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Chatbots as Digital Language Tutors: Revolutionizing Education Through AI

Senny Luckyardi[1], Juliana Karin[1], R. Rosmaladewi[2], Achmad Hufad[3], Nuria Haristiani[3]*

[1]Universitas Komputer Indonesia, Bandung, Indonesia
[2]Politeknik Pertanian Negeri Pangkajene Kepulauan, Pangkep, Indonesia
[3]Universitas Pendidikan Indonesia, Bandung, Indonesia
*Correspondence: E-mail: senny@email.unikom.ac.id

ABSTRACT

Artificial intelligence (AI) is changing the landscape of language education and AI-enhanced chatbots are in the process of becoming digital tutors. This study explores how chatbots enhance language acquisition through real-time, interactive, and personalized learning experiences. As virtual tutors, they allow students to repeat the vocabulary, grammar, pronunciation, and conversation skills in dynamic contexts and give immediate feedback to improve language. Multilingual features enable chatbots to reach a broad spectrum of learners addressing issues of scalability and accessibility. For teachers, chatbots extend themselves beyond conventional teaching, lessen workloads, and facilitate large-scale and multilinguistic programmes. It is important to have an easy-to-use, culturally-pragmatic design so that the integration in curricula can appropriately address learners' heterogeneous needs. Chatbots provide democratizing language education of top quality by circumventing cost and access barriers and offering life changing solutions for language learners worldwide. They offer real-world pointers to further develop AI-powered educational technologies, and thus, provide a platform for broader application to the language curriculum. As Artificial Intelligence develops, chatbots will be a fundamental tool for promoting linguistic and communicative competence in contemporary education.

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1. INTRODUCTION

The application of artificial intelligence in learning has been an area of increasing interest over the past few years, with the emergence of new technology facilitating the design of effective pedagogical tools (**Table 1**).

Table 1. References on AI applications in learning.

No.	Document Title	Ref
1.	Chatbot artificial intelligence as educational tools in science and engineering education: A literature review and bibliometric mapping analysis with its advantages and disadvantages.	[1]
2.	How bibliometric analysis using vosviewer based on artificial intelligence data (using researchrabbit data): Explore research trends in hydrology content.	[2]
3.	Trends in the use of artificial intelligence (AI) technology in increasing physical activity.	[3]
4.	Bibliometric analysis of research trends in conceptual understanding and sustainability awareness through artificial intelligence (AI) and digital learning media.	[4]
5.	The future of learning: ethical and philosophical implications of artificial intelligence (AI) integration in education.	[5]
6.	University students' awareness of, access to, and use of artificial intelligence for learning in Kwara state.	[6]
7.	Bibliometric analysis on artificial intelligence research in Indonesia vocational education.	[7]
8.	Primary education undergraduates' competency in the use of artificial intelligence for learning in Kwara State.	[8]
9.	Artificial intelligence (AI)-based learning media: Definition, bibliometric, classification, and issues for enhancing creative thinking in education.	[9]

There among others a tool that has attracted an increasing number of people's attention, the chatbot, an artificial intelligence-based conversational agent, able to simulate human-like discourse. Chatbots have the potential to revolutionize the field of language education by providing personalized, interactive, and scalable learning experiences [1].

Given that language learning is a complex and multi-layered process, utilizing chatbots as digital tutors offers several potential benefits (**Table 2**).

Table 2. References on benefits of using chatbots as digital tutors in language learning.

No.	Document Title	Ref
1.	Bibliometric using VOSviewer with publish or perish (using google scholar data): From step-by-step processing for users to the practical examples in the analysis of digital learning articles in pre and post covid-19 pandemic.	[10]
2.	Digital applications as assistive technology for students with disabilities.	[11]
3.	Undergraduate awareness and perception on the use of digital collaborative tools in facilitating learning in selected universities within the Ilorin metropolis.	[12]
4.	Development and validation of digital photo series for the teaching of BT in Ilorin, Nigeria.	[13]
5.	Bibliometric analysis of the integration of digital tools in marine conservation education.	[14]
6.	The digital frontier: AI-enabled transformations in higher education management.	[15]
7.	Memetized learning: How humor-infused stories can engage geography students in the digital age.	[16]
8.	The effectiveness of learning videos as a source of digital literacy on poster learning in elementary schools.	[17]
9.	Factors affecting satisfaction on online education on students digital teaching page in Ho Chi Minh City, Vietnam.	[18]
10.	Utilization of electronic community library as a localhost-based digital library in optimizing learning resources.	[19]

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Table 2 (continue). References on benefits of using chatbots as digital tutors in language learning.

No.	Document Title	Ref
11.	Bibliometric analysis of research trends in conceptual understanding and sustainability awareness through artificial intelligence (AI) and digital learning media.	[20]
12.	Postgraduate students' attitude towards the use of digital library repositories for research in Kwara State.	[21]
13.	Measurement of the level of digital competence of vocational teachers in learning development.	[22]
14.	Embracing digitalization in higher education: A constructivist perspective.	[23]
15.	Development of digital-based interactive teaching materials in draping courses. *Indonesian Journal of Teaching in Science*, *3*(1), 97-104.	[24]
16.	The effects of digital media instruction on senior high school students' performance in organic chemistry nomenclature.	[25]
17.	Digital to face-to-face classes: students' challenges during the transitions of educational modes.	[26]
18.	Optimizing instagram in sociology materials to improve digital literacy for junior high school students.	[27]
19.	Implementation of the educational personnel program for elementary school students in the digital age using google classroom.	[28]
20.	Distance teaching of stress materials to junior high school students using digital media.	[29]
21.	Fun simple style and airplane science teaching to digital-based elementary school students.	[30]
22.	Weather and Its effect learning on digital-based early childhood education students.	[31]
23.	Socialization of digital literacy in compiling a balanced healthy menu to members of POKJA III the PKK Movement Team of Purwakarta Regency.	[32]
24.	A digital accessibility and inclusive design-based e-module in higher education: Does it work in a classroom with a deaf student?.	[33]
25.	Digital transformation in special needs education: Computational bibliometrics.	[34]

That is the reason why much research regarding language education (see **Table 3**). There is also no doubt that these AI-based personal assistants can trigger students who are intelligent and contextually appropriate discussion which is customized to the student's own needs and his/her competencies. Through simulation of the natural language dialogues, the chatbots allow the students to repeatedly revisit and practice the natural language in a safe, encouraging manner and to get feedback, which progressively aids in their development [35]. In addition, chatbots can take advantage of the history of language learning by relieving the dean from the burden of access to highly specialized teachers and from the constraint on the size of the solution to apply to a larger number of students. They can be set up at the global scale and are open to learners from all linguistic/cultural backgrounds, hence they have the potential to bring the language teaching field democratized by making it easily accessible and inexpensive [36].

Table 3. Previous studies relating to language education.

No.	Document Title	Ref
1.	Technology and hybrid multimedia for language learning and cross-cultural communication in higher education.	[37]
2.	Introduction of Indonesian poem (pantun) as a creative effort of elementary school students in improving language skills in the Covid-19 pandemic era.	[38]
3.	Indonesian Textbooks Oriented on Social Integration and 21st Century Skills in Higher Education: Validity, Practicality, and Effectiveness.	[39]
4.	Implementation of early intervention with family resourced to improve development of expressive language in children with cerebral palsy.	[40]

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Table 3 (continue). Previous studies relating to language education.

No.	Document Title	Ref
5.	A computer-based approach to teaching foreign languages.	[41]
6.	Impact of communicative language test assessments in enhancing learners' capacity.	[42]
7.	Evaluation of assessment projects in English language education: A bibliometric review.	[43]
8.	Bibliometric analysis using VOSviewer with Publish or Perish of CEFR-based comparison of English language teaching models for communication.	[44]
9.	Efforts to improve the vocabulary of Indonesian language for 1st-grade elementary students with hearing impairment for through the application of mnemonic.	[45]
10.	The weaknesses of the curriculum in the teaching of Arabic (a Muslim language) as a foreign language.	[46]
11.	Linguistics and semantics difficulties in Arabic language among senior secondary schools in Ekiti, Nigeria.	[47]
12.	ICT tools for teaching the Arabic language.	[48]
13.	Using Illustration Images to Enhance Junior High School Students' Writing Skills.	[49]
14.	Enhancing ASEAN Students' Cross-Cultural Adaptability in Higher Education: Exploring the Issues of Applying Bilingual Education in China Panorama Curriculum.	[50]
15.	Mobilizing Metacognitive Strategies Through Zoom for EFL Classrooms: An Innovative Practice Amidst Covid 19.	[51]
16.	Students' Learning Styles in Blended English Learning in an Indonesian Private School.	[52]
17.	Verbal Phatic Expressions in EFL Student Teachers' Classroom Interaction.	[53]
18.	Language Skills in Business Context: A Bibliometric Analysis Using the VOS Viewer Application.	[54]
19.	Research Gap on Differentiated Learning in The EFL Classroom: A Conceptual Framework.	[55]
20.	Validation Study of a Self-Assessment Questionnaire for Middle School Students' Self-Presentation Skills.	[56]
21	Research Gap on Oral Corrective Feedback in Second Language Acquisition Theory-Affective Filter Analysis: A Conceptual Framework.	[57]
22	A Systematic Review of EFL Students' Self-Efficacy in The Learning Context.	[58]
23	Improving Reading Comprehension of Narrative text by Using LBA (Literature-based Approach) at the Ninth-grade students of SMP Negeri 1 Nunukan.	[59]
24	Increasing students' vocabulary using fairy tales at SMKN 6 Makassar.	[60]
25	English Teachers' Strategies in Creating Formative Test Questions in a Public High School.	[61]
26	Area Assessment of English in the Application of Edupreneurship in Convention and Event Business Management in a Public Tourism Polytechnic.	[62]
27	How Do English Teachers Prepare Diagnostic Assessment for Students? Insight from Teachers' Experiences in an Indonesian Remote Island.	[63]
28	Fostering Self-Directed Learning through Local Wisdom Project-Based Learning.	[64]
29	Storytelling in Higher Education: Comparing Expectancy-Value in Task-Exposed and Non-Exposed English Learners.	[65]
30	The Importance of English Language in Tourism Sector: A Study in Socotra Island.	[66]
31	Role-Play in Language Learning: A Bibliometric Analysis and its Impact on Thailand Secondary Education.	[67]
32	Tailoring CEFR to BISOL (" Bahasa Indonesia" for Speakers of Other Languages): A Model for Integrative Language Teaching Materials.	[68]
33	Digital Natives Generation Enjoyment Using Online Resources as Virtual Learning Environment in Learning English Speaking.	[69]
34	Higher Order Thinking Skills in Reading Literacy Questions at Vocational High Schools in Indonesia.	[70]
35	Do Mind Maps Really Catalyze EFL Grammar Learning? Conjunction as a Case.	[71]
36	Pre-Service EFL Teachers' Language Assessment Literacy Satisfaction and Assessment Preparedness.	[72]
37	Exploring the Effect of Extensive Reading on Young English Learners' Second Language Writing Achievement in a Vietnamese Primary School Setting.	[73]

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Table 3 (continue). Previous studies relating to language education.

No.	Document Title	Ref
38	Revealing the Kafoa Language Vitality through the Basic Cultural Vocabulary Mastery: Implications for Language Education.	[74]
39	The Application of Probing Prompting Learning Models in Mastering Foreign Language Vocabulary.	[75]
40	Writing with Cultural Insight: Elevating Analytical Exposition through Local Culture and Project-Based Learning.	[76]
41	The Application of Moderate Politeness into School Practices of an Urban Muhammadiyah Primary Students in the Era of Global Communication.	[77]
42	ASEAN students' interest in learning the Indonesian language: A descriptive study from the perspective of SEAMEO ASEAN.	[78]
43	Indigenous Values of Short Stories in Indonesian Fictional Prose in Higher Education: Implication on Language Education.	[79]
44	Development of an EFL Curriculum Components to Promote Intercultural Communicative Competence for Chinese College Students.	[80]
45	Enhancing Paragraph Writing Proficiency: A Study of Students' Performance Post Global English Textbooks Exposure	[81]
46	Investigating the Classroom Implementation of Mandarin Teachers' Pedagogical Content Knowledge (PCK): Exploring Effective Strategies and Practices for Teaching Chinese as a Foreign Language in the Philippines.	[82]
47	How to Improve Healthy Environment in Urban School Climate (USC) by Communication Language Strategies? Arabic Based Communication Language and Statistic Description Analysis.	[83]
48	Interlanguage Pragmatic Competence of University Students: An Error Analysis of Apology Speech Act Strategies in Japanese Learners.	[84]
49	Contributing Factors and Challenges in Mastering Academic Writing Skills: Multiple Case Studies of Deaf Students in Inclusive Universities in Indonesia.	[85]
50	Arabic Language Implementation Viewed from a Social and Cultural Perspective at Maitreechit Withayattan School Bangkok.	[86]
51	The Endangered Central Malay Folklore: A Medium for Internalizing Character Values in Indonesian Language and Literature	[87]
52	Understanding the Dynamics of Materials Adaptation in an English-Chinese Bilingual Storytelling Curriculum for First Graders.	[88]

Furthermore, the 24-hour-a-day availability of the AI chatbot was another benefit to the experimental group. Learning for students is facilitated by the use of the chatbot at times not covered by class so that students can continue their practice and skill development with flexibility to fit their schedule. This flexibility holds particular promise for students who have difficulty with time management or have outside commitments in addition to their learning [35]. While the control group could not participate in the long learning, thus their performance score may not have changed. The data of the present work is from previous work that highlights the role of technology in reducing language learning anxiety. Lab studies have shown the positive effect of artificial intelligence (AI) application in language teaching to create a more supportive learning environment crucial for students exposed to language learning anxiety (**Table 4**).

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Table 4. Research trends from Scopus regarding chatbot. Data was taken on December 2024.

No.	Document Title	Ref
1.	Chatbot application for the dissemination of election information	[89]
2.	The Potential of Chatbots for Emotional Support and Promoting Mental Well-Being in Different Cultures: Mixed Methods Study	[90]
3.	Artificial Intelligence-Based Chatbot to Support Public Health Services in Indonesia	[91]
4.	Autonomous Learning Through Chatbot-based Application Utilization to Enhance Basic Japanese Competence of Vocational High School Students	[92]
5.	Exploration of Telemidwifery: An Initiation of Application Menu in Indonesia	[93]
6.	Design of the use of chatbot as a virtual assistant in banking services in Indonesia	[94]
7.	Bershca: Bringing chatbot into hotel industry in Indonesia	[95]
8.	The analysis of customer satisfaction factors which influence chatbot acceptance in Indonesia	[96]
9.	Chatbot adoption framework for real-time customer care support	[97]
10.	Waste bank chatbot technology	[98]

2. METHODS

This study employed a descriptive research method, focusing on a comprehensive literature review of chatbot applications in education, particularly for language teaching and learning. The review aimed to classify chatbots by their educational purposes, such as language acquisition, and evaluate their advantages and disadvantages in this context. Bibliometric analysis was conducted on research papers published between 2019 and 2024. Data was taken from the Scopus database on December 2024. The analysis visualized the evolution of academic focus, identified gaps in the literature, and highlighted trends shaping the future of chatbot applications in language education technologies.

3. RESULTS AND DISCUSSION

3.1. Bibliometric analysis data

Bibliometrics have been used for analyzing research trend, as reported elsewhere (see **Table 5**). Based on the bibliometric data, a total of 26 papers were selected, showcasing an oscillating publication trend: one paper in 2019, two in 2020, three in 2021, a significant increase to 10 in 2022, followed by a gradual decline to eight in 2023 and two in 2024. Data analysis focused on identifying influential authors, tracking emerging themes, and evaluating the progression of dominant topics in chatbot research. This study is a descriptive method study. The data collection in this study was conducted through literature reviews on previous researches about chatbot and its' use. Literature reviews were conducted with a view toward the classification of chatbots in particular, those for educational purposes such as language acquisition, as well as to the pros/cons of chatbots in language teaching and learning. Using the bibliometric research data from 2019 to 2024, 26 papers were chosen. Publication count displayed an oscillating pattern, i.e., the initial one with one post in 2019, the second one with two in 2020, and the third one with three in 2021. The second largest surge happened in 2022, 10 papers, which gradually declined to eight publications in 2023 and then to two publications in 2024. In particular, the data analysis concentrated on how to discover influential papers and authors, and how to track the development of important subjects in chatbot research for teaching purposes. The research set out to visualize the evolution of dominant themes, probe the evolution of the focus of the academic journal, and identify areas where the corpus of the literature appears to be lacking. This bibliometric method indicated frontiers for research, suggesting what type and tendency such to the study contributions are. In other words, it also

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generated a wealth of information about the research area's growth trajectory and its impact in a downstream context of the language educational technologies field.

Table 5. Previous studies on bibliometric.

No.	Title	Ref
1.	Bibliometric using Vosviewer with publish or perish (using google scholar data): From step-by-step processing for users to the practical examples in the analysis of digital learning articles in pre and post Covid-19 pandemic.	[99]
2.	How to search and manage references with a specific referencing style using google scholar: From step-by-step processing for users to the practical examples in the referencing education.	[100]
3.	Mapping of nanotechnology research in animal science: Scientometric analysis.	[101]
4.	Scientific research trends of flooding stress in plant science and agriculture subject areas (1962-2021).	[102]
5.	Introducing ASEAN Journal of Science and Engineering: A bibliometric analysis study.	[103]
6.	A bibliometric analysis of chemical engineering research using VOSviewer and its correlation with Covid-19 pandemic condition.	[104]
7.	Past, current and future trends of salicylic acid and its derivatives: A bibliometric review of papers from the Scopus database published from 2000 to 2021.	[105]
8.	Bibliometric analysis of engineering research using Vosviewer indexed by google scholar.	[106]
9.	Evaluation on research effectiveness in a subject area among top class universities: A case of Indonesia's academic publication dataset on chemical and material sciences.	[107]
10.	Bibliometric computational mapping analysis of publications on mechanical engineering education using VOSviewer.	[108]
11.	Research trend on the use of mercury in gold mining: Literature review and bibliometric analysis.	[109]
12.	Domestic waste (eggshells and banana peels particles) as sustainable and renewable resources for improving resin-based brakepad performance: Bibliometric literature review, techno-economic analysis, dual-sized reinforcing experiments, to comparison with commercial product.	[110]
13.	Bibliometric analysis of educational research in 2017 to 2021 using VOSviewer: Google scholar indexed research.	[111]
14.	Development analysis research on physics education by mapping keywords using the VOSviewer application.	[112]
15.	Computational bibliometric analysis of research on science and Islam with VOSviewer: Scopus database in 2012 to 2022.	[113]
16.	Bibliometric analysis of special needs education keyword using VOSviewer indexed by google scholar.	[114]
17.	Bibliometric analysis for understanding the correlation between chemistry and special needs education using vosviewer indexed by google.	[115]
18.	A bibliometric analysis of nanocrystalline cellulose production research as drug delivery system using VOSviewer.	[116]
19.	Research trends in farming system soil chemical: A bibliometric analysis using VOSviewer.	[117]
20.	A bibliometric analysis of chemistry industry research using Vosviewer application with Publish or Perish.	[118]
21.	A bibliometric analysis of climate smart agriculture research using VOSviewer.	[119]
22.	Bibliometric and visualized analysis of scientific publications on geotechnics fields.	[120]
23.	Bibliometric data analysis of research on resin-based brake-pads from 2012 to 2021 using VOSviewer mapping analysis computations.	[121]
24.	A bibliometric analysis of computational mapping on publishing teaching science engineering using VOSviewer application and correlation.	[122]
25.	Correlation between process engineering and special needs from bibliometric analysis perspectives.	[123]

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Table 5 (continue). Previous studies on bibliometric.

No.	Title	Ref
26.	Bibliometric analysis of magnetite nanoparticle production research during 2017-2021 using VOSviewer.	[124]
27.	Computational bibliometric analysis on publication of techno-economic education.	[125]
29.	Bibliometric analysis of computational chemistry research and its correlation with Covid-19 pandemic.	[127]
30.	Bibliometric analysis of nano metal-organic frameworks synthesis research in medical science using VOSviewer.	[128]
31.	The use of simple spectrophotometer in STEM education: A bibliometric analysis.	[129]
32.	Computing bibliometric analysis with mapping visualization using VOSviewer on "Pharmacy" and "Special Needs" research data in 2017-2021.	[130]
33.	Trends in research related to photonic crystal (PHC) from 2009 to 2019: A bibliometric and knowledge mapping analysis.	[131]
34.	What is the correlation between chemical engineering and special needs education from the perspective of bibliometric analysis using vosviewer indexed by google scholar?.	[132]
35.	Counseling guidance in science education: Definition, literature review, and bibliometric analysis.	[133]
36.	Computational bibliometric analysis of english research in science education for students with special needs using vosviewer.	[134]
37.	Nutritional research mapping for endurance sports: A bibliometric analysis.	[135]
38.	Sustainable development goals (SDGs) in science education: Definition, literature review, and bibliometric analysis.	[136]
39.	A bibliometric analysis: research trend of critical thinking in science education.	[137]
40.	Renewable energy online learning: A systematic literature network analysis.	[138]
41.	The bibliometric analysis for identifying future research on habits of mind topic.	[139]
42.	Literature review and bibliometric mapping analysis: Philosophy of science and technology education.	[140]

The "Documents by year" in **Figure 1** demonstrates a fluctuating trend from 2019 to 2024. The topic was first addressed in a single publication in 2019. The next year, in 2020, the count went up by one by two papers, which showed a slight increase in attention. A has been gradually increasing until the year 2021, with three papers, showing an increase in the awareness of the utility of chatbots in learning. The peak of research activity occurred in 2022, with ten publications, reflecting a surge in scholarly attention and advancements in the field. However, this momentum declined in 2023, with only eight publications, followed by a significant drop in 2024 to just two publications. This trend indicates that while the topic gained substantial attention and development during its peak, recent years have seen a decrease in research activity, possibly due to a shift in academic focus or the saturation of foundational studies in this area.

The distribution of document types for **Figure 2**. highlights a significant dominance of conference papers, which make up 53.8% of the total documents, amounting to 14 publications. This indicates that the topic has been widely discussed in academic and professional conferences, showcasing its relevance in collaborative and research-oriented environments. Articles constitute the second-largest category, comprising 30.8% or 8 publications, reflecting a substantial focus on detailed and peer-reviewed explorations of the subject. Conference reviews account for 11.5%, with 3 documents, suggesting some degree of analysis and synthesis of conference contributions. Lastly, errata represent the smallest portion at 3.8%, with only one document, indicating minimal corrections or amendments in the existing literature. These proportions demonstrate the academic community's preference

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for disseminating research findings on this topic through conference presentations and journal articles.

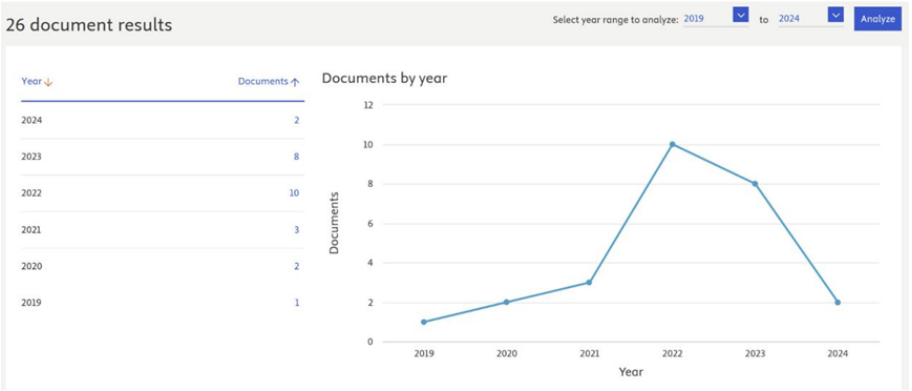

Figure 1. Document results by terms chatbot.

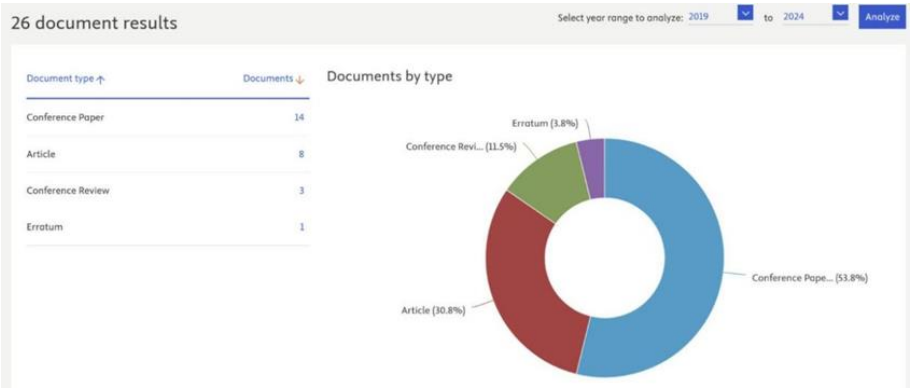

Figure 2. Documents by type.

The analysis of documents by country or territory for **Figure 3**. reveals that Indonesia has the most significant contribution, accounting for 21 documents. This overwhelming dominance indicates that research on this topic is highly prevalent and widely studied in Indonesia. Other countries, including China, Hong Kong, and South Korea, each contributed 1 document, showing a much smaller engagement with this research area. Additionally, there are 3 documents classified under "Undefined," suggesting that their country or territory of origin was not specified. This distribution emphasizes Indonesia's strong interest and focus on leveraging AI technologies like chatbots for educational purposes.

In **Figure 4**, documents discussing chatbots by subject a concentration of research predominantly in the field of Computer Science, which accounts for 29.9% of the total documents. This is followed by Engineering at 19.4%, reflecting the technical foundation and development of chatbot systems. Decision Sciences represents 11.9% of the publications, highlighting the use of chatbots in decision-making processes. Mathematics and Social Sciences each contribute 9.0%, suggesting a focus on algorithmic design and societal impacts, respectively. Business, Management, Accounting, Energy, and Medicine each account for 4.5% of the documents, indicating diverse applications of chatbots across various sectors. Meanwhile, Environmental Science and Arts and Humanities each have 1.5%, reflecting minimal but emerging interest in these areas. This distribution underscores the interdisciplinary nature of chatbot research, with the largest contributions stemming from technical and computational domains, alongside growing exploration of practical applications in different fields.

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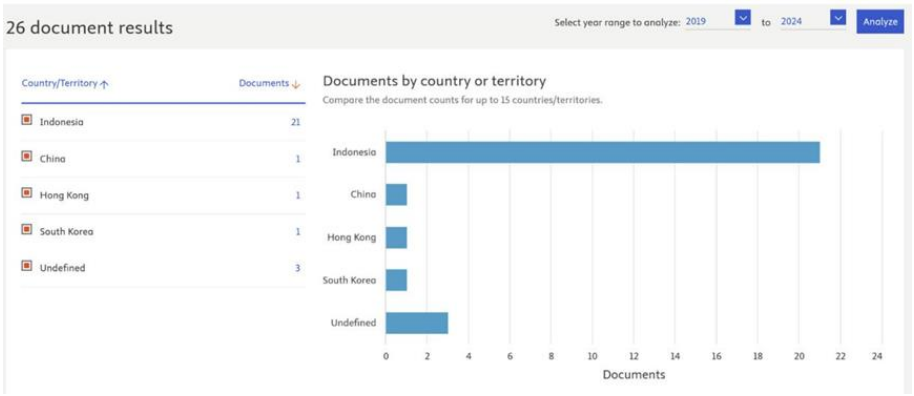

Figure 3. Documents by country or territory.

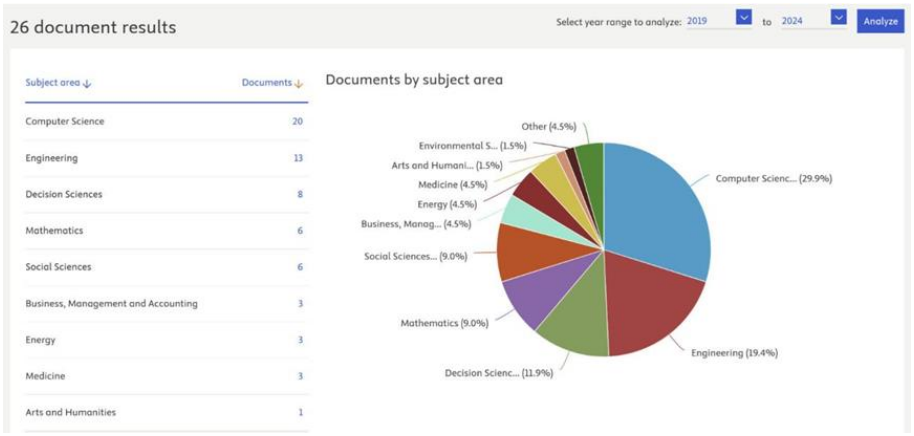

Figure 4. Documents by subject area.

Figure 5 shows 26 documents supported by various funding sponsors. Among these, the "Kementerian Riset Teknologi dan Pendidikan Tinggi Republik Indonesia" is the leading sponsor, funding 2 documents. Several other institutions contributed equally by funding 1 document each, including "Direktorat Riset dan Pengabdian Masyarakat," "Institute for Basic Science," "Kementerian Keuangan Republik Indonesia," "Kementerian Riset, Teknologi dan Pendidikan Tinggi," "National Research Foundation of Korea," "Queensland University of Technology," "Science and Engineering Faculty, Queensland," "Universitas Indonesia," and "Universitas Padjadjaran." This broad funding distribution demonstrates diverse institutional support for advancing research on AI and education.

Figure 5. Documents by funding sponsor.

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3.2. The Concept of Chatbots in AI

The findings of this study underscore the significant potential of chatbots as digital language tutors in revolutionizing language education. As highlighted in the introduction, chatbots offer a personalized, scalable, and interactive learning experience, which can alleviate challenges such as access to specialized teachers and time constraints. These benefits are supported by the literature, which demonstrates that chatbots not only help reduce language learning anxiety but also facilitate flexible, continuous practice. The descriptive method used in this study reveals a diverse landscape of research activity, with a noticeable peak in 2022, reflecting the growing interest in integrating AI into education. However, the recent decline in publications suggests either a shift in academic focus or the saturation of foundational studies in the field.

The analysis of document types and contributions by country further highlights the significance of chatbots in educational research, with Indonesia emerging as a leading contributor. The dominance of conference papers and journal articles emphasizes the academic community's preference for disseminating findings through collaborative and peer-reviewed platforms. Additionally, the diverse funding sources illustrate a global commitment to advancing this field, with notable support from Indonesian institutions. Overall, the study demonstrates that while chatbots have made substantial contributions to language learning, ongoing research, and innovation are essential to address the evolving needs of students and to sustain interest in this promising educational technology.

The detailed exploration of chatbots from the perspective of artificial intelligence (AI) and their application, with a focus on language education, are explained in the sub-section.

3.2.1. The Evolution of Chatbots in Artificial Intelligence

Chatbots are conversational agents designed to simulate human-like interaction through text or voice. Emerging from the broader field of artificial intelligence, they leverage natural language processing (NLP) and machine learning (ML) to interpret and respond to user input. Over the years, chatbots have evolved from rule-based systems with preprogrammed responses to sophisticated AI-driven tools capable of dynamic, context-aware interactions. This progression underscores their increasing utility across domains, particularly in education.

3.2.2. Chatbots in Education: The Role of AI

In the educational landscape, chatbots are increasingly employed to enhance learning experiences. Powered by AI, these tools provide personalized feedback, automate routine tasks, and foster engagement. By bridging the gap between students and educational resources, AI chatbots act as virtual tutors, answering queries, guiding learning processes, and supporting self-paced education.

3.2.3. Natural Language Processing (NLP) as a Foundation

A chatbot’s ability to understand and generate human-like responses is grounded in NLP, a subfield of AI. NLP enables chatbots to parse and interpret the structure of language, including syntax, semantics, and context. Advanced models like OpenAI’s GPT-4, Google's BERT, and others have revolutionized NLP, allowing chatbots to engage in nuanced, contextually accurate conversations.

Key components of NLP in chatbots include:

(i) Tokenization: Breaking down sentences into smaller components for analysis.
(ii) Sentiment Analysis: Understanding the tone or sentiment behind user inputs.

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(iii) Context Awareness: Maintaining the flow of conversation by remembering earlier exchanges.
(iv) Intent Recognition: Identifying the user's goals or queries.

3.2.4. Applications of Chatbots in Language Education

In language learning, chatbots offer unique advantages by mimicking real-life conversational scenarios, providing immediate feedback, and adapting to individual learning needs. Their AI-driven capabilities make them particularly effective in this domain.

(i) Language Practice: Chatbots enable learners to practice speaking and writing in a new language without fear of judgment. For example, apps like Duolingo integrate AI chatbots to simulate dialogues, helping users improve grammar, vocabulary, and fluency.
(ii) Personalized Learning Paths: By analyzing user performance, chatbots can tailor lessons to individual needs. AI models track progress, identify weak areas, and suggest targeted exercises.
(iii) Immediate Feedback: Chatbots provide instant feedback on grammar, sentence structure, and pronunciation. This immediate reinforcement accelerates learning and minimizes errors.
(iv) Cultural Context: Advanced chatbots simulate culturally appropriate language use, helping learners understand idiomatic expressions and conversational norms.
(v) Accessibility: Chatbots provide learning opportunities 24/7, allowing students from diverse backgrounds and time zones to access resources at their convenience.

3.2.5. Advantages and Challenges of Chatbots in Language Education

Advantages of chatbots in language education are:

(i) Scalability: Chatbots can support large numbers of learners simultaneously, making them cost-effective for institutions.
(ii) Consistency: Unlike human tutors, chatbots provide consistent responses and evaluations.
(iii) Engagement: Interactive and gamified experiences foster motivation and long-term learning engagement.
(iv) Data-Driven Insights: Chatbots collect data on user performance, enabling educators to refine curricula and teaching strategies.

Challenges of chatbots in language education are:

(i) Language Nuances: Understanding context-dependent nuances, slang, or humor remains a challenge for many chatbots.
(ii) Technical Limitations: Errors in NLP interpretation can lead to misunderstandings or frustration.
(iii) Lack of Emotional Intelligence: Chatbots lack the empathy and emotional understanding that human educators provide.
(iv) Bias and Inclusivity: AI models may inadvertently reflect biases present in their training data, which can impact user experience.

Case Studies of chatbots in language education are:

(i) Duolingo's AI Chatbot: Duolingo uses AI chatbots to engage users in contextual conversations. These bots adapt to user proficiency levels, offering feedback and introducing vocabulary in practical scenarios.
(ii) ELSA Speak: This AI-driven app focuses on pronunciation. Its chatbot evaluates speech patterns, highlights errors, and provides corrective suggestions, enabling learners to achieve native-like fluency.

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(iii) Busuu: Busuu integrates chatbots to supplement lessons with conversational practice, making language acquisition interactive and practical.

Future Directions of chatbots in language education are:

(i) Multimodal Learning: Integrating visual, auditory, and textual elements, future chatbots will create immersive learning environments. For instance, virtual reality (VR) combined with chatbots could simulate real-world conversations.

(ii) Emotion Recognition: Advancements in AI could enable chatbots to detect emotional cues, tailoring responses to user feelings and fostering a more empathetic learning experience.

(iii) Cross-Language Translation: AI models like ChatGPT and DeepL Translator are already bridging language barriers. Future chatbots could seamlessly translate and adapt content for learners worldwide.

(iv) Integration with Learning Management Systems (LMS): Chatbots could serve as intelligent assistants within LMS platforms, automating administrative tasks and enhancing the user experience.

(v) Lifelong Learning: Beyond formal education, chatbots could support continuous learning for professionals, adapting to evolving industry needs.

The rise of AI chatbots brings ethical concerns, including:

(i) Privacy and Data Security: Safeguarding student data from unauthorized access or misuse is critical.

(ii) Bias and Fairness: Ensuring that AI systems are free from biases that disadvantage certain user groups.

(iii) Dependency: Over-reliance on chatbots might reduce opportunities for human interaction and collaborative learning.

(iv) Accountability: Determining responsibility for errors or misinformation provided by AI systems.

4. CONCLUSION

AI-powered chatbots represent a transformative force in education, particularly in language learning. By simulating real-world interactions, personalizing content, and providing instant feedback, they empower learners to achieve linguistic proficiency efficiently. However, the integration of chatbots into education requires careful consideration of technical, ethical, and pedagogical aspects to maximize their potential. As AI continues to evolve, chatbots are poised to play an even more significant role in shaping the future of education.

5. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. The authors confirmed that the paper was free of plagiarism.

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