywords: *Chatbots, language learning, artificial intelligence, natural language processing, bibliometric analysis, research trends, collaborative networks, personalized learning*

1. Introduction

The integration of chatbots into language learning has garnered significant attention in recent years due to their potential to revolutionize language acquisition processes. Chatbots, powered by artificial intelligence and natural language processing technologies, offer unique opportunities for interactive and personalized language learning experiences. These intelligent conversational agents can provide learners with immediate feedback, engage them in authentic conversations, and offer language practice opportunities at their convenience. This research paper aims to conduct a bibliometric analysis using Scopus, a comprehensive catalog of scholarly papers, authors, and institutions, to gain valuable insights into using chatbots for language learning. By examining a wide range of scholarly publications, this analysis seeks to explore key research themes, identify influential authors and research groups, and uncover the interconnections between concepts in this rapidly evolving domain. Understanding the current state of research on chatbots in language learning is crucial for several reasons. Firstly, it allows us to identify prominent themes and trends in the field, shedding light on areas that have received considerable attention from researchers. Secondly, it enables us to identify gaps and areas for further investigation, providing valuable guidance for future research endeavors. Thirdly, it offers insights into research collaborations and networks, fostering potential collaborations and knowledge sharing within the chatbot-based language learning community. To achieve these objectives, this study leverages Scopus as a comprehensive source of scholarly literature. Scopus

provides researchers access to a vast collection of papers, ensuring the inclusiveness and comprehensiveness of the analysis. By utilizing these open and comprehensive catalogs, we ensure that our bibliometric study encompasses a wide range of publications, allowing us to capture the breadth of research related to chatbots in language learning. By Systematically analyzing key terms, co-authorship networks, and term co-occurrence networks, this research aims to provide a comprehensive overview of the current research landscape in chatbot-based language learning. The findings of this analysis will inform researchers, practitioners, and policymakers about existing knowledge, potential research directions, and collaborative opportunities in this field. Ultimately, this research advances chatbot-based language-learning approaches and effective language-learning solutions.

2. Literature Review

The integration of chatbots into language learning has been the subject of extensive research. Several studies have investigated the effectiveness of chatbots in language learning contexts and highlighted their potential to enhance language acquisition processes. For instance, researchers conducted a systematic review demonstrating how chatbots can provide personalized and interactive learning experiences, promoting language practice and learner engagement [1]. Furthermore, chatbots have been found to offer immediate feedback, reducing the dependence on human instructors and fostering autonomous learning [2, 3, 4]. This aspect is particularly valuable in self-paced language learning environments, where instant guidance and correction are crucial. Researchers have also explored the role of chatbots in developing learners' speaking and listening skills through simulated conversations [5, 6]. These interactive dialogues provide learners with a controlled and supportive environment to practice their language skills, ultimately enhancing confidence and fluency. The utilization of natural language processing and machine learning techniques in chatbot-based language learning has also been investigated. Researchers studied chatbots' societal, technological, and educational benefits in language learning, and they found that chatbots provide a timely, accessible, personalized experience and promote coherent and open interactions [7]. Despite the progress made in this field, research gaps still need to be addressed. Based on this study findings, one area that requires further exploration is the design and development of chatbots that engage learners in meaningful and contextually relevant conversations. We noticed that more research is needed to understand the long-term impact of chatbot-based language learning and "the novelty effect" [8]. Another area is the impact of using chatbots on diverse learner populations, including children, adult learners, and individuals with different linguistic backgrounds. Moreover, while existing studies have primarily focused on the effectiveness of chatbots in specific language skills, such as speaking and listening, we realized the need for research that examines their impact on other language domains, such as reading and writing. Understanding the potential benefits and limitations of chatbots in these areas can inform the development of comprehensive language-learning solutions. The literature review underscores the significance of incorporating chatbots into language learning. It highlights their potential to provide personalized and interactive learning experiences, offer immediate feedback, and enhance learners' speaking and listening skills. However, based on the bibliometric analysis, we found that further research is required to address gaps in the literature concerning the design of contextually relevant chatbot interactions and their impact on different language domains and learner populations.

3. Methodology

Scopus is relevant to the study as it provides access to various academic publications related to the research topic. It allows researchers to retrieve relevant studies on using chatbots in language learning, including empirical research, theoretical papers, systematic reviews, and conference proceedings. The data collection process involved systematically searching the Scopus database using appropriate search terms related to chatbots and language learning. The search was performed for terms in the titles, abstracts, and keywords sections of each article. The keywords used in the Scopus search were chatbot, chatgpt, generative model, and language learning. The search code was described as follows:

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TITLE-ABS-KEY ( ( chatbot OR chatgpt OR "generative model" ) AND "language learning" )
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The methodology used in this bibliometric analysis follows the science mapping workflow described in [9]. It consists of the following steps: 1) data collection and saving, 2) data loading, 3) descriptive data

analysis, and 4) data mapping and visualization. This study used R language with the package bibliometrix to implement the workflow.

4. Results and Findings

4.1 Data Acquisition
Publications from the period (2004-2023) were retrieved from Scopus, stored, and analyzed, resulting in 116 records. The records were inspected to ensure they were relevant to the search query. Additionally, the metadata for each publication is extracted and stored in an R data frame, followed by a data cleaning process. An initial inspection of records shows that the annual publication growth rate is 21.27%, with an average of 13 citations per paper. These results indicate increased interest and research activity in "using chatbots for language learning" topic, especially within the last three years.

4.2 Descriptive Analysis
The descriptive analysis calculated the main bibliometric measures of the collected dataset and the main information is summarized in Table. 1. Additionally, results show that multi-author publications count for 80% of the total publications, with an average of three authors per paper. The percentage of International co-authorships is 19.83%. The number of publications in each category is fifty-two journal articles, seven book chapters, forty-seven conference papers, four conference reviews, one editorial note, and four reviews. Haristiani N and Kohnke L are the top most productive authors, with five publications each. Moreover, the results show that the Education University of Hong Kong, Universitas Pendidikan Indonesia, Icahn School of Medicine at Mount Sinai, Institute of Cognitive Science, Keck School of Medicine of USC, and State University of Trade and Economics are the most relevant affiliations of authors. Collaboration between universities can bring about numerous benefits. Key advantages include knowledge and expertise sharing, research advancement, expanded resources, and Internationalization and global reach. The analysis revealed that the top countries in research production based on corresponding author affiliations are Hong Kong and China, Korea, the USA, and Indonesia. Each article was assigned to a single country based on the corresponding author affiliation. Fig. 1 (a) shows the top countries with the intra-country (SCP) and inter-country (MCP) collaboration indices. If we include all the authors from each publication, the USA will be ranked first, and the ranking will differ, as shown in Fig. 1 (b). Hong Kong and China are at the top of the list of the "most cited countries," with 582 citations.

Table 1: Main descriptive information regarding the collection.

Description	
Publication Average Age (years)	2.7
Average citations per publication	12.7
Number of References	3926
Numbe of Keywords Plus (ID)	505
Number of Author's Keywords (DE)	346
Number of Authors	326

(a)   (b)
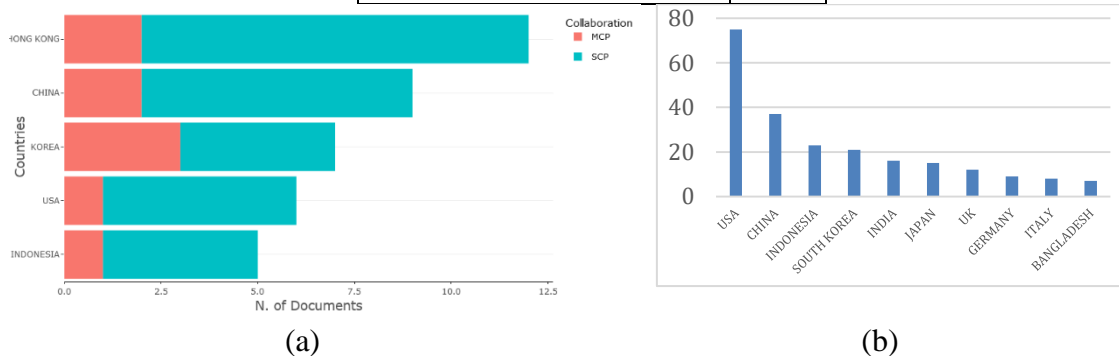
Fig. 1. (a) Corresponding Author's Top Countries in production with MCP and SCP indices. Results show that Korea has the best MCP ratio, which indicates more international collaborations with other

countries. (b) Country scientific production measures the number of authors' appearances by country affiliations.

The publication "*Stimulating and sustaining interest in a language course: An experimental comparison of Chatbot and Human task partners*" has the highest number of citations, 161. In second place, the publication *"Chatbot learning partners: Connecting learning experiences, interest and competence*" has 131 citations. Table 2 shows the most frequent words based on keywords plus and author keywords. Keywords plus were extracted from each article references, mostly previous years. There are comon terms between the two categories. Keywords plus reflect the main concepts in this topic and author keywords represent the articles' content. Since chatgpt is a relatively new term, it is not present in the top keywords plus terms.

Table 2: Most frequent words and terms.

Terms from keywords plus	Frequency	Terms from author keywords	Frequency
language learning	31	chatbot	47
chatbot	31	language learning	24
learning systems	16	artificial intelligence	18
students	13	chatgpt	14
artificial intelligence	11	natural language processing	6
computer aided instruction	9	computer assisted language learning	5
computational linguistics	8	machine learning	4

4.3 Conceptual Analysis

Conceptual analysis can be approached through three different methods. Network analysis, which is widely used in bibliometric analyses. Factorial analysis, a technique for reducing data complexity. The third approach combines elements from previous techniques called thematic maps and evolution. In this study, we utilized conceptual analysis to identify key themes and research hotspots, create visualization of bibliometric data, and understand the evolution of different topics. In Fig. 2, we created a thematic map based on all bigrams (pairs of consecutive written terms) extracted from the publications' abstracts. We used stemming, a process to reduce each word to its stem. Co-word analysis draws clusters of keywords that appeared in the same document. We used the Walktrap algorithm for clustering and limited the node label to the top two bigrams.The node size is based on the total number of term occurrences.

4.4 Social Structure Analysis

We constructed the co-authorship network to study the social structure and uncover the collaborative relationships and knowledge-sharing patterns among researchers. The co-authorship or scientific collaboration network is composed of authors as nodes and co-authorships as links.
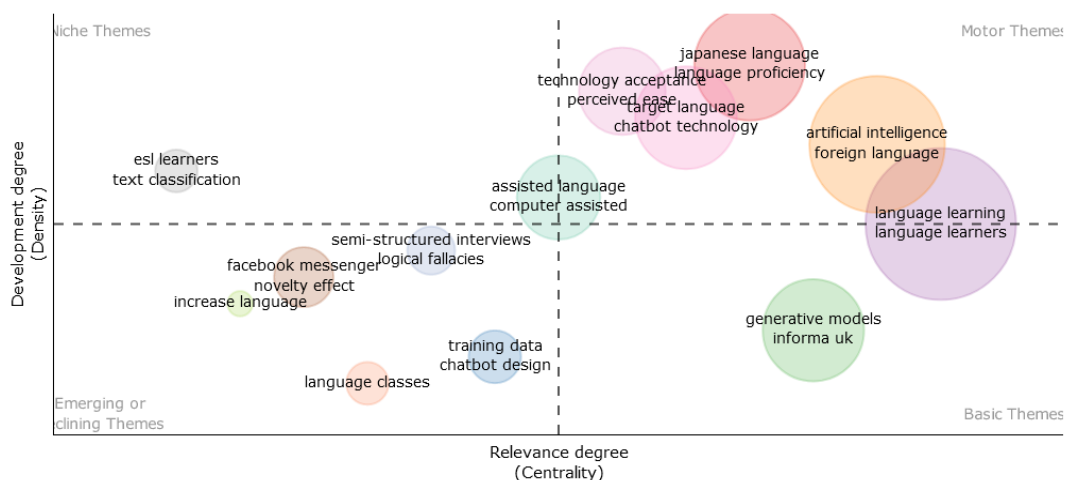

Fig. 2. The thematic map displays clusters and bigrams identified by co-occurrence network analysis from 2004 to 2023. It categorizes themes into four quadrants based on centrality (importance) and

density (development): motor themes (highly developed and essential), isolated themes (highly developed but less significant), emerging or declining themes (weakly developed and marginal), and primary/transversal themes (general topics spanning research areas).
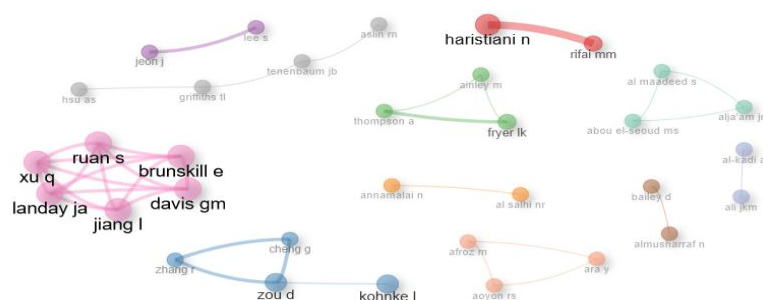

Fig. 3. The collaboration network reveals research groups investigating specific topics and their relationships, including identifying the most prominent research group in the analyzed area.

Co-authorship is widely recognized as one of the most extensively documented forms of scientific collaboration. Fig. 3 shows a total of 11 research groups for this topic. The biggest group comprises six authors, and four out of eleven groups are composed of only two members.

5. Conclusion and Future Work

This paper conducted a comprehensive bibliometric analysis of using chatbots for language learning. The integration of chatbots into language learning is a promising approach due to their ability to provide personalized and interactive experiences. The analysis identified key research themes, influential authors, and collaborative networks in this field. The findings contribute insights for researchers, practitioners, and policymakers, enabling a deeper understanding of the current landscape and fostering collaborations. Our future work will examine additional publication databases and utilize more bibliometric analyses at the institution and country levels.

Acknowledgment

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