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Bibliometric Review on Artificial Intelligence-Based Tools for Language Learning

[1]Hernán Javier Guzmán Murillo, [2]William Niebles, [3]José Marcelo Torres Ortega

1Doctor en Ciencias de la Educación

Universidad de Sucre

hernan.guzman@unisucre.edu.co

https://orcid.org/0000-0002-6757-4549

2Doctor en Ciencias Gerenciales

Universidad de Sucre

williamniebles@yahoo.com.mx

https://orcid.org/0000-0001-9411-4583

3Doctor en Economía y Empresas

Doctor en Estudios Políticos

Universidad de Sucre

jose.torres@unisucre.edu.co

https://orcid.org/0000-0001-8107-8763

Abstract

This bibliometric analysis uses data from the Scopus database to analyze the trends, impact, and evolution of research on AI-based language learning tools between 2018 and 2025. In this expanding sector, the study highlights important authors, significant organizations, and well-known publication sources. The findings show a notable rise in scientific output with a growth rate of 67.79%, especially in 2024 (266 publications), 2023 (195), and 2022 (115), which reflects the growing significance of AI technology in language learning. The information demonstrates how technologically advanced countries like China (276), Italy (168), and the United States (647 documents) dominate research production. Despite an increase in publications, the authorship pattern shows that only 0.6% of contributors have produced three or more papers, while 94.8% have only published one. This suggests that the most reliable contributors to the area are a select few researchers, such as DENNY P, LIU X, and WANG L. Leading journals for sharing research on AI language learning include IEEE ACCESS, APPLIED SCIENCES (SWITZERLAND), and PROCEDIA COMPUTER SCIENCE. The study emphasizes how deep learning, adaptive learning models, and natural language processing are becoming increasingly important topics. To guarantee that AI-based language learning tools successfully handle a variety of educational situations, future research should prioritize long-term studies, cross-disciplinary collaboration, and global inclusivity.

Keywords: Artificial intelligence, Natural language processing, Deep learning, Educational technology, Bibliometrics.

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1 Introduction

In the field of education, artificial intelligence (AI) has become more relevant, particularly for language learning. AI-based technologies have entirely changed traditional teaching approaches by means of which Almusaed et al., 2023 provide innovative ideas supporting tailored learning experiences, raise teaching efficacy, and boost student involvement. As educational institutions continuously adopting digital technology, artificial intelligence is fundamentally altering language learning strategies to better address the evolving demands of present students (Chen et al., 2020).

Artificial intelligence-based language learning systems often mix natural language processing (NLP), machine learning techniques, and deep learning models among other methods. These techniques enable intelligent systems to fast identify, assess, and respond to activities linked to languages (Li et al., 2020). These advancements have created complex systems that provide tailored lesson plans, adaptive learning routes, and real-time feedback thereby allowing students to engage with information suited to their particular learning needs and speed (Isaeva et al., 2024). This tailoring has especially great effect in language acquisition as students usually struggle with diverse ability levels, pronunciation, and learning preferences (Kovalenko & Baranivska, 2024).

The ability of artificial intelligence to motivate more student autonomy and enhance self-directed learning adds even more importance to its effectiveness in language acquisition. Products driven by artificial intelligence provide among other interactive elements virtual teachers, chatbots, and voice recognition systems. These instruments provide students fast remarks and replicate human contact (Praveenkumar et al., 2024). These tools provide a dynamic learning environment where students may improve their language skills in practical environments even without relying only on traditional classroom techniques (Kurhila & Kotilainen, 2020).

Apart from improving personal learning experiences, artificial intelligence technologies aid teachers in automating administrative duties, creating data-driven insights, and supporting course design (Ahmad et al., 2023). AI data allows teachers to more precisely assess student performance, identify patterns in learning behavior, and change their plans (Dimitriadou & Lanitis, 2023). By means of this data-driven approach, teachers might design targeted interventions to address language proficiency gaps and raise academic performance (Gauthie et al., 2022).

The corpus of research in this field reflects the increasing intellectual curiosity in artificial intelligence-based language learning systems. Recent bibliometric data indicates that 2024, 2023, and 2022 were the most successful years based on a development in publications during the last several years. This increase in study emphasizes how more generally regarded artificial intelligence's capacity to revolutionize language education by way of creative tools and procedures is becoming (Wei, 2023).

Notwithstanding this rapid growth, authorship patterns reveal a very scattered research environment: just 0.6% of academics have written three or more papers and 94.8% of contributors have written only one. This trend suggests that there is still a lack of consistent academic involvement in the field even if the number of researchers is rising. More cross-disciplinary collaboration is needed to build more strong theoretical frameworks and practical implementations even if eminent writers have become significant contributors (Urbano & Ardanuy, 2020).

Research results in this discipline have been much disseminated thanks in great part to several scholarly journals. These publications underline the interdisciplinary aspect of AI-based language learning (Dzogovic et al., 2024) by citing fields like computer science, cognitive psychology, and educational research.

Geographically, studies output is largely concentrated on technologically developed nations; United States, China, and Italy are the most often cited sources. This trend highlights the considerable financial outlay these countries' institutions are making to develop and enhance AI-based language learning systems. However, limited research efforts from undeveloped regions draw attention to a potential disparity in global accessibility to AI-driven educational developments. Increasing research efforts encompassing

different learning contexts will help to ensure that these instruments are adaptable enough to accommodate a larger range of cultural and linguistic backgrounds (Schissel et al., 2021).

Notable research institutes in this field help to explain the exceptionally impressive concentration of institutional funds. By means of coordinated efforts and technical advancements, these universities have greatly contributed to increase the use of artificial intelligence in language instruction (Su & Zou, 2020). Still, this limited number of major donors emphasizes the need of expanding international research networks to sufficiently explore the possibilities of artificial intelligence-based language learning systems.

The most important efforts in this field have focused on improving natural language processing systems, developing adaptive learning models, and combining artificial intelligence technologies with traditional language teaching approaches. Highly referenced research highlighting how artificial intelligence might enhance voice recognition, language comprehension, and interactive learning have affected academic debate on this topic.

There are still major problems that need to be resolved even if the use of artificial intelligence in language instruction offers great possibilities. One of the main disadvantages is the lack of long-term studies assessing how artificial intelligence technology might affect student performance. Moreover, academics caution against depending too much on data produced by computers as it might limit opportunities for actual linguistic communication and innovative thinking. Future research should emphasis long-term studies, foster interdisciplinary cooperation, and go into underrepresented disciplines to help to allay these issues. Expanding the parameters of their research helps researchers to guarantee that AI-based language learning resources are inclusive, culturally sensitive, and easily available to a large spectrum of students all around.

This bibliometric analysis attempts to provide a whole picture of the direction of research in artificial intelligence-based language learning. This study offers analytical analysis of the potential, problems, and future directions of artificial intelligence in language instruction by means of publication trends, eminent authors, and important research subjects. These insights will help academics, instructors, and lawmakers to better understand how artificial intelligence technology may be used to enhance language learning thus increasing access to high-quality language education worldwide and so enhancing educational results.

2 Materials and methods

The frequency and influence of publications on AI-based language learning systems is the focus of this bibliometric study. Using a set of targeted search phrases linked to the topic of the study, data from the Scopus database was acquired in February 2025.

The data was processed and assessed using R and VOS Viewers—famous for their ability to see and understand bibliometric networks—Moral-Muñoz et al., 2020. Using a descriptive documentary approach, one was able to identify notable authors, growing trends, most populated countries, and organizations of great relevance in this subject (López-Belmonte et al., 2020). This approach also enabled KPIs including variations in researcher cooperation, document categorization, and publication expansion (Pessin et al., 2022).

While Lotka's law was used to examine author output and identify patterns in scientific production (Awan & Abbas, 2023), Bradford's Law was used to ascertain the most significant papers in this field. At last, we examined important factors such author affiliations, source relevance, and citation patterns in order to evaluate the exposure and effect of the work.

Table 1. Variables and descriptors.

Variable	Descriptor
Tools	Instruments, Implements

Artificial intelligence	Intelligent systems, Cognitive automation
Learning	Knowledge acquisition, Languages

Source: author using R software based on information from Scopus (2025).

Based on the identification of these elements, the following search equation is proposed in the Scopus database: "(TITLE-ABS-KEY ("Tools") OR TITLE-ABS-KEY ("Instruments") OR TITLE-ABS-KEY ("Implements") AND TITLE-ABS-KEY ("Artificial intelligence") OR TITLE-ABS-KEY ("Intelligent systems") OR TITLE- ABS-KEY ("Cognitive automation") AND TITLE-ABS-KEY ("Learning") OR TITLE-ABS-KEY ("Knowledge acquisition") AND TITLE-ABS-KEY ("Languages")) AND PUBYEAR > 2018 AND PUBYEAR < 2025."

3 Results

Table 2. Description of main information.

MAIN INFORMATION ABOUT DATA	
Timespan	2019:2024
Sources (Journals, Books, etc)	379
Documents	686
Annual Growth Rate %	67.79
Document Average Age	2.21
Average citations per doc	19.38
References	35014
DOCUMENT CONTENTS	
Keywords Plus (ID)	3992
Author's Keywords (DE)	2132
AUTHORS	
Authors	2763
Authors of single-authored docs	70
AUTHORS COLLABORATION	
Single-authored docs	71
Co-Authors per Doc	4.32
International co-authorships %	27.55
DOCUMENT TYPES	
article	485
book	8

book chapter	1
conference paper	118
data paper	1
editorial	3
review	65
short survey	5

Source: author using R software based on information from Scopus (2025).

The general data on scientific production in this field of knowledge is displayed in Table 2 above, which shows a growth rate of 67.79% in recent years. There are 379 sources and 686 documents listed overall, with 2763 authors contributing to these publications. Similarly, Figure 1 makes this rise more evident, showing that the years 2024 (266), 2023 (195), and 2022 (115) are the ones with the highest yearly production.

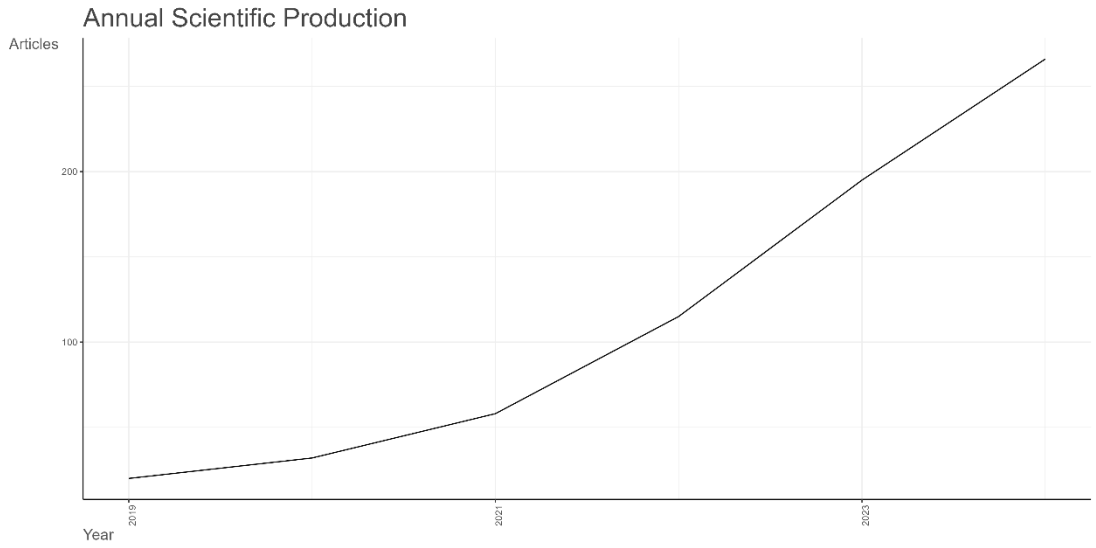

Fig. 1. Annual scientific production, source: author based on information from Scopus (2024).

Laws of bibliometric productivity

When examining the correlation between the quantity of publications and the number of authors, Lotka's law is essential since it provides a clear understanding of their influence on the field of knowledge (). Table 3 shows that 94.8% of the authors have only contributed one work, 4.1% have published two or more, and 0.6% have contributed three or more. Since the majority of authors only contributed one paper, a tiny number of authors contributed more extensively, indicating a strong concentration in scientific activity.

Table 3. Lotka 's Law.

Documents written	N. of Authors	Proportion of Authors
1	2618	0.948
2	113	0.041
3	16	0.006

4	9	0.003
5	6	0.002
7	1	0

Source: own elaboration (2025).

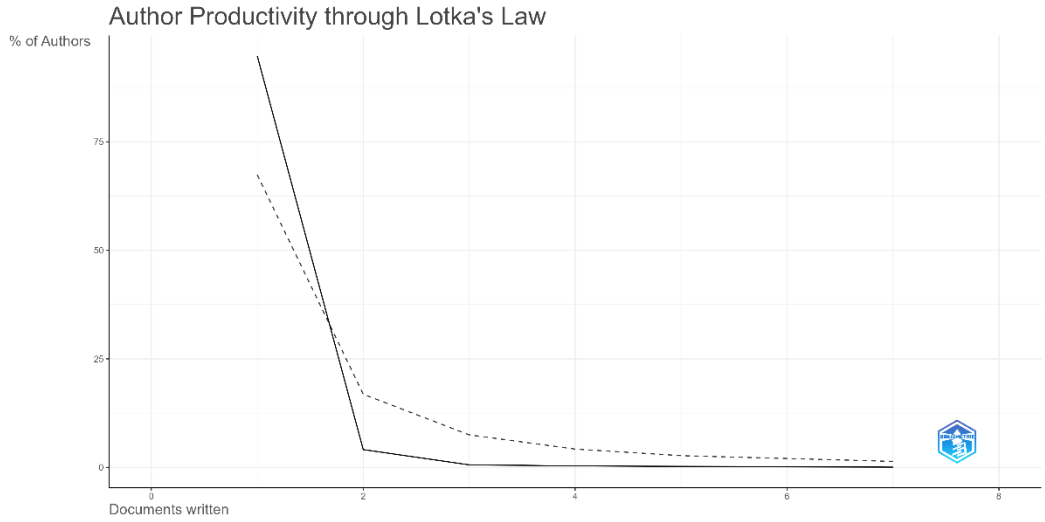

Fig. 2. Lotka's Law, source: author based on information from Scopus (2025).

Based on the frequency of publications on the topic and the percentiles displayed by the Bradford Law, which divides journals into three performance zones, each with an increase in the number of publications and a comparable proportion of articles (Xie, 2020), the most pertinent sources are shown. The percentages corresponding to each zone of the Bradford Law are displayed in Table 4. With 33.82% of the group's publications, zona 2 leads, followed by zona 1 (33.24%), and finally, zona 3 (32.94%). Figure 3 shows the most representative magazines according to this law.

Table 4. Bradford's Law.

Zone	No. Magazines	No. Titles	Percentages
Zone 1	30	228	33.24%
Zone 2	123	232	33.82%
Zone 3	226	226	32.94%

Source: own elaboration (2025).

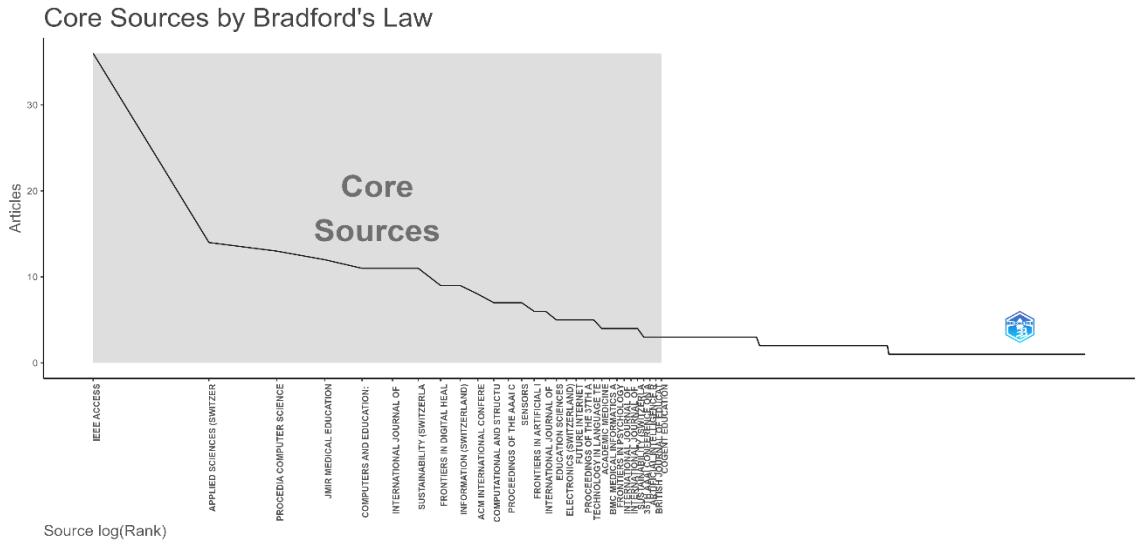

Fig. 3. Bradford's Law, source: author based on information from Scopus (2025).

Bibliometric indicators

In accordance with Table 5, IEEE ACCESS is the leading publication in the field with 36, followed by APPLIED SCIENCES (SWITZERLAND) with 14 and PROCEDIA COMPUTER SCIENCE with 13.

Table 5. Most relevant sources.

Sources	Articles
IEEE ACCESS	36
APPLIED SCIENCES (SWITZERLAND)	14
PROCEDIA COMPUTER SCIENCE	13
JMIR MEDICAL EDUCATION	12
COMPUTERS AND EDUCATION: ARTIFICIAL INTELLIGENCE	11
INTERNATIONAL JOURNAL OF ADVANCED COMPUTER SCIENCE AND APPLICATIONS	11
SUSTAINABILITY (SWITZERLAND)	11
FRONTIERS IN DIGITAL HEALTH	9
INFORMATION (SWITZERLAND)	9
ACM INTERNATIONAL CONFERENCE PROCEEDING SERIES	8

Source: own elaboration (2025).

However, Figure 4 compares the output of scientific publications across the nations with the highest number of published papers based on the results of the bibliometric analysis. With 647 documents, the United States is by far the largest producer, followed by China (276), and Italy (168).

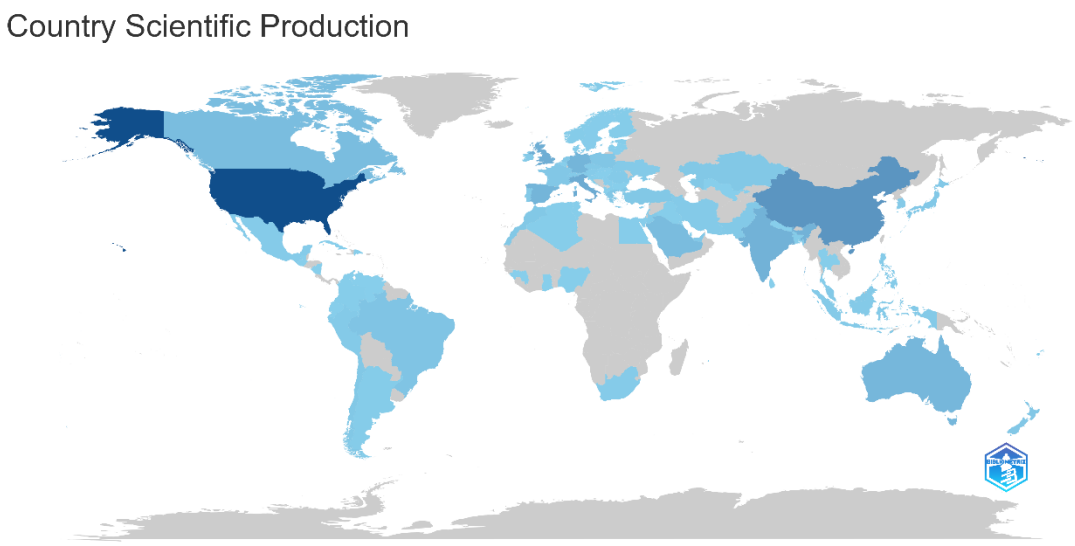

Fig. 4. Scientific production between countries, source: author based on information from Scopus (2025).

Based to this sequence of concepts, Figure 5 lists the universities that have contributed the most to the research topic: KING ABDULAZIZ UNIVERSITY (24) followed by SOUTHERN MEDICAL UNIVERSITY and WROCŁAW UNIVERSITY OF SCIENCE AND TECHNOLOGY (20) each.

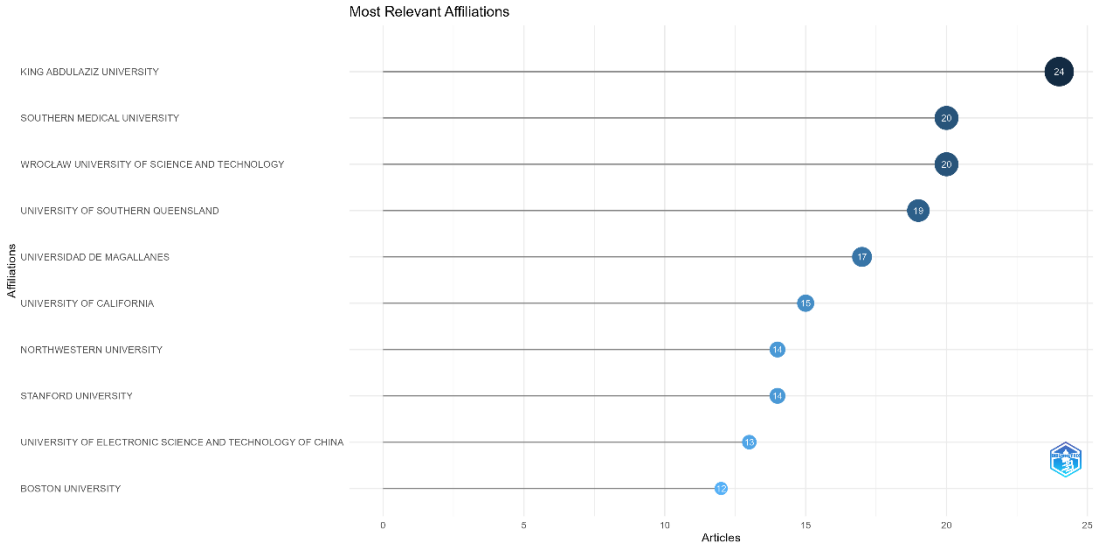

Fig. 5. Most relevant affiliations, source: author based on information from Scopus (2025).

In a different sequence of concepts, the frequency index is used as a reference to gauge production per researcher; Figure 6 illustrates the leadership of DENNY P with seven (7) contributions, followed by LIU X with five (5) contributions and WANG L.

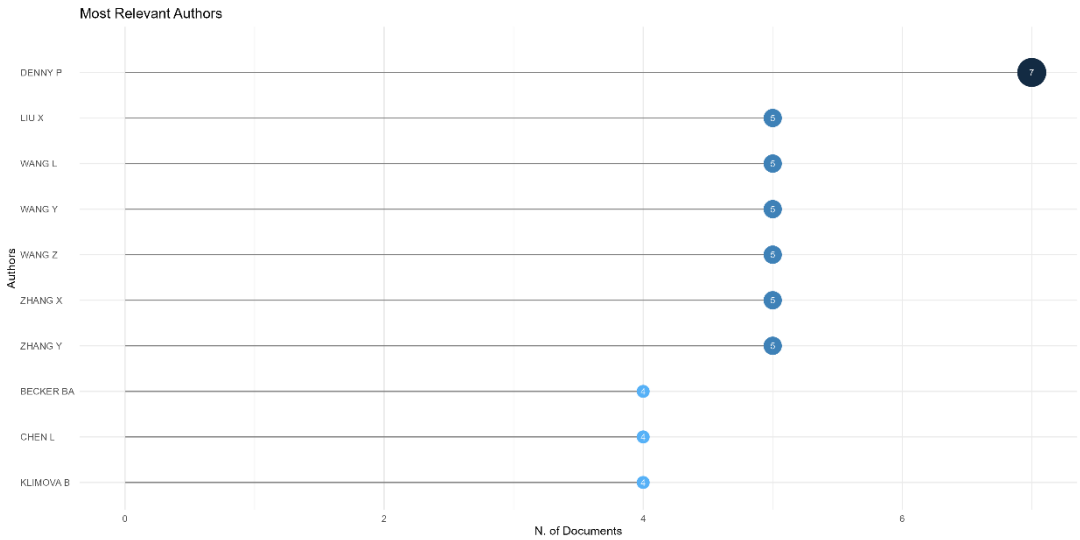

Fig. 6. Most relevant authors, source: author using R software based on information from Scopus (2024).

The twenty papers with the most citations pertaining to the study's subject are shown in Table 6. Among these, three papers in particular are noteworthy: FARROKHNIA M (2024) in Innov Educ Teach Int, which has 395 citations; DAVE T (2023) in Frontier Artif Intell, which has 556 citations; and GILSON A (2023), published in JMIR Med Educ, which has 968 citations. These findings establish these authors as important sources for further research since they demonstrate how their work has significantly influenced the field's literature.

Table 6. Most cited articles.

Articles	TWO	Total Citations	TC per Year	Normalized TC
GILSON A, 2023, JMIR MED EDUC	10.2196/45312	968	322.67	29.64
DAVE T, 2023, FRONTIER ARTIF INTELL	10.3389/frai.2023.1169595	556	185.33	17.03
FARROKHNIA M, 2024, INNOV EDUC INT HOUSE	10.1080/14703297.2023.2195846	395	197.50	61.09
CROMPTON H, 2023, INT J EDUC TECHNOL HIGH EDUC	10.1186/s41239-023-00392-8	338	112.67	10.35
RASCHKA S, 2020, INFORMATION	10.3390/info11040193	310	51.67	9.07
MEMON J, 2020, IEEE ACCESS	10.1109/ACCESS.2020.3012542	309	51.50	9.04
ADIGUZEL T, 2023, CONTEMP EDU TECH	10.30935/cedtech/13152	306	102.00	9.37
KOCOŃ J, 2023, INF FUSION	10.1016/j.inffus.2023.101861	305	101.67	9.34
QIU S, 2019, APPL SCI	10.3390/app9050909	284	40.57	7.70
JAVAID M, 2023, BENCHCOUNC TRANS BENCHMARKS, STAND EVALUATION	10.1016/j.tbench.2023.100115	231	77.00	7.07

MEYER JG, 2023, BIODATA MIN	10.1186/s13040-023-00339-9	214	71.33	6.55
SCHWALLER P, 2021, MACH LEARN: SCI TECHNOL	10.1088/2632-2153/abc81d	202	40.40	9.72
RAMESH D, 2022, ARTIF INTELL REV	10.1007/s10462-021-10068-2	193	48.25	10.24
KWABENA PATRICK M, 2022, J KING SAUD UNIV - COMPUT INFORM SCI	10.1016/j.jksuci.2019.09.014	189	47.25	10.03
WARDAT Y, 2023, EURASIA J TYPE SCI TECHNOL EDUC	10.29333/ejmste/13272	161	53.67	4.93
BECKER BA, 2023, SIGCSE - PROC ACM TECH SYMP COMPUT SCI EDUC	10.1145/3545945.3569759	152	50.67	4.65
San V, 2019, Ai Conf Artip Intel, Ai, Innov Apple Artip Eigens Conf, Ee Ai Chimp Eduk ATV RTP Intel, Hey	10.1609/aaai.v33i01.3301 6949	152	21.71	4.12
ARGYLE LP, 2023, POLIT ANAL	10.1017/pan.2023.2	147	49.00	4.50
DENNY P, 2023, SIGCSE - PROC ACM TECH SYMP COMPUT SCI EDUC	10.1145/3545945.3569823	139	46.33	4.26
TAKAGI S, 2023, JMIR MED EDUC	10.2196/48002	116	38.67	3.55

Source: author using R software based on information from Scopus (2025).

Analysis of relationships and co-occurrences

Finally, as illustrated in Figure 7, the comprehensive cluster analysis carried out using VOS VIEWER clearly identifies the phrases with the greatest influence arranged by their co-occurrence. Keywords that are very relevant to the topic, such as "natural language processing," "language model," "artificial intelligence," and "deep learning," are visible in this analysis.

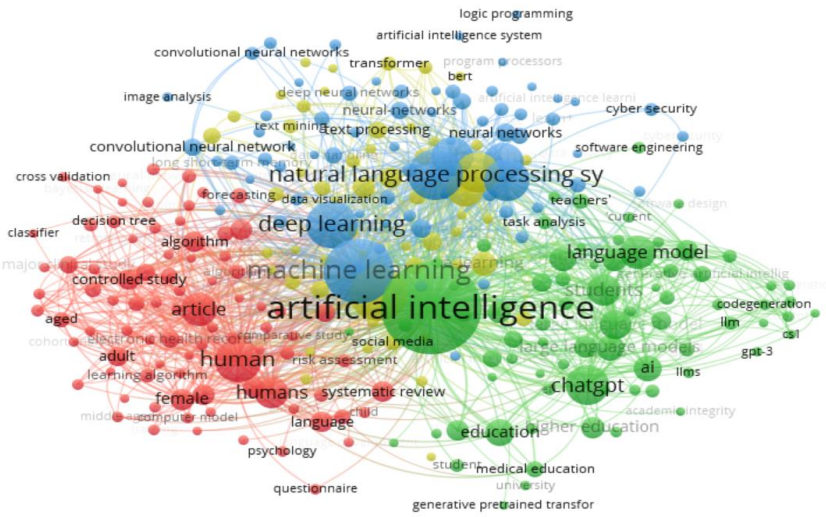

Fig. 7. Co-occurrence of keywords, source: author based on information from Scopus (2025).

4 Discussion

The findings of this bibliometric analysis show that research on artificial intelligence (AI)-based language learning systems has significantly increased. This increase, which has grown at a rate of 67.79% in recent years, demonstrates the growing interest in creating and comprehending AI-driven instructional systems. The steady rise in publications, especially in 2024 (266 documents), 2023 (195), and 2022 (115), is indicative of the rising need for machine learning, individualized learning, and improved student participation in intelligent language learning technologies.

Only 0.6% of authors produced three or more papers, compared to 94.8% who contributed only one, demonstrating the very dispersed nature of scholarly activity in this discipline. This implies that the majority of contributions are discrete endeavors, which restricts the creation of long-term theoretical frameworks. Important researchers like DENNY P (7 publications), LIU X (5), and WANG L (5) have become prominent names in spite of this fragmentation, suggesting that a small number of academics are spearheading ongoing research in the subject.

IEEE ACCESS (36 articles), APPLIED SCIENCES (SWITZERLAND) (14), and PROCEDIA COMPUTER SCIENCE (13) are the top journals in terms of publishing sources. These resources, which combine knowledge from computer science, linguistics, and education, demonstrate the multidisciplinary character of AI-based language learning . This distribution shows how the field is becoming more and more relevant in a variety of fields.

In terms of research production, the United States leads with 647 documents, followed by China with 276 and Italy with 168. These regions' dominance demonstrates their robust technological infrastructure and significant investment in AI research. The dearth of noteworthy contributions from underdeveloped nations, however, points to possible limitations in educational materials and access to AI technologies. To ensure the global applicability, research activities must be expanded to encompass more varied educational systems.

The increasing impact of important academic centers is also reflected in institutional contributions. Important contributors to this field include WROCŁAW UNIVERSITY OF SCIENCE AND TECHNOLOGY (20), SOUTHERN MEDICAL UNIVERSITY (20), and KING ABDULAZIZ UNIVERSITY (24 publications). Their participation highlights the growing amount of money being invested in developing AI-driven educational models by global organizations.

Important studies like FARROKHNIA M (2024) in Innov Educ Teach Int (395 citations), DAVE T (2023) in Frontier Artif Intell (556 citations), and GILSON A (2023) in JMIR Med Educ (968 citations) are highlighted in the citation analysis. These widely cited works show how AI applications in language learning are becoming more widely acknowledged for their ability to enhance language engagement, understanding, and acquisition.

Some research issues including "natural language processing," "language model," "artificial intelligence," and "deep learning" are also revealed by co-occurrence analysis. These keywords draw attention to the increasing interest in AI-powered language processing models and their potential to enhance content delivery and customize learning experiences.

Even though this field is growing quickly, a number of obstacles still exist. The high proportion of one-time contributors suggests that scholars have not been actively involved in the subject for very long, which could jeopardize its theoretical coherence. Furthermore, the geographic focus of research emphasizes the necessity of more extensive international cooperation to guarantee that these technologies can be adapted to other educational systems.

To guarantee that AI-based language learning tools successfully meet the changing needs of learners globally, future research should concentrate on bolstering longitudinal studies, fostering cross-disciplinary collaboration, and encouraging global involvement..

5 Conclusions

With 686 publications from 379 sources and a noteworthy 67.79% growth rate in recent years, this bibliometric analysis demonstrates the increasing scholarly interest in AI-based language learning technologies. Peak publication years 2024 (266 documents), 2023 (195), and 2022 (115) attest to the growing popularity of AI-driven language tools as educational institutions embrace digital advances to improve language learning. This upward trend is a reflection of the growing use of AI tools to enhance language learning and engagement, including deep learning, natural language processing, and adaptive learning systems.

94.8% of authors only contributed one paper, and only 0.6% contributed three or more, indicating that the field has dispersed authorship patterns despite these advancements. The creation of thorough frameworks and best practices may be hampered by the absence of constant engagement from a larger research community, even if important scholars like DENNY P (7 publications), LIU X (5), and WANG L (5) have emerged as consistent contributors. To advance this discipline, it will be essential to support researchers' ongoing participation and create cooperative research networks.

The most well-known publication sources, IEEE ACCESS (36 publications), APPLIED SCIENCES (SWITZERLAND) (14), and PROCEDIA COMPUTER SCIENCE (13) — demonstrate the multidisciplinary nature of the discipline by combining knowledge from educational philosophy, computer science, and languages. The continuous development of AI-powered solutions intended to improve educational outcomes and individualized language learning experiences is reflected in this diversity of information.

Geographically speaking, the field is dominated by the United States (647 documents), China (276), and Italy (168), highlighting the role that highly developed countries play in fostering innovation. But this focus also highlights research gaps in areas where contributions are still scarce, such Latin America, Africa, and portions of Europe. In order to guarantee that AI-based language learning solutions are inclusive, flexible, and culturally appropriate for educational settings, research efforts should be expanded to include underrepresented regions.

The field's body of knowledge has grown significantly thanks to institutional contributions from universities including WROCŁAW UNIVERSITY OF SCIENCE AND TECHNOLOGY (20), SOUTHERN MEDICAL UNIVERSITY (20), and KING ABDULAZIZ UNIVERSITY (24 publications). Nonetheless, the dominance of particular institutions highlights the necessity of more extensive scholarly cooperation to support global initiatives in AI language instruction.

Citation analysis highlights important works including FARROKHNIA M (2024) with 395 citations, DAVE T (2023) with 556 citations, and GILSON A (2023) with 968 citations, so stressing the need of research combining artificial intelligence (AI) models, natural language processing systems, and adaptive learning strategies. These pieces have shaped academic debates and provided significant fresh ideas on how artificial intelligence may improve tailored learning routes, language comprehension, and communication skills.

Many challenges still persist even although research on AI-based language learning systems is expanding greatly. Although a lack of consistent study involvement may hinder the development of effective methods, the predominance of short-term studies limits knowledge on long-term learning results and student retention. Future research should mostly be focused on longitudinal studies to assess how long-term consequences of artificial intelligence-driven technologies affect cognitive development, linguistic proficiency, and student performance. Moreover, promoting multidisciplinary interaction among linguists, IT businesses, and academic institutions would result in innovative ideas that effectively satisfy many learning needs.

In essence, further study is required to grasp the full potential of AI-based language learning tools even if they indicate a great lot of possibilities to transform education. Global engagement, higher empirical validation, and support of inclusive research methods will be absolutely vital to ensure that these

technologies enhance language learning opportunities on a more extensive level. If these problems are addressed, AI-driven language tools might be a great weapon for advancing lifetime learning, improved communication skills, and academic performance.

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