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A Bibliometric Mapping Analysis of Publications on The Utilization of Artificial Intelligence Technology in Language Learning

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ABSTRACT

A plethora of publications have shed light, particularly on the affordances of Artificial Intelligence (AI)-powered technology to maximize the language learning preparation, process, and outcomes. In search of the current portrait of empirical evidence in this context, this paper reports on a bibliometric mapping analysis of publications on the utilization of AI technology in language learning in the last five years (2018-2023). Relevant studies associated with the theme were collected from several journals sorted out using predetermined criteria. Eighty-eight titles and abstracts were further reviewed to generate a mapping of relevant keywords. The analysis results showed that studies on the utilization of AI technology for language learning have gradually increased in number and grabbed considerable attention among scholars in the Asia context. Several mainstream key terms attached to AI technology comprised personalized learning, mobile learning, and chatbot applications, indicating more concerns in reviewing the role of AI technology as a smart personal assistant for language learners. Furthermore, the use of AI technology was found to be beneficial for maximizing language learning preparation, language skills development such as reading and writing, and language learning evaluation particularly in providing feedback or assessing students' works. However, challenges in using AI technology in a language learning context remain on the surface. The present mapping analysis can serve as a reference for contemplating the retrospect and envisioning the prospect of AI-powered technology use toward sustaining advanced and quality language learning.

1. Introduction

Earlier than AI technology, Information Communication Technology (ICT) has brought about a lot of improvements and transformations to enhance learning environments. Many reports regarding ICT have been developed [1-35]. Later on, Artificial Intelligence (AI) technology comes to the surface of educationists' attention in multiple aspects and in reshaping how teaching and learning are conducted [36-38]. AI technology is increasingly integrated into various aspects of life in this more

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mobilized and technological era. Previous studies have also noticed that AI technology has considerably long been integrated into education in the form of natural language processing in machine learning, data mining, and learning analytics [36,39].

In the past years, conventional learning dominated the whole of education [40-47]. It has an impact on students in their awareness and competency in using AI. It has been revealed in previous studies that a staggering 80.3% of university students lack awareness of AI in the context of learning, besides in other universities, only 44.8% are trained and competent in using AI for learning [36,37]. This fact shows that the use of AI in higher education is still unfamiliar. However, the majority of the students would like to have AI-driven technology integrated into the classroom in order to learn more about the technology [48]. The emergence of AI technologies has opened up new avenues for innovation, efficiency, and personalized learning experiences in education. Previous studies found that teachers either in Indonesia or in the Philippines have a will to approach technology to develop new strategies in their teaching [49,50]. These previous researches opened up a new way for authors to conduct comprehensive research on AI in language learning.

Language education is one aspect that has undergone a transformation of technology [51-58]. Previous studies researched that language education needs improvement for better performance in the learning process, either for teachers or for learners [59-70]. The development of technology provides a learning environment with better quality for students to learn languages. The new era of Industry 4.0 opened up a new way to use AI in the field of language teaching. AI is ready to transform conventional pedagogical approaches, providing plenty of chances for language learners around the world through technology-assisted language coaching and language assessment.

This article aims to explore and analyze the scholarly literature surrounding the adoption and impact of AI in education, especially in language learning in the form of bibliometric analysis. Bibliometric [71] is a method of data analysis of existing research that requires mapping to visualize data. Table 1 shows previous studies regarding bibliometric.

Table 1
Previous studies on bibliometric analysis

No	Title	Ref.
1	Dental suction aerosol: Bibliometric analysis.	[72]
2	A bibliometric analysis of Covid-19 researches using VOSViewer.	[73]
3	The latest report on the advantages and disadvantages of pure biodiesel (B100) on engine performance: Literature review and bibliometric analysis	[74]
4	A bibliometric analysis of management bioenergy research using VOSviewer application	[75]
5	Oil palm empty fruit bunch waste pretreatment with benzotriazolium-based ionic liquids for cellulose conversion to glucose: Experiments with computational bibliometric analysis	[76]
6	Biomass-based supercapacitors electrodes for electrical energy storage systems activated using chemical activation method: A literature review and bibliometric analysis.	[77]
7	Bibliometric analysis of nano metal-organic frameworks synthesis research in medical science using VOSViewer	[78]
8	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.	[79]
9	Correlation between process engineering and special needs from bibliometric analysis perspectives.	[80]
10	Bibliometric analysis for understanding the correlation between chemistry and special needs education using VOSviewer indexed by Google.	[81]
11	Computing bibliometric analysis with mapping visualization using VOSviewer on “pharmacy” and “special needs” research data in 2017-2021.	[82]
12	Nutritional research mapping for endurance sports: A bibliometric analysis.	[83]
13	Bibliometric and visualized analysis of scientific publications on geotechnics fields.	[84]
14	A bibliometric analysis of computational mapping on publishing teaching science engineering using VOSviewer application and correlation.	[85]

No	Title	Ref.
15	What is the correlation between chemical engineering and special needs education from the perspective of bibliometric analysis using VOSviewer indexed by Google Scholar?	[86]
16	Counselling guidance in science education: Definition, literature review, and bibliometric analysis.	[87]
17	Phytochemical profile and biological activities of ethylacetate extract of peanut (Arachis hypogaea L.) stems: In-vitro and in-silico studies with bibliometric analysis.	[88]

Table 1 (Continue)
Previous studies on bibliometric analysis and systematic review

No	Title	Ref.
18	A bibliometric analysis of materials research in Indonesian journal using VOSViewer	[89]
19	Research trend on the use of mercury in gold mining: Literature review and bibliometric analysis	[90]
20	Bibliometric analysis of educational research in 2017 to 2021 using VOSViewer: Google Scholar indexed research.	[91]
21	Bibliometric analysis of special needs education keyword using VOSviewer indexed by Google Scholar	[92]
22	Sustainable development goals (SDGs) in science education: Definition, literature review, and bibliometric analysis.	[93]
23	Computational bibliometric analysis of research on science and Islam with VOSViewer: Scopus database in 2012 to 2022.	[94]
24	Resin matrix composition on the performance of brake pads made from durian seeds: From computational bibliometric literature analysis to experiment.	[95]
25	Bibliometric Analysis of Briquette Research Trends During the Covid-19 Pandemic.	[96]
26	Computational Bibliometric Analysis on Publication of Techno-Economic Education.	[97]
27	How bibliographic dataset portrays decreasing number of scientific publications from Indonesia	[98]
28	Research trends from the Scopus database using keyword water hyacinth and ecosystem: A bibliometric literature review	[99]
29	Bibliometric analysis of high school keyword using VOSviewer indexed by google scholar	[100]
30	How to calculate bibliometric using VOSviewer with Publish or Perish (using Scopus data): Science education keywords	[101]
31	Bibliometric analysis for understanding “science education” for “student with special needs” using VOSViewer	[102]
32	Bibliometric analysis of research development in sports science with VOSViewer.	[103]
33	Bibliometric analysis of engineering research using VOSviewer indexed by Google Scholar	[104]
34	Bibliometric computational mapping analysis of publications on mechanical engineering education using VOSViewer	[105]
35	Introducing ASEAN Journal of Science and Engineering: A Bibliometric Analysis Study	[106]
36	Introducing ASEAN Journal of Science and Engineering Education: A Bibliometric Analysis Study for Understanding Internationalization	[107]
37	Exploring Iron Oxide's Role in Hydrogen Production: Bibliographic and Bibliometric Analysis	[108]
37	How Technology Can Change Educational Research? Definition, Factors for Improving Quality of Education and Computational Bibliometric Analysis	[109]
38	Is Universitas Pendidikan Indonesia Ready for Internationalization? A Bibliometric Analysis in The Science and Technology-Related Publications	[110]
39	Social Impact and Internationalization of “Indonesian Journal of Science and Technology” the Best Journal in Indonesia: A Bibliometric Analysis	[111]
40	Mapping of nanotechnology research in animal science: Scientometric analysis	[112]
41	Strategies in language education to improve science student understanding during practicum in laboratory: Review and computational bibliometric analysis	[113]
42	How language and technology can improve student learning quality in engineering? definition, factors for enhancing students comprehension, and computational bibliometric analysis	[114]
43	Involving particle technology in computational fluid dynamics research: A Bibliometric analysis	[115]
44	Small-scale botanical in enhancing indoor air quality: A bibliometric analysis (2011-2020) and short review	[160]
45	The importance of life cycle cost components for green highway and road management: A review	[161]
46	The effect of supply chain risk management practices on resilience and performance: A systematic literature review	[162]

Previous bibliometric studies have gained popularity in researching AI in education [116,117]. Recently, Huang, *et al*., [118] also studied AI in language education trends in 2000-2019 and found research trends, common applications, and advantages of using AI in language learning. The study strongly recommends investigating the potential of AI to improve teaching and learning outcomes, and the possibility of AI utilization for language processes. Based on all previous findings we seek to expand the insights into key trends, utilization of AI in language education and the evolution of this rapidly evolving field in 2018 - 2023, especially in Asia. We consider that it is necessary to explore Indonesia's present AI in language learning research trends in 2018 - 2023. Specifically, this research aims to explore (1) the visualization of publications on the use of AI in the education field; (2) the trends of scholarly publications on the use of AI in language learning (3) the themes of findings have emerged from the studies on the use of AI in language learning.

The examination and solutions to the study objectives (1-3) would hopefully gain some insights for undergraduate and graduate students, language education scholars, and practitioners searching in the context of contemporary research subjects and theories to frame their studies. Additionally, they could see and learn various research techniques of AI in language learning that they might use in their future studies. In addition, they could have a better understanding of the trends that will affect AI and language learning education research as well as study topics that scholars haven't explored as much but that could be useful for their future goals. Through this research, understanding the trajectory of AI in language learning will also be discovered. This research is essential not only for educators and institutions but also for policymakers and researchers. In addition, this research also offers some insights into how the technology of AI is reshaping the educational field. The conclusions and analyses in this work may also help to create a research roadmap for further research.

2. Methodology

2.1 Flowchart of Bibliometric Analysis Procedure

This research employs a bibliometric analysis method with twofold objectives: (1) to provide the current trends of publications on the use of AI in the education field in the last five years (2018 – 2023) and (2) to understand the current portrait of publications on the utilization of AI technology for language learning in particular. In obtaining comprehensive data, the researchers employed a two-stage procedure. The first stage focused on compiling data using Publish or Perish software and processing the search results using VOSViewer to generate the data visualization to accomplish the first objective. The second stage dealt with searching papers from Google Scholar database to specifically probe into emerging trends on the use of AI technology for language learning. Google Scholar was used considering such a database contains a myriad of articles published in various scientific journals. First, the search strategy was determined to obtain relevant papers from the database by using specific search terms such as “Artificial Intelligence” OR “AI technology” OR “AI-powered technologies or tools” OR “chatbot system”. Such terms were also accompanied by other terms signifying the context such as “language learning” OR “foreign language learning”. Second, the data of papers generated from the database were compiled to be further analyzed. Prior to data analysis of the papers collected, the researchers set criteria to sort out the relevant papers for further analysis. The flowchart of the data selection process is depicted in Figure 1.

2.2 Preparing Tools and Materials

Google Scholar was used as the main database to obtain the papers. The criteria of selection comprise: (1) the paper is written in English; (2) the paper contains the keywords determined before in the title; and (3) the paper can be research-based or review paper on previous studies. All papers not adhered to those criteria were excluded from the pool. Meanwhile, the selected papers proceeded to detailed reading and analysis from its titles and abstracts.

2.3 Harvesting and Screening Data

The first search yielded 500 papers related to the use of technology or AI technology in the last five years (2018-2023) using the Publish or Perish tool. All entries were first processed by using VOSViewer to generate a general visualization. All entries were then cross-checked to the Google Scholar as the main database and to ensure whether the papers showcase the criteria determined earlier. All entries that have been cross-checked were analyzed further to match the titles with the predetermined criteria. The second stage excluded 382 titles due to duplications and lack of access to the papers. All remaining titles were sorted out based on the quality of the abstract content. At this stage, thirty (30) titles were excluded from the pool due to titles related to teaching, not learning; some were books; and few of them did show clear content, leaving out 88 titles for inclusion.

2.4 Data Visualization

Finally, eighty-eight (88) papers were included for further analysis. The abstracts were further analyzed in generating not only the keywords but also the main themes emerged from the database. The analysis results would yield two main data sets. The first data set contains information about the metadata of the papers: the author's name(s), year of publication, country of origin where the research was conducted, and level of education being concerned in the research. The second data set was concerned with the main content from the abstracts. While the first data set was to address the first research question, the second data set was aimed to answer the second research question. Both datasets would be visualized using tables and figures.

2.5 Data Analysis Procedure

Once the papers were sorted out, the abstract content was analyzed to generate the main themes regarding the use of AI in language learning. First, the researchers read the abstract content carefully to understand the research focus, methods, and main results. Second, the main results were labeled based on the verbatim keywords that emerged in the abstract. Third, the labels were grouped based on the connection between each label to generate bigger themes. Ideas and data related to each theme were documented to support the presentation and discussion of the data analysis results.

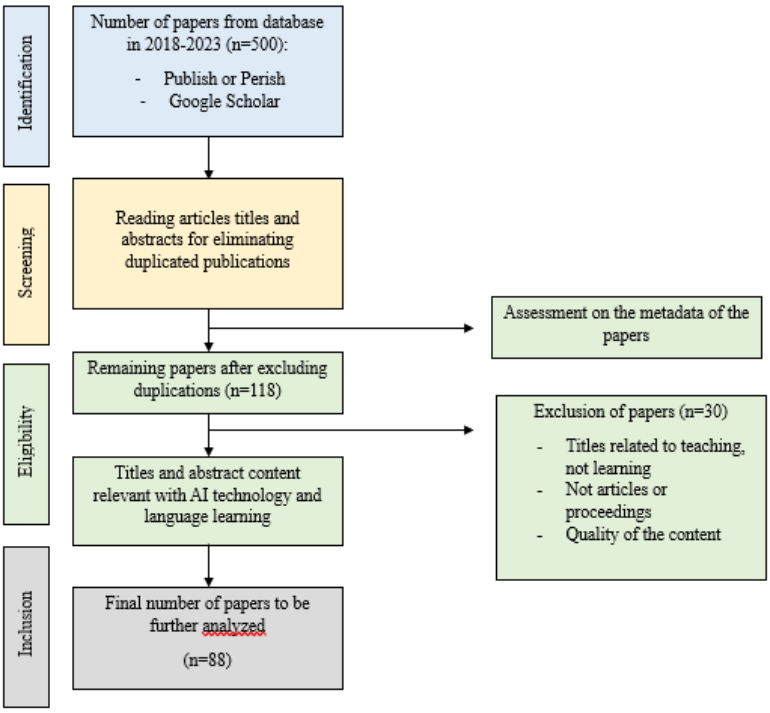

Fig. 1. Data selection process about the use of AI in language learning

3. Results and Discussion

3.1 The Visualization of Data on Publications Regarding the Use of AI in the Education Field

Figure 2 shows the network visualization of the keyword 'AI' with other relevant terms in the education field. The results demonstrated that the use of AI in education was associated with various domains including education policy, implementation particularly in higher education or university settings, effect of AI use, evaluation, assessment, and report of such agenda, as well as the initiation of implementing AI education [e.g., 152-153].

If viewed in a narrow sense (see Figure 3), the application of AI in education is closely linked to several key terms such as 'natural language processing', 'educator', 'element', 'decade', and 'language'. Publications focused on investigating AI applications in a language context are closely related to several key terms such as 'systematic literature review', 'implementation', 'environment', 'response', 'computer', 'effect', 'attitude', 'user', 'nursing education', and 'skill'. However, the term language is not directly connected with learning or education, indicating that studies on the application of AI in language context might focus on the scrutinization of AI language or algorithm. In other words, there is a scarcity of research on how AI technology has been applied in language learning context.

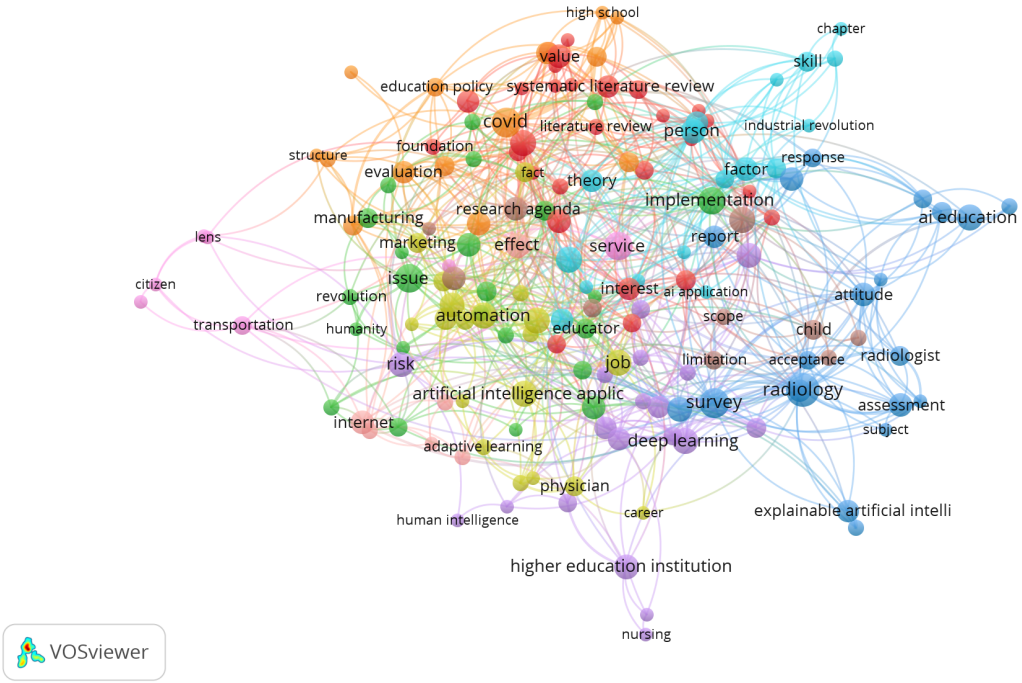

Fig. 2. Network visualization from VOSViewer about AI use in education

Fig. 3. Terms networked with AI applications and language

The overlay visualization yielded a general representation of the position of research on language in relation to the use of AI technology (see Figure 4). Such research was considered new considering the tendency of publications on this issue in 2019 on-ward, followed by other associated terms. The recency of publications on systematic literature review on this particular issue was no surprise since authors tend to examine the milestone from previous studies.

Regarding the results of density visualization in Figure 5, it demonstrated that publications on language-related AI applications have grabbed recent attention among scholars. It is indicated by the bold yellow color in the area of language and its associated terms. This encourages the researchers to further investigate trends of scholarly publications on the use of AI technology for language learning in the following subsections.

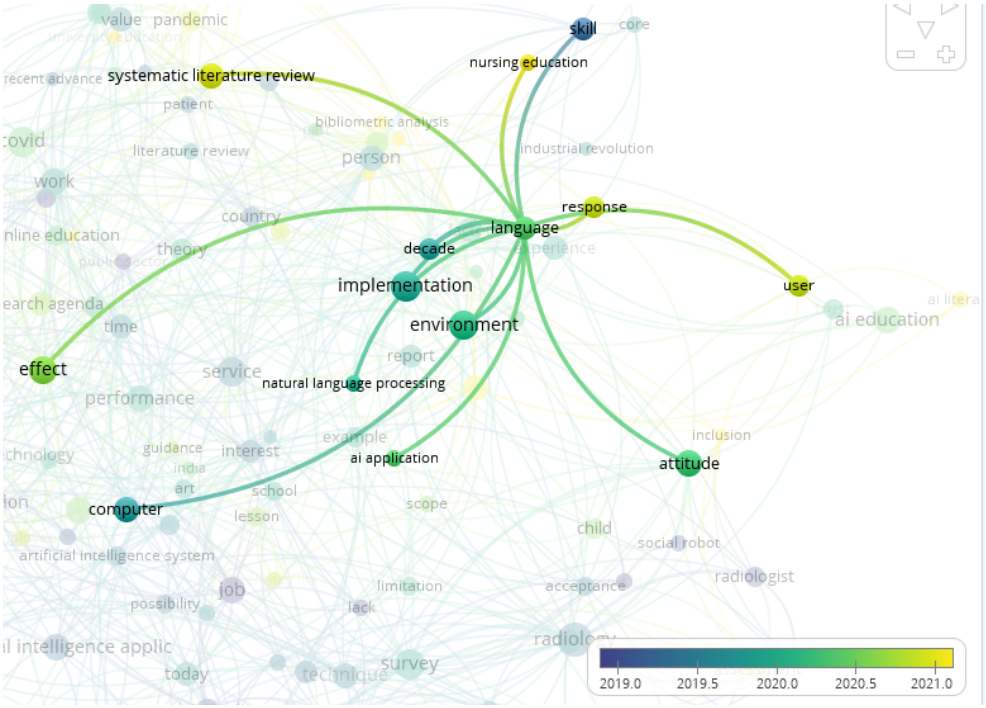

Fig. 4. Overlay visualization from VOSViewer about AI applications and language

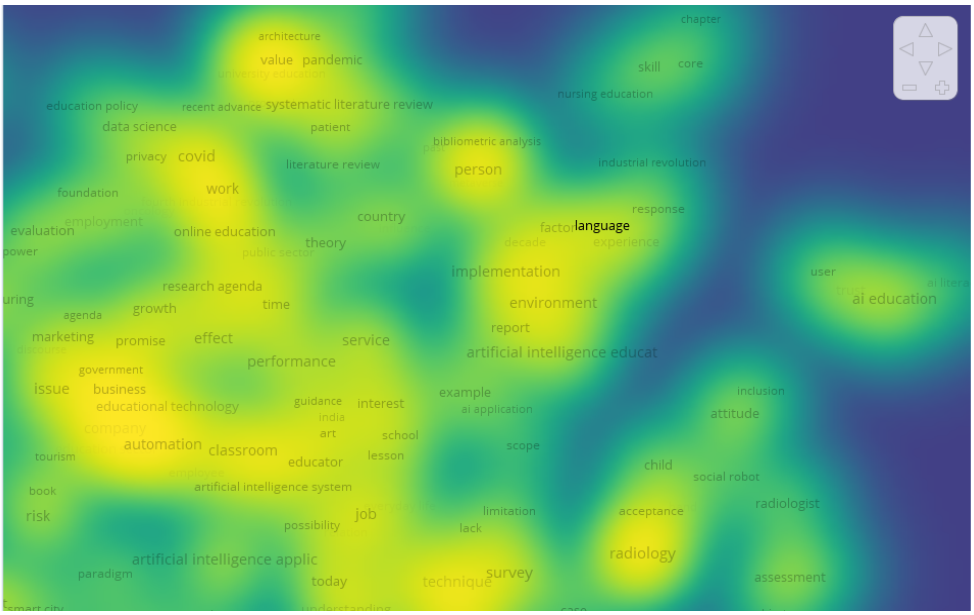

Fig. 5. Density visualization of language-related publications and AI use

3.2 The Trends of Scholarly Publications on the use of AI in Language Learning

3.2.1 Country of research

The results showed that the use of AI in the last five years has attracted much attention from several years in Asia and Europe. In Asiatic regions, studies on this topic have been initiated in Arab countries [119], Indonesia [120], Korea [121], Malaysia [122], Japan [123], and China [124], to mention a few. Similar studies were also emerging in European countries such as Greece [125] and the United States of America [126]. This indicates that the use of AI technology has appealed to many researchers from diverse regions.

3.2.2 Year of publication and key terms

Figure 6 chow the number of publications on AI in language learning. In the last five years, publications on the use of AI in language learning have exhibited a growing number of interests. While there were six papers published in 2018, the number of featured papers has considerably increased in the last two years (2022=13 papers; 2023=26 papers). Such trends are associated with the current demands in this more globalized era. First, the implementation of education in the world is now generally concerned with the advancement of quality in delivering the learning materials, conducting the teaching and learning process, and evaluating the students' learning outcomes and progress. Second, students in the current era have been surrounded by the advancement of technology from social media to mobile applications. This encourages initiatives of educational researchers and practitioners to develop technologies, powered by AI to ease the students' learning process. Furthermore, the keywords from the abstracts were compared across years to yield key terms related to the use of AI-powered technology, as shown in Table 2.

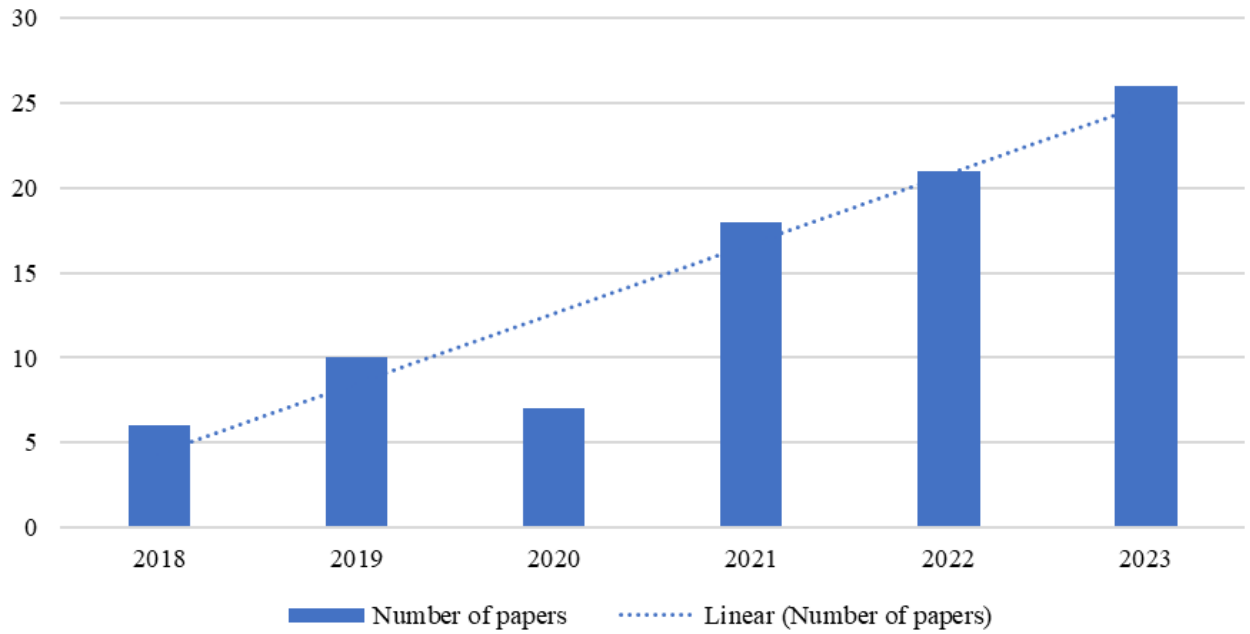

Fig. 6. The trend line of the number of publications on AI in language learning

Table 2
Key terms related to the use of AI in language learning across years

2018	2019	2020	2021	2022	2023
Adaptivity, Fuzzy Logic, **Intelligent Tutoring Systems**, Machine Learning, **Personalization**, Human Intelligence, CALL, second language learning, second	Education, Efficiency, Siri, **English as a Foreign Language**, Technology, System construction, Japanese Language	**Mobile apps**, Linguistics, Educational sustainability; Spaced repetition, Forgetting curve, **Neural networks**, **Adaptive learning**, Education, Analytical models, Data	English language learning, **Personalized language learning**, Teachers and student perceptions, Educational technology, **Computer assisted**	LINE **ChatBot**, Artificial intelligence markup language (AIML), Competitive strategy, **English learning**, Contextual learning, Computer-assisted writing, Learner expectation and satisfaction, **Artificial Intelligence in writing and reading**, AEE, AERW,	**Virtual and extended reality, Chatbots**, Human-computer interaction, spoken dialogue systems; **Multi-modal interaction**, **Automated writing evaluation**, Intelligent

language instruction, Computer Assisted language learning, **Mobile Assisted Language Learning**, **Network Learning**	models, Solid modeling, Cultural differences; NLP-based Chatbot, Explainable Artificial Intelligence (XAI), Ontology graph, GPT-2, Transfer Learning; **Grammar learning**, **Personal Learning Environment (PLE)**, **Social media**	**language learning**, Effectiveness, Transformation, AI writer, L2 text production, Big data, **Neural networks, Learning analytics**, Data ethics, **English speaking performance**, Retention, Motion sensing system, TPR	Education theory, AI affordances, Intelligent computer assisted language learning, **Metaverse, Virtual reality, Augmented reality**, **Gender,** Primary education, Undergraduate, **AI in the EFL context**, Middle school, Machine translation, **Automatic corrective feedback**, Second language writing, AI based mobile learning, EFL students competence	tutoring system, Speech evaluation system, **Universities, Personalized learning**, Online tutoring, **Learner engagement**, Multimedia communication, Presenting skills, **Society 5.0**, Multiple intelligences, **Personalization and engagement, Machine translation**

Table 2 demonstrates that while several key terms are particular in each year, some others have been a consensus in the last five years. For example, studies on fuzzy logic, system construction, or Explainable Artificial Intelligence (XAI) might not appear more than machine learning, personalization, or mobile-assisted language learning every year. Mainstream topics such as personalized learning, English language, mobile learning, and chatbot applications can make scholarly discussions last longer than the previous particular topics. This indicates a stronger attention on how AI can be a smart personal assistant for language learners.

3.2.3 Level of education concerned

In general, the level of language education being concerned in the previous publications varied across years of publication, comprising secondary and higher education (see Table 3). However, higher education has become the educational level most frequently occurring in the data sets. This can be explained by two main reasons. First, higher education has projected more concerns with internationalization and international education that can be accessed by people around the world than ever. Second, the use of AI technology is aligned with the characteristics of language learning in higher education institutions where the learning process is complex, comprehensive, and holistic. Such circumstances trigger more focus on developing and integrating AI-powered technologies into language learning at a higher education level.

Table 3
Levels of education identified in the previous studies

Level of education	Samples of studies
Primary	[38]
Secondary	[127-129]
Higher education	[37, 118, 129 - 141]

3.2.4 Target language

Table 4 shows exhibits the general portrait that English has been the most frequently concerned language in publications on AI technology utilization in language learning in the last five years. Other

languages were identified such as Arabic, French, and Japanese in several studies. The results somehow are not surprising, considering English has been the major language of machine learning, including in developing AI technologies.

Table 4
Language being analyzed

Language	Samples of studies
English	[129-130,139,142-144]
Japanese	[56]
French	[145]
Arabic	[146,147]
Indonesian	[134, 135, 138]

3.3 Emerging Themes of Findings from the Studies on the Use of AI in Language Learning

3.3.1 Types of AI technology to support language learning

Some types of AI technology were identified, such as intelligent tutoring systems, chatbots like SIRI, and ChatGPT, developed chatbot partners namely Replika, Kuki, and Wysa, as well as applications such as Google Translate, Orai, Text-to-speech, Elsa, Duolingo, to mention a few. Several studies have employed AI-powered applications to support language learning. Some others investigated the use of AI-powered webpages. Basically, the AI technologies integrated machine learning and natural language processing to enable the realization of personalized language learning for students. For example, the use of AI techniques in creating a personalized and adaptive language learning environment. In particular, they developed a model for diagnosing errors such as spelling mistakes, misuse of tenses and verbs in learning English and French.

Another example is a study conducted by Haristiani, focusing on the incorporation of AI (AI) chatbot as a medium of language learning. Such a chatbot was used to assist the students in realizing independent language learning. In Korean college situations, Kim [148] studied the use of AI-powered chatbots to develop students' general English grammar skills. The results of such intervention were statistically measured using a pre- and post-test design. Other types of chatbots were noticed in the last five years such as the use of SIRI [134] and ChatGPT. The former chatbot system was utilized in conducting English language learning.

The latter chatbot system was also concerned with the exploration of dimensions of ChatGPT use in English language learning. Even such generative AI-powered chatbot has grabbed enormous people's attention to explore their potential for supporting foreign language learning. Another use of chatbots was spotted in Belda-Medina and Calvo-Ferrer's [149] study that chatbots can be conversational partners in gaining linguistic knowledge in language learning classrooms. This reinforces that the international status of English has been so pervasive that the development of AI-powered with tools is concerned in implementing English language learning.

3.3.2 AI and language learning preparation

Recently, much attention has been spent exploring the use of AI-powered chatbots such as ChatGPT to help students prepare for their learning [150-153]. First, the language learning process needs to be foreblished well prior to its implementation since students may not have stable motivation to start their learning process. Chiu et al. [150] found that AI technology can promote student motivation to learn. Kohnke [151] also argues that chatbots can be used as a pedagogical tool to supplement students' language learning. It is aligned with the characteristics of AI-powered

chatbots, which are made to create interactive personalized communication between human and computer tools. This is supported by Kuhail et al. [154] that educational chatbots are beneficial for creating interactions. Kohnke, et al. [153] provided a comprehensive portrait of how ChatGPT can be used to prepare for learning materials in various language learning domains such as reading, vocabulary mastery, and writing. Such generative AI-powered chatbots can formulate a wide array of questions about certain texts and compose a particular text under specific conditions, allowing the students to learn language through such model text.

3.3.3 AI and language skills development

Some studies [122, 139, 141, 146, 152, 154-156] have shown that the use of AI could be a potential alternative to enhance students' language skills. Intelligent systems such as robots can be integrated into language learning, as discussed in Morales et al. [146] study. They posit that AI can be utilized as a supporting tool for Arabic language learning. Some other scholars were concerned with the use of ChatGPT in maximizing the enhancement of language skills. Abd Rahim, et al. [122] surveyed 181 students in Universiti Teknologi MARA, Malaysia on the students' perceptions of ChatGPT as a language learning tool. The results revealed that most students perceived such a tool as a helpful means for improving their English writing skills. In an intervention research setting, Zou, et al. [141] extend the conversation that social network-based interaction within AI-assisted language learning can assist students in enhancing their speaking skills, demonstrating positive attitudes towards the interactive activities. In other words, students' productive skills during the language learning process can be enhanced using AI-powered tools.

3.3.4 AI and language learning evaluation

Another theme associated with the affordability of AI technology in language learning was the learning evaluation domain. Several studies [154, 155, 157]. Chatbots are found to be useful for obtaining feedback on students' performance or work [155]. This might be related to the natural language processing feature AI has so that such technology can provide evaluative or corrective feedback on the students' works. AI technology is also made generative, meaning that the technology can learn by itself to understand human language and provide answers relevant to the questions, forms, or instructions, based on the predetermined data. The potential use of AI tools in obtaining feedback was justified by Wang [157] whose study focused on exploring EFL students' expectations and the perceived effectiveness of intelligent automated essay evaluation tools. By conducting observation, interview, and survey, the data showcases students' high expectations for such tools in effectively scoring their works and providing feedback. Such high expectations rendered the significantly improved writing ability.

3.3.5 Challenges in using AI to assist language learning

Despite the potential uses of AI in maximizing the language learning process, challenges remain on the surface of discussion [137, 153, 157]. First, issues on the integrity and originality of works among students learning foreign languages can be raised by the massive use of AI-powered chatbots, in particular. The ease of obtaining texts generated by the chatbots or just simply getting answers to the questions posed by the teachers may cause students to feel dependent on such technology and reluctant to be proud of their capabilities and capacity. Kohnke et al. [153] were also concerned about raising students' awareness of being responsible digital citizens with integrity where they need to

train their digital literacy in utilizing ChatGPT as a learning tool. Such concerns were reinforced by Makeleni et al. [137] that laziness among the students, not only teachers, would arise from this use of AI technology, leading to a lack of accountability and academic dishonesty. Hence, it is the role of teachers pivotal for prevent such issues while students utilize AI-powered tools in their language learning process.

4. Conclusions

This paper has delineated the mapping visualization of publication data on the use of AI as an educational technology in general, followed by the trends of scholarly publications on the use of AI tools in language learning as well as themes emerging from those publications in the last five years (2018-2023). The analysis results highlight the continuous attention on studying the use of AI-powered chatbots to assist students' foreign language learning process, considering the increasing importance of research on this issue in the last two years among language learning scholars. Additionally, this paper underlines the major challenges students will face during the learning process with AI technology such as academic dishonesty and the possible decline of autonomous and critical thinking. Hence, the results of this bibliometric analysis are expected to not only provide a mapping of current studies but also trigger new research-potential ideas to extend the conversation where discussions and debates on the use of AI technologies for assisting students' language learning are predicted to be more fruitful in the near future than ever before.

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