# BUKTI KORESPONDENSI ARTIKEL PADA JURNAL NASIONAL TERAKREDITASI SINTA



PENGUSUL PUTRI KHOIRIN NASHIROH, S.Pd., M.Pd. NIP. 199009102018032001 NIDN. 0010099002

UNIVERSITAS NEGERI SEMARANG

2024

# Yth. Penilai pada usulan PAK

Bersama dengan surat ini, saya bermaksud menyertakan bukti-bukti korespondensi proses publikasi artikel pada Jurnal Nasional Terakreditasi Sinta 3 dengan judul "Bibliometric analysis: Learning using generative AI", yang dimuat pada Journal of Research in Instructional, edisi Vol. 4 No. 1, terbit pada 3 Juni 2024, ISSN: 2776-222X, hal: 194-204.

Adapun kronologi korespondensi terdiri dari beberapa poin proses editorial yang terekam melalui OJS jurnal, yang tersusun dalam tabel berikut ini.

No	Tanggal	Aktivitas
1.	4 Mei 2024	Submit artikel pada Journal of Research in Instructional
2.	17 Mei 2024	Artikel masuk pada tahap review
3.	30 Mei 2024	Revisi artikel
4.	1 Juni 2024	Artikel diterima
5.	3 Juni 2024	Copyediting dan Uji Plagiasi
6.	3 Juni 2024	Penerbitan Artikel

Demikian kronologi korespondensi ini agar dapat menjadi periksa. Terimakasih.

Semarang, 14 Juni 2024

Hormat saya,

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Putri Khoirin Nashiroh, S.Pd., M.Pd.

### Lampiran 1. Informasi Artikel pada Jurnal

Judul	: Bibliometric analysis: Learning using generative AI
Penulis	: Putri Khoirin Nashiroh, Ranu Iskandar
Jurnal	: Journal of Research in Instructional
Volume	: 4
Nomor	:1
Edisi Terbitan	: Juni (mulai terbit 1 Januari – 30 Juni setiap tahun)
Tanggal Terbit Artikel	: 3 Juni 2024
Halaman	: 194 – 204
Link Artikel	: https://jurnal.unipa.ac.id/index.php/jri/article/view/392
e-ISSN	: 2776-222X
Penerbit	: Universitas Papua
Akreditasi Jurnal	: Sinta 3
Laman Informasi Juri	nal



# Informasi Frekuensi Terbitan



# Informasi SINTA Jurnal

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# Sertifikat Akreditasi Jurnal



### Daftar Artikel edisi Juni

#### **Current Issue**

#### Vol. 4 No. 1 (2024): Journal of Research in Instructional

#### Issues in progress

Authored/co-authored countries: Indonesia (=), Malaysia (=), Nepal ()

Published: 2024-01-04

Articles

Promoting harmony and renewal: The transformation of peace education within the islamic education curriculum

Lalu Gede Muhammad Zainuddin Atsani, Prosmala Hadisaputra

DF (ENGLISH)

Strategy for improving teacher pedagogic competence through ummi method certification at SD Islam Al Alifah Palembang

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1. Tahap Submission (Submit Artikel – 4 dan 5 Mei 2024)

2. Tahap Review Artikel dan Revisi Artikel (17 Mei 2024)

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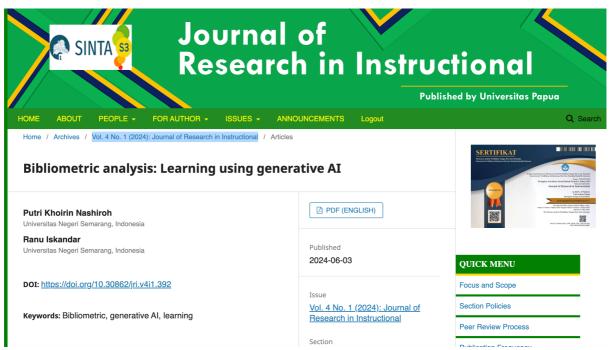
3. Tahap Copyediting dan Uji Plagiasi menggunakan Turnitin (3 Juni 2024)

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4. Tahap Publication (3 Juni 2024)

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5. Laman Artikel yang Terbit dan Tanggal Terbit (3 Juni 2024)



#### Bibliometric analysis: learning using generative ai research trends

xx-xx-xxxx Accepted: xx-xx-xxxx

Published:

XX-XX-XXXX

Submitted:

and 4) analyze the relationship between authors. Bibliometric analysis was used to help researchers study bibliographic content and citation analysis of each article taken from Harzing's Publish or Perish (PoP) 8 database. The data was taken from Scopus January 2018-2024 entitled, "learning using generative AI" in English. The maximum number of articles accessed is 500 articles. The collected articles are stored in CSV and RIS format. Articles were filtered according to analysis needs using MS Excel and VOSViewer. Twenty-nine documents from the Scopus database have been used in this research. The results show that 1) in 2022, there was one manuscript; in 2023, there were 27 manuscripts; and in 2024, there was one manuscript published. There are ten manuscripts published in conference proceedings, 14 articles in journals, and five manuscripts in edited books; 2) Suh, Popenici, Crosthwaite, Kim, and Chan wrote the 5 most cited articles; 3) Future research topics include GPT, student agency, learning approaches, higher education, state-of-the-art, reinforcement learning, opportunities, and challenges. Potential future research (novelty) could use keywords that are not yet widely used, including pedagogy, simulations, Socratic tutors, teaching methods, neuro-inclusive learning, and metacognition; 4) a network of writers outside the group consisting of Han, Ariel; Leu, U; Leu, Eunso; Lim, Cheoil; Kim, Hyeoncheol;

Lee, Jeongji; Kim, Jiwon is the cluster with the highest relationship between nodes.

Abstract: This research aims to 1) analyze the number of articles per year and their types,

2) analyze the five articles with the most citations, 3) analyze keywords in the data collected,

Keywords: bibliometric, generative ai, learning

Abstrak: Penelitian ini bertujuan untuk 1) menganalisis jumlah artikel per tahun dan jenisnya, 2) menganalisis lima artikel dengan kutipan terbanyak, 3) menganalisis kata kunci dalam data yang dikumpulkan, dan 4) menganalisis hubungan antar penulis. Analisis bibliometrik digunakan untuk membantu peneliti mempelajari isi bibliografi dan analisis sitasi setiap artikel yang diambil dari database Harzing's Publish or Perish (PoP) 8. Data diambil dari Scopus Januari 2018-2024 yang berjudul "learning using generative Al" dalam bahasa Inggris. Jumlah artikel yang diakses maksimal 500 artikel. Artikel yang dikumpulkan disimpan dalam format CSV dan RIS. Artikel disaring sesuai kebutuhan analisis menggunakan MS Excel dan VOSViewer. Dua puluh sembilan dokumen dari database Scopus telah digunakan dalam penelitian ini. Hasil penelitian menunjukkan bahwa 1) pada tahun 2022 terdapat satu naskah; pada tahun 2023 berjumlah 27 naskah; dan pada tahun 2024, terdapat satu naskah yang diterbitkan. Terdapat sepuluh manuskrip yang diterbitkan dalam prosiding konferensi, 14 artikel di jurnal, dan lima manuskrip dalam buku yang telah diedit; Suh, Popenici, Crosthwaite, Kim, dan Chan menulis 5 artikel yang paling banyak dikutip;
 Topik penelitian masa depan meliputi GPT, keagenan mahasiswa, pendekatan pembelajaran, pendidikan tinggi, kecanggihan, pembelajaran penguatan, peluang, dan tantangan. Potensi penelitian kebaruan dapat menggunakan kata kunci yang belum banyak digunakan, termasuk pedagogi, simulasi, tutor socrates, metode pengajaran, pembelajaran neuro-inklusif, dan metakognisi; 4) jaringan penulis di luar kelompok yang terdiri dari Han, Ariel; Leu, kamu; Leu, Eunso; Lim, Cheoil; Kim, Hyeoncheol; Lee, Jeongji; Kim, Jiwon adalah cluster dengan hubungan antar node tertinggi

Kata kunci: bibliometrik, generative ai, pembelajaran

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#### **INTRODUCTION**

The Industrial Revolution (IR) progresses faster in each era, starting from 0.0 to 5.0. Before 1760, people thought traditionally of agricultural triggers for survival. In 1760-1830, society entered IR 1.0, where steam engines and water power mechanism systems emerged, resulting in the emergence of textile, iron, steel, and transportation industries. Starting in the 1870s, society entered IR 2.0, where electrical technologies emerged and the Title Author

mechanization of iron and steel mass production systems, car industries, and the discovery of oil refineries to replace coal. In the 1970s, IR 3.0 began to enter, where computers, cellphones, and the internet appeared and entered industries. From 2010 until now, we entered IR 4.0, where robot technologies, chatbot artificial intelligence (AI), and the Internet of Things (IoT) emerged (Maghfiroh & Iskandar, 2023). We are currently transitioning towards IR 5.0, where AI and robots are here to work together with humans. It encourages efficiency and productivity by utilizing technology utilized by human intelligence (Ikhsan, 2023; Restendy et al., 2021; Siagian, 2023; The Editors of Encyclopaedia Britannica, 2023).

The increasingly rapid shift in the industrial revolution means that all sectors, including education, must adapt. If RI 4.0, education 4.0 emerges as the education sector's answer to adapting, then when RI 5.0, education 5.0 will appear (Iskandar, 2024). Education 5.0 is the integration of AI and IoT in the education sector.

Artificial intelligence (AI) is a computer program that works like human intelligence to carry out tasks and solve problems. AI was introduced by John McCarthy at a summer conference at Dartmouth College in 1956. AI branches include machine learning, deep learning, natural language processing, and computer vision.

Generative AI is machine learning capable of producing new content such as text written in natural language, images (including photos, digital paintings, and cartoons), videos, music, and software code in response to commands written in natural-language conversational interfaces (Google, n.d.; UNESCO, 2023).

Text generative AI uses a type of ANN known as a general-purpose transformer and a large language model. Text GenAI is often referred to as large language modeling or LLM. The type of LLM used by Text GenAI is known as a generative pre-trained transformer (UNESCO, 2023). An example is chatGPT (chat.openai.com). ChatGPT can answer all questions in the form of text prompts, carry out conversations, and check the similarity of writing (Maghfiroh & Iskandar, 2023). In its development, various alternatives to chatGPT emerged, including Alpaca, Bard, Chatsonic, Ernie, Hugging Chat, Perplexity, Jasper, Llama, Open Assistant, Tongyi Qianwen, YouChat, ChatPDF, and Elicit. In the development of chatGPT, chatGPT 4 can use image generative AI as a prompt.

Image generative AI and music generative AI use an ANN generative adversarial network (GAN) that can also be combined with variational autoencoders (UNESCO, 2023). Examples of Image-generative AI are Craiyon, DALL E 2, DreamStudio, Fotor, Midjourney, NightCafe, and Photosonic. Examples of Music generative AI are Aiva, Boomy, Soundraw, and Voicemod. Examples of AI generative videos are Elai, which can convert PPT, websites, and text into video; GliaCloud, which can produce videos from statistical data, live sports events, and social media posts; Pictory, which can make videos from long-form content; Runway, which is capable of sorting videos and images as well as editing.

Many publications discuss vocational learning with generative AI. Various articles can be accessed via Google Scholar or directly on the Google search engine. Several previous publications have conducted research on learning with generative AI in vocational schools, such as that undertaken by Rahman, Sembiring, Aulia, Dafitri, & Liza (2023) entitled, "Pengenalan ChatGPT untuk Meningkatkan Pengetahuan Siswa-Siswi di SMK Negeri 1 Pantai Labu", Sakti et al. (2023) entitled, Membangun Motivasi Siswa dengan Literasi Digital Menggunakan Chat GPT", dan Sari, Maryaningsih, & Asnawati (2023) entitled, "Pemanfaatan Kecerdasan Buatan dalam Pembelajaran di Sekolah Menengah Kejuruan (SMK) Negeri 2 Commented [..1]: Tahun?

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Title Author

Bengkulu Utara". Although many authors have published publications related to learning with generative AI, until now, no one has carried out mapping using bibliometric analysis of related publications indexed by Scopus with the help of VOSviewer.

Based on the problem above, the objectives of this research are 1) analyzing the number of articles per year and their types, 2) analyzing the five articles with the most citations, 3) analyzing keywords in the data collected, and 4) analyzing the relationship between authors.

#### **METHOD**

Analysis is part of the research evaluation method and from the various literature that has been produced, it is possible to carry out bibliometric analysis using its method (Ellegaard & Wallin, 2015). The method used was bibliometric analysis to help researchers in studying bibliographic content and citation analysis of each article taken from the Harzing's Publish or Perish (PoP) 8 database. The data was taken from Scopus January 2018-2024 with the title, "Learning using generative AI" in English. The maximum number of articles accessed is 500 articles. The collected articles are stored in CSV and RIS format. Articles filtered according to analysis needs. VOSviewer 1.6.18 can visualize predefined article searches; the steps can be summarized as follows: determine search keywords, perform article search, filter and process search result data according to needs, collect and compile statistical data on search results, as well as conduct bibliometric analysis (Iskandar, 2023).

#### **RESULTS AND DISCUSSION**

Forty-four manuscripts and 72 citations were harvested using PoP 8 software until early 2024. The data were saved in CSV format for Microsoft Excel and RIS format for VOSviewer software.

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Figure 1. Manuscript Harvest Results Using PoP

Asatiza: Jurnal Pendidikan Vol. x No. x (2021)

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# Journal of Research in Instructional

e-ISSN: 2776-222X Vol. 4(1) 2024, pp. 1 – 17 https://doi.org/10.30862/jri.v4i1.277

CSV file on Ms. Excel and RIS files in Mendeley were selected one by one to see whether the content matches the title learning using generative AI. If something does not match the title, the data is deleted. Of the 44 existing manuscripts, 29 manuscripts were found that matched the title. In Mendeley, the 29 manuscripts were completed with the contents by writing down all the authors and entering author keywords.

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urova, M. haran, Shanti		•	Kim, B	ChatGPT and Generative AI Tools for Learning and Research	2023	Computers in Libraries	Mer 26	Type of Work:
isouky, I. guson, Rebecca		•	Stone, I	Exploring the Research Gap: Generative AI and Learning of Python Programming among Post-Primary Students	2023	ACM International Conference Pro	Mar 26	
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#### Figure 2. RIS File Opened in Mendeley

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	0 M Behfar, M Khanmi	o Financial literacy, disor	dered money behaviora	in the context fina	ancial therapy conce	opts	2023	Journal	of Finance &	ijfma.srbiau.ac.ir	https:/	/ijfma.srb	iau.	757
	1 M Jain	A Study of Financial Lite	aracy Level towards Elect	ronic Banking Amo	ongst Youth		2023	Journal of	Corporate Fin	hmjournals.com	http://	hm https:/	//sc	742
	0 WM Siregar, R Yuliar	A Study of Financial Lite	eracy among Millennials	during COVID-19 P	andemic to Reduce	Pover	2023	Journal	of Advances in	journal.smintellectual	co https:/	/journal.s	min	813
	0 DS Jyothi Acharya, P	S A Study on Financial Lit	eracy and Investment Be	haviour of Teacher	rs		2023	Journal of	Survey in	sifisheriessciences.com	n http://	sifisherie	sscie	842
		A bibliometric analysis					2023	American	Journal of Bus	emerald.com	https:/	/w https:/	//sc	769
	0 K Hainzer, C Gard, C	CA design approach for f	inancial literacy curriculi	m targeting smallh	holders in Papua Ne	w Guir	2023	of Lifeld	ong Education	Taylor & Francis	https:/	/www.tar	ofb	637
	0 J Torma, D Barbić, M	ANALYZING THE EFFECT	S OF FINANCIAL EDUCAT	ON ON FINANCIAL	LUTERACY AND FIN	ANCIA	2023	South E	ast European J	journal.efsa.unsa.ba	http://	iournal.ef	sa.u	103
	0 M Kapenda	An Analysis of Personal	Financial Literacy amon	Teachers in Secor	ndary Schools		2023	Internatio	nal Journal of	ideas.repec.org	https:/	/ideas.rec	ec.	632
0	0 MD Kaur, P Vilay	An Empirical Study of F	inancial Literacy among t	, chool Students In I	(National Capital Te	rritory	2023	Journal of	Pharmaceutic	pnriournal.com	https:/	/www.pn	riou	278
	0 NA Sharfina, C Pahle	Analysis Of The Influen	ce Of Financial Literacy A	nd Digital Literacy	Of The Community	On Srr	2023	Journal	of	e-journal.citakonsultin	do https:/	/e-iourna	l,cit	773
2	0 W Guan, H Zhang		us and Strategies to Enh				2023	Journal of	Human Resou	clausiuspress.com	https:/	/www.da	usic	259
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Figure 3. The CSV File Opened in MS Excel

The data in Excel was filtered in tables. The table title "year" was used to group the year the manuscript was published. Type headings were used to group publication types. The results of grouping publication years showed that in 2018-2021, there were no manuscripts published; in 2022, there was one manuscript; in 2023, there were 27 manuscripts published; and in 2024, there was one manuscript published. The results of

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grouping the forms of published manuscripts show that ten manuscripts were published in conference proceedings, 14 articles in journals, and five manuscripts in edited books.

		Table 1. The Top 5	Manusci	ripts	
Cites	Authors	Titles	Years	Sources	Publishers
8	Suh, S. & An, P.	Leveraging Generative Conversational AI to Develop a Creative Learning Environment for Computational Thinking	2022	International Conference on Intelligent User Interfaces, Proceedings IUI	АСМ
7	Popenici, S., Rudolph, J., Tan, S., & Tan, S.	A critical perspective on generative AI and learning futures. An interview with Stefan Popenici	2023	Journal of Applied Learning and Teaching	Simon Fraser University
5	Crosthwaite, P. & Baisa, V.	Generative AI and the end of corpus-assisted data- driven learning? Not so fast!	2023	Applied Corpus Linguistics	Science Direct, Elsevier B.V.
3	Kim, B.	ChatGPT and Generative AI Tools for Learning and Research	2023	Computers in Libraries	Information Today, Inc.
2	Chan, C.K.Y & Lee, K. K. W.	The AI generation gap: Are Gen Z students more interested in adopting generative AI such as ChatGPT in teaching and learning than their Gen X and millennial generation teachers?	2023	Smart Learning Environments	Springer Nature

From the data above, it can be seen that 80% of the articles cited came from journals, while the rest came from conference proceedings. However, articles published in conference proceedings had the highest number of citations, with eight citations. The article was written by Suh & An (2022). This article can be accessed at the ACM Digital Library. This is because articles published in conference proceedings are open access, whereas, in journals, there is usually a fee to access them (AlRyalat et al., 2019; Pranckutė, 2021).

The edited RIS data was then opened using VosViewer. The analysis used in VosViewer was based on keywords and authors. The analysis procedure was to click "create," and then a popup appears to select the type of data. Click "Create a map based on bibliographic data" and click "Next." Then, a pop-up would appear to choose the data source. Clicked "read data from reference management files" and click "Next." Then, a pop-up would appear to select the file. Clicked ris and select the ris file that has been edited using Mendeley, then click "next." Then, a pop-up would appear to choose the type of analysis and counting method. There are two types of analysis methods, namely Co-authorship and Co-occurrence. Co-authorship is used to analyze authors writing in the same network, whether directly or indirectly. Co-occurrence is used to analyze keywords (University of Illinois

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Chicago, 2023). Choose one analysis method. When you have finished visualizing the data, choose another analysis method. In the counting method, select full counting and click "next." Then, a pop-up would appear to select the threshold. Wrote the number 1 so that all authors or keywords appear in the visualization, then click "next." Wrote down the number of all authors or keywords and clicked "finish."

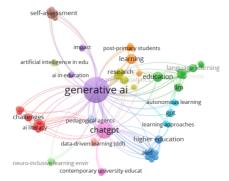


Figure 4. Network Visualization of Co-occurrence

Co-occurrence analysis displays network visualization between keywords. The larger the node, the greater the number of keywords that appear (Zakaria et al., 2022). Edge connects between nodes and the strength of the relationship. The closer the distance between one node and another node is, the higher the relationship between the nodes is (Aribowo, 2019). Figure 4 shows a network visualization of co-occurrence. The keyword that appears most often is generative AI. Colored nodes indicate how many clusters there are. There are 13 clusters in the network visualization of co-occurrence. Cluster 1-8 is the dominant cluster because the keywords appear a lot, while cluster 9-1 is the dominant cluster because the keywords rarely appear.

	Table 2. Keywords of Cluster 1-8
Clusters	Keywords
1 (red)	Advantages, AI literacy, benefits, challenges, competencies, holistic,
	opportunities, reinforcement learning, risks, state-of-the-art
2 (green)	auto-generated course units, bias, diffusion model, education, equality,
	generative AI models, language learning, LLM, personalized learning
3 (blue)	Aided, algorithmic bias, artificial intelligence (AI), big tech, education
	technology, fascism, higher education, superintelligence
4 (yellow)	Editorial, genai, learning analytics, practice, research, user-centered
	research
5 (purple)	AI in education, ai-generated learning content, impact
6 (arctic)	Autonomous learning, Flipped classroom, GPT, learning approaches,
	student agency.
7 (orange)	Learning, new literacies, post-primary students, python programming
8 (grape)	Chatbot, gpt-4, quizizz ai, self assessment

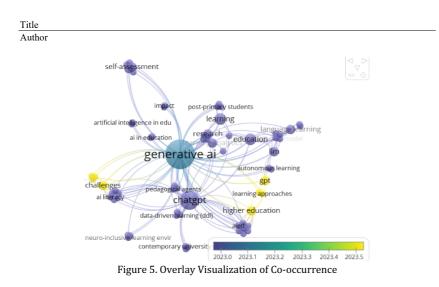


Figure 5 displays an overlay visualization of co-occurrence. This figure displays future research trends. The bluer the node, the earlier the year of publication; conversely, the more recent the publication, the yellower the node. Future research topics include GPT, student agency, learning approaches, higher education, state-of-the-art, reinforcement learning, opportunities, and challenges.

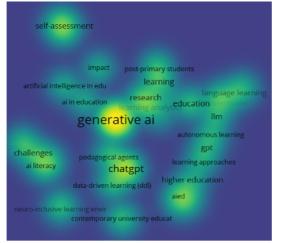


Figure 6. Density Visualization of Co-occurrence

Figure 5 displays a density visualization of co-occurrence. This image is a topic that still needs to be used regarding generative AI. Hotspots on the map that are increasingly yellow indicate that more keywords are being used, while the darker the color, the more research using these keywords is rarely carried out (Soesanto & Handalani, 2023). Potential

future research could use keywords that have yet to be widely used, including pedagogy, simulations, Socratic tutors, teaching methods, neuro-inclusive learning, and metacognition.

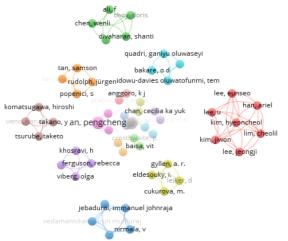


Figure 7. Network Visualization of Co-authorship

Co-authorship analysis to see author networks. In this study, 65 authors from 29 manuscripts met the requirements for analysis. Which means there are 2.24 authors per manuscript. Data visualization shows that cluster 1 has a network of writers outside the group consisting of Han, Ariel; Leu, U; Leu, Eunso; Lim, Cheoil; Kim, Hyeoncheol; Lee, Jeongji; Kim, Jiwon is the cluster with the highest relationship between nodes. Other authors collaborate with teammates or even research individually.

#### CONCLUSION

The development of learning using generative AI research in the last five years has been analyzed using bibliometric methods. In 2022, there was one manuscript; in 2023, there were 27 manuscripts; and in 2024, there was one manuscript published. There are ten manuscripts published in conference proceedings, 14 articles in journals, and five manuscripts in edited books. Suh, Popenici, Crosthwaite, Kim, and Chan wrote the 5 most cited articles. Future research topics include GPT, student agency, learning approaches, higher education, state-of-the-art, reinforcement learning, opportunities, and challenges. Potential future research (novelty) could use keywords that are not yet widely used, including pedagogy, simulations, socratic tutors, teaching methods, neuro-inclusive learning, and metacognition. a network of writers outside the group consisting of Han, Ariel; Leu, U; Leu, Eunso; Lim, Cheoil; Kim, Hyeoncheol; Lee, Jeongji; Kim, Jiwon is the cluster with the highest relationship between nodes.

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#### Bibliometric analysis: learning using generative ai research trends

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Published: xx-xx-xxxx Abstract: This research aims to 1) analyze the number of articles per year and their types, 2) analyze the five articles with the most citations, 3) analyze keywords in the data collected, and 4) analyze the relationship between authors. Bibliometric analysis was used to help researchers study bibliographic content and citation analysis of each article taken from Harzing's Publish or Perish (PoP) 8 database. The data was taken from Scopus January 2018-2024 entitled, "learning using generative AI" in English. The maximum number of articles accessed is 500 articles. The collected articles are stored in CSV and RIS format. Articles were filtered according to analysis needs using MS Excel and VOSViewer. Twenty-nine documents from the Scopus database have been used in this research. The results show that 1) in 2022, there was one manuscript; in 2023, there were 27 manuscripts; and in 2024, there was one manuscript published. There are ten manuscripts published in conference proceedings, 14 articles in journals, and five manuscripts in edited books; 2) Suh, Popenici, Crosthwaite, Kim, and Chan wrote the 5 most cited articles; 3) Future research topics include GPT, student agency, learning approaches, higher education, state-of-the-art, reinforcement learning, opportunities, and challenges. Potential future research (novelty) could use keywords that are not yet widely used, including pedagogy, simulations, Socratic tutors, teaching methods, neuro-inclusive learning, and metacognition; 4) a network of writers outside the group consisting of Han, Ariel; Leu, U; Leu, Eunso; Lim, Cheoil; Kim, Hyeoncheol; Lee, Jeongji; Kim, Jiwon is the cluster with the highest relationship between nodes.

Keywords: bibliometric, generative ai, learning

Abstrak: Penelitian ini bertujuan untuk 1) menganalisis jumlah artikel per tahun dan jenisnya, 2) menganalisis lima artikel dengan kutipan terbanyak, 3) menganalisis kata kunci dalam data yang dikumpulkan, dan 4) menganalisis hubungan antar penulis. Analisis bibliometrik digunakan untuk membantu peneliti mempelajari isi bibliografi dan analisis sitasi setiap artikel yang diambil dari database Harzing's Publish or Perish (PoP) 8. Data diambil dari Scopus Januari 2018-2024 yang berjudul "learning using generative Al" dalam bahasa Inggris. Jumlah artikel yang diakses maksimal 500 artikel. Artikel yang dikumpulkan disimpan dalam format CSV dan RIS. Artikel disaring sesuai kebutuhan analisis menggunakan MS Excel dan VOSViewer. Dua puluh sembilan dokumen dari database Scopus telah digunakan dalam penelitian ini. Hasil penelitian menunjukkan bahwa 1) pada tahun 2022 terdapat satu naskah; pada tahun 2023 berjumlah 27 naskah; dan pada tahun 2024, terdapat satu naskah yang diterbitkan. Terdapat sepuluh manuskrip yang diterbitkan dalam prosiding konferensi, 14 artikel di jurnal, dan lima manuskrip dalam buku yang telah diedit; Suh, Popenici, Crosthwaite, Kim, dan Chan menulis 5 artikel yang paling banyak dikutip;
 Topik penelitian masa depan meliputi GPT, keagenan mahasiswa, pendekatan pembelajaran, pendidikan tinggi, kecanggihan, pembelajaran penguatan, peluang, dan tantangan. Potensi penelitian kebaruan dapat menggunakan kata kunci yang belum banyak digunakan, termasuk pedagogi, simulasi, tutor socrates, metode pengajaran, pembelajaran neuro-inklusif, dan metakognisi; 4) jaringan penulis di luar kelompok yang terdiri dari Han, Ariel; Leu, kamu; Leu, Eunso; Lim, Cheoil; Kim, Hyeoncheol; Lee, Jeongji; Kim, Jiwon adalah cluster dengan hubungan antar node tertinggi

Kata kunci: bibliometrik, generative ai, pembelajaran

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#### INTRODUCTION

The Industrial Revolution (IR) progresses faster in each era, starting from 0.0 to 5.0. Before 1760, people thought traditionally of agricultural triggers for survival. In 1760-1830, society entered IR 1.0, where steam engines and water power mechanism systems emerged, resulting in the emergence of textile, iron, steel, and transportation industries. Starting in the 1870s, society entered IR 2.0, where electrical technologies emerged and the **Commented** [..2]: Pendahuluan anda kurang kuat, Dasar untuk anda lakukan analisis bibliomterik kurang kuat. Teori-teori pendukung sangat lemah Title Author

mechanization of iron and steel mass production systems, car industries, and the discovery of oil refineries to replace coal. In the 1970s, IR 3.0 began to enter, where computers, cellphones, and the internet appeared and entered industries. From 2010 until now, we entered IR 4.0, where robot technologies, chatbot artificial intelligence (AI), and the Internet of Things (IoT) emerged (Maghfiroh & Iskandar, 2023). We are currently transitioning towards IR 5.0, where AI and robots are here to work together with humans. It encourages efficiency and productivity by utilizing technology utilized by human intelligence (Ikhsan, 2023; Restendy et al., 2021; Siagian, 2023; The Editors of Encyclopaedia Britannica, 2023).

The increasingly rapid shift in the industrial revolution means that all sectors, including education, must adapt. If RI 4.0, education 4.0 emerges as the education sector's answer to adapting, then when RI 5.0, education 5.0 will appear (Iskandar, 2024). Education 5.0 is the integration of AI and IoT in the education sector.

Artificial intelligence (AI) is a computer program that works like human intelligence to carry out tasks and solve problems. AI was introduced by John McCarthy at a summer conference at Dartmouth College in 1956. AI branches include machine learning, deep learning, natural language processing, and computer vision.

Generative AI is machine learning capable of producing new content such as text written in natural language, images (including photos, digital paintings, and cartoons), videos, music, and software code in response to commands written in natural-language conversational interfaces (Google, n.d.; UNESCO, 2023).

Text generative AI uses a type of ANN known as a general-purpose transformer and a large language model. Text GenAI is often referred to as large language modeling or LLM. The type of LLM used by Text GenAI is known as a generative pre-trained transformer (UNESCO, 2023). An example is chatGPT (chat.openai.com). ChatGPT can answer all questions in the form of text prompts, carry out conversations, and check the similarity of writing (Maghfiroh & Iskandar, 2023). In its development, various alternatives to chatGPT emerged, including Alpaca, Bard, Chatsonic, Ernie, Hugging Chat, Perplexity, Jasper, Llama, Open Assistant, Tongyi Qianwen, YouChat, ChatPDF, and Elicit. In the development of chatGPT, chatGPT 4 can use image generative AI as a prompt.

Image generative AI and music generative AI use an ANN generative adversarial network (GAN) that can also be combined with variational autoencoders (UNESCO, 2023). Examples of Image-generative AI are Craiyon, DALL E 2, DreamStudio, Fotor, Midjourney, NightCafe, and Photosonic. Examples of Music generative AI are Aiva, Boomy, Soundraw, and Voicemod. Examples of AI generative videos are Elai, which can convert PPT, websites, and text into video; GliaCloud, which can produce videos from statistical data, live sports events, and social media posts; Pictory, which can make videos from long-form content; Runway, which is capable of sorting videos and images as well as editing.

Many publications discuss vocational learning with generative AI. Various articles can be accessed via Google Scholar or directly on the Google search engine. Several previous publications have conducted research on learning with generative AI in vocational schools, such as that undertaken by Rahman, Sembiring, Aulia, Dafitri, & Liza (2023) entitled, "Pengenalan ChatGPT untuk Meningkatkan Pengetahuan Siswa-Siswi di SMK Negeri 1 Pantai Labu", Sakti et al. (2023) entitled, Membangun Motivasi Siswa dengan Literasi Digital Menggunakan Chat GPT", dan Sari, Maryaningsih, & Asnawati (2023) entitled, "Pemanfaatan Kecerdasan Buatan dalam Pembelajaran di Sekolah Menengah Kejuruan (SMK) Negeri 2 Commented [..3]: Menurut siapa?

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Bengkulu Utara". Although many authors have published publications related to learning with generative AI, until now, no one has carried out mapping using bibliometric analysis of related publications indexed by Scopus with the help of VOSviewer.

Based on the problem above, the objectives of this research are 1) analyzing the number of articles per year and their types, 2) analyzing the five articles with the most citations, 3) analyzing keywords in the data collected, and 4) analyzing the relationship between authors.

#### METHOD

Analysis is part of the research evaluation method and from the various literature that has been produced, it is possible to carry out bibliometric analysis using its method (Ellegaard & Wallin, 2015). The method used was bibliometric analysis to help researchers in studying bibliographic content and citation analysis of each article taken from the Harzing's Publish or Perish (PoP) 8 database. The data was taken from Scopus January 2018-2024 with the title, "Learning using generative AI" in English. The maximum number of articles accessed is 500 articles. The collected articles are stored in CSV and RIS format. Articles filtered according to analysis needs. VOSviewer 1.6.18 can visualize predefined article searches; the steps can be summarized as follows: determine search keywords, perform article search, filter and process search result data according to needs, collect and compile statistical data on search results, as well as conduct bibliometric analysis (Iskandar, 2023).

#### **RESULTS AND DISCUSSION**

Forty-four manuscripts and 72 citations were harvested using PoP 8 software until early 2024. The data were saved in CSV format for Microsoft Excel and RIS format for VOSviewer software.

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Figure 1. Manuscript Harvest Results Using PoP

Asatiza: Jurnal Pendidikan Vol. x No. x (2021)

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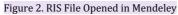
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# Journal of Research in Instructional

e-ISSN: 2776-222X Vol. 4(1) 2024, pp. 1 – 17 https://doi.org/10.30862/jri.v4i1.277

CSV file on Ms. Excel and RIS files in Mendeley were selected one by one to see whether the content matches the title learning using generative AI. If something does not match the title, the data is deleted. Of the 44 existing manuscripts, 29 manuscripts were found that matched the title. In Mendeley, the 29 manuscripts were completed with the contents by writing down all the authors and entering author keywords.

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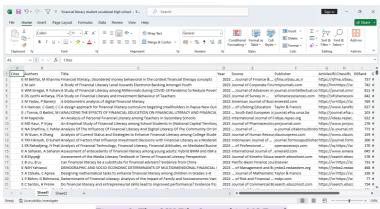


Figure 3. The CSV File Opened in MS Excel

The data in Excel was filtered in tables. The table title "year" was used to group the year the manuscript was published. Type headings were used to group publication types. The results of grouping publication years showed that in 2018-2021, there were no manuscripts published; in 2022, there was one manuscript; in 2023, there were 27 manuscripts published; and in 2024, there was one manuscript published. The results of

Title

#### Author

grouping the forms of published manuscripts show that ten manuscripts were published in conference proceedings, 14 articles in journals, and five manuscripts in edited books.

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		Table 1. The Top 5	Manusci	ripts	
Cites	Authors	Titles	Years	Sources	Publishers
8	Suh, S. & An, P.	Leveraging Generative Conversational AI to Develop a Creative Learning Environment for Computational Thinking	2022	International Conference on Intelligent User Interfaces, Proceedings IUI	АСМ
7	Popenici, S., Rudolph, J., Tan, S., & Tan, S.	A critical perspective on generative AI and learning futures. An interview with Stefan Popenici	2023	Journal of Applied Learning and Teaching	Simon Fraser University
5	Crosthwaite, P. & Baisa, V.	Generative AI and the end of corpus-assisted data- driven learning? Not so fast!	2023	Applied Corpus Linguistics	Science Direct, Elsevier B.V.
3	Kim, B.	ChatGPT and Generative AI Tools for Learning and Research The AI generation gap: Are	2023	Computers in Libraries	Information Today, Inc.
2	Chan, C.K.Y & Lee, K. K. W.	Gen Z students more interested in adopting generative AI such as ChatGPT in teaching and learning than their Gen X and millennial generation teachers?	2023	Smart Learning Environments	Springer Nature

From the data above, it can be seen that 80% of the articles cited came from journals, while the rest came from conference proceedings. However, articles published in conference proceedings had the highest number of citations, with eight citations. The article was written by Suh & An (2022). This article can be accessed at the ACM Digital Library. This is because articles published in conference proceedings are open access, whereas, in journals, there is usually a fee to access them (AlRyalat et al., 2019; Pranckutė, 2021).

The edited RIS data was then opened using VosViewer. The analysis used in VosViewer was based on keywords and authors. The analysis procedure was to click "create," and then a popup appears to select the type of data. Click "Create a map based on bibliographic data" and click "Next." Then, a pop-up would appear to choose the data source. Clicked "read data from reference management files" and click "Next." Then, a pop-up would appear to select the file. Clicked ris and select the ris file that has been edited using Mendeley, then click "next." Then, a pop-up would appear to choose the type of analysis and counting method. There are two types of analysis methods, namely Co-authorship and Co-occurrence. Co-authorship is used to analyze authors writing in the same network, whether directly or indirectly. Co-occurrence is used to analyze keywords (University of Illinois

Chicago, 2023). Choose one analysis method. When you have finished visualizing the data, choose another analysis method. In the counting method, select full counting and click "next." Then, a pop-up would appear to select the threshold. Wrote the number 1 so that all authors or keywords appear in the visualization, then click "next." Wrote down the number of all authors or keywords and clicked "finish."

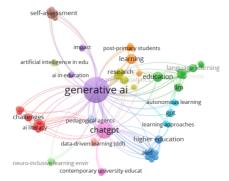


Figure 4. Network Visualization of Co-occurrence

Co-occurrence analysis displays network visualization between keywords. The larger the node, the greater the number of keywords that appear (Zakaria et al., 2022). Edge connects between nodes and the strength of the relationship. The closer the distance between one node and another node is, the higher the relationship between the nodes is (Aribowo, 2019). Figure 4 shows a network visualization of co-occurrence. The keyword that appears most often is generative AI. Colored nodes indicate how many clusters there are. There are 13 clusters in the network visualization of co-occurrence. Cluster 1-8 is the dominant cluster because the keywords appear a lot, while cluster 9-1 is the dominant cluster because the keywords rarely appear.

	Table 2. Keywords of Cluster 1-8
Clusters	Keywords
1 (red)	Advantages, AI literacy, benefits, challenges, competencies, holistic,
	opportunities, reinforcement learning, risks, state-of-the-art
2 (green)	auto-generated course units, bias, diffusion model, education, equality,
	generative AI models, language learning, LLM, personalized learning
3 (blue)	Aided, algorithmic bias, artificial intelligence (AI), big tech, education
	technology, fascism, higher education, superintelligence
4 (yellow)	Editorial, genai, learning analytics, practice, research, user-centered
	research
5 (purple)	AI in education, ai-generated learning content, impact
6 (arctic)	Autonomous learning, Flipped classroom, GPT, learning approaches,
	student agency.
7 (orange)	Learning, new literacies, post-primary students, python programming
8 (grape)	Chatbot, gpt-4, quizizz ai, self assessment

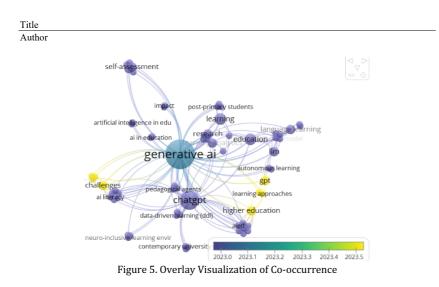


Figure 5 displays an overlay visualization of co-occurrence. This figure displays future research trends. The bluer the node, the earlier the year of publication; conversely, the more recent the publication, the yellower the node. Future research topics include GPT, student agency, learning approaches, higher education, state-of-the-art, reinforcement learning, opportunities, and challenges.

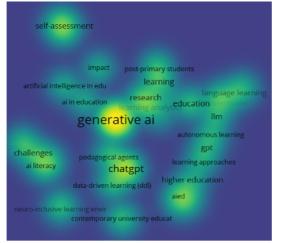


Figure 6. Density Visualization of Co-occurrence

Figure 5 displays a density visualization of co-occurrence. This image is a topic that still needs to be used regarding generative AI. Hotspots on the map that are increasingly yellow indicate that more keywords are being used, while the darker the color, the more research using these keywords is rarely carried out (Soesanto & Handalani, 2023). Potential

future research could use keywords that have yet to be widely used, including pedagogy, simulations, Socratic tutors, teaching methods, neuro-inclusive learning, and metacognition.

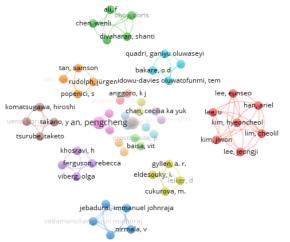


Figure 7. Network Visualization of Co-authorship

Co-authorship analysis to see author networks. In this study, 65 authors from 29 manuscripts met the requirements for analysis. Which means there are 2.24 authors per manuscript. Data visualization shows that cluster 1 has a network of writers outside the group consisting of Han, Ariel; Leu, U; Leu, Eunso; Lim, Cheoil; Kim, Hyeoncheol; Lee, Jeongji; Kim, Jiwon is the cluster with the highest relationship between nodes. Other authors collaborate with teammates or even research individually.

#### CONCLUSION

The development of learning using generative AI research in the last five years has been analyzed using bibliometric methods. In 2022, there was one manuscript; in 2023, there were 27 manuscripts; and in 2024, there was one manuscript published. There are ten manuscripts published in conference proceedings, 14 articles in journals, and five manuscripts in edited books. Suh, Popenici, Crosthwaite, Kim, and Chan wrote the 5 most cited articles. Future research topics include GPT, student agency, learning approaches, higher education, state-of-the-art, reinforcement learning, opportunities, and challenges. Potential future research (novelty) could use keywords that are not yet widely used, including pedagogy, simulations, socratic tutors, teaching methods, neuro-inclusive learning, and metacognition. a network of writers outside the group consisting of Han, Ariel; Leu, U; Leu, Eunso; Lim, Cheoil; Kim, Hyeoncheol; Lee, Jeongji; Kim, Jiwon is the cluster with the highest relationship between nodes.

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#### Lampiran 5. Hasil Revisi Artikel oleh Penulis

#### Journal of Research in Instructional e-ISSN: 2776-222X

Vol. 4(1) 2024, pp. 1 – 17 https://doi.org/10.30862/jri.v4i1.277

#### Bibliometric analysis: learning using generative ai

#### Putri Khoirin Nashiroh\*, Ranu Iskandar

Universitas Negeri Semarang, Indonesia

Submitted: xx-xx-xxxx Accepted:

Accepted: xx-xx-xxxx

Published: xx-xx-xxxx Abstract: This research aims to 1) analyze the number of articles per year and their types, 2) analyze the five articles with the most citations, 3) analyze keywords in the data collected, and 4) analyze the relationship between authors. Bibliometric analysis was used to help researchers study bibliographic content and citation analysis of each article taken from Harzing's Publish or Perish (PoP) 8 database. The data was taken from Scopus January 2018-2024 entitled, "learning using generative AI" in English. The maximum number of articles accessed is 500 articles. The collected articles are stored in CSV and RIS format. Articles were filtered according to analysis needs using MS Excel and VOSViewer. Twenty-nine documents from the Scopus database have been used in this research. The results show that 1) in 2022, there was one manuscript; in 2023, there were 27 manuscripts; and in 2024, there was one manuscript published. There are ten manuscripts published in conference proceedings, 14 articles in journals, and five manuscripts in edited books; 2) Suh, Popenici, Crosthwaite, Kim, and Chan wrote the 5 most cited articles; 3) Future research topics include GPT, student agency, learning approaches, higher education, state-of-the-art, reinforcement learning, opportunities, and challenges. Potential future research (novelty) could use keywords that are not yet widely used, including pedagogy, simulations, Socratic tutors, teaching methods, neuro-inclusive learning, and metacognition; 4) a network of writers outside the group consisting of Han, Ariel; Leu, U; Leu, Eunso; Lim, Cheoil; Kim, Hyeoncheol; Lee, Jeongji; Kim, Jiwon is the cluster with the highest relationship between nodes.

Keywords: bibliometric, generative ai, learning

Abstrak: Penelitian ini bertujuan untuk 1) menganalisis jumlah artikel per tahun dan jenisnya, 2) menganalisis lima artikel dengan kutipan terbanyak, 3) menganalisis kata kunci dalam data yang dikumpulkan, dan 4) menganalisis hubungan antar penulis. Analisis bibliometrik digunakan untuk membantu peneliti mempelajari isi bibliografi dan analisis sitasi setiap artikel yang diambil dari database Harzing's Publish or Perish (PoP) 8. Data diambil dari Scopus Januari 2018-2024 yang berjudul "learning using generative AI" dalam bahasa Inggris. Jumlah artikel yang diakses maksimal 500 artikel. Artikel yang dikumpulkan disimpan dalam format CSV dan RIS. Artikel disaring sesuai kebutuhan analisis menggunakan MS Excel dan VOSViewer. Dua puluh sembilan dokumen dari database Scopus telah digunakan dalam penelitian ini. Hasil penelitian menunjukkan bahwa 1) pada tahun 2022 terdapat satu naskah; pada tahun 2023 berjumlah 27 naskah; dan pada tahun 2024, terdapat satu naskah yang diterbitkan. Terdapat sepuluh manuskrip yang diterbitkan dalam prosiding konferensi, 14 artikel di jurnal, dan lima manuskrip dalam buku yang telah diedit; 2) Suh, Popenici, Crosthwaite, Kim, dan Chan menulis 5 artikel yang paling banyak dikutip; Topik penelitian masa depan meliputi GPT, keagenan mahasiswa, pendekatan 3) pembelajaran, pendidikan tinggi, kecanggihan, pembelajaran penguatan, peluang, dan tantangan. Potensi penelitian kebaruan dapat menggunakan kata kunci yang belum banyak digunakan, termasuk pedagogi, simulasi, tutor socrates, metode pengajaran, pembelajaran neuro-inklusif, dan metakognisi; 4) jaringan penulis di luar kelompok yang terdiri dari Han, Ariel; Leu, kamu; Leu, Eunso; Lim, Cheoil; Kim, Hyeoncheol; Lee, Jeongji; Kim, Jiwon adalah cluster dengan hubungan antar node tertinggi

Kata kunci: bibliometrik, generative ai, pembelajaran

\*Corresponding author: <u>putrikhoirin@mail.unnes.ac.id</u>

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#### **INTRODUCTION**

The Industrial Revolution (IR) progresses faster in each era, starting from 0.0 to 5.0. Before 1760, people thought traditionally of agricultural triggers for survival. In 1760-1830, society entered IR 1.0, where steam engines and water power mechanism systems emerged, resulting in the emergence of textile, iron, steel, and transportation industries. Starting in the 1870s, society entered IR 2.0, where electrical technologies emerged and the mechanization of iron and steel mass production systems, car industries, and the discovery of oil refineries to replace coal. In the 1970s, IR 3.0 began to enter, where computers, cellphones, and the internet appeared and entered industries. From 2010 until now, we entered IR 4.0, where robot technologies, chatbot artificial intelligence (AI), and the Internet of Things (IoT) emerged (Maghfiroh & Iskandar, 2023). We are currently transitioning towards IR 5.0, where AI and robots are here to work together with humans. It encourages efficiency and productivity by utilizing technology utilized by human intelligence (Ikhsan, 2023; Restendy et al., 2021; Siagian, 2023; The Editors of Encyclopaedia Britannica, 2023).

The increasingly rapid shift in the industrial revolution means that all sectors, including education, must adapt. If RI 4.0, education 4.0 emerges as the education sector's answer to adapting, then when RI 5.0, education 5.0 will appear (Iskandar, 2024). Education 5.0 is the integration of AI and IoT in the education sector.

Artificial intelligence (AI) is a computer program that works like human intelligence to carry out tasks and solve problems (Korteling et al., 2021). AI was introduced by John McCarthy at a summer conference at Dartmouth College in 1956. AI branches include machine learning, deep learning, natural language processing, and computer vision. Generative AI is machine learning capable of producing new content such as text written in natural language, images (including photos, digital paintings, and cartoons), videos, music, and software code in response to commands written in natural-language conversational interfaces (Google, 2024; UNESCO, 2023).

Text generative AI uses a type of ANN known as a general-purpose transformer and a large language model. Text GenAI is often referred to as large language modeling or LLM. The type of LLM used by Text GenAI is known as a generative pre-trained transformer (UNESCO, 2023). An example is chatGPT (chat.openai.com). ChatGPT can answer all questions in the form of text prompts, carry out conversations, and check the similarity of writing (Maghfiroh & Iskandar, 2023). In its development, various alternatives to chatGPT emerged, including Alpaca, Bard, Chatsonic, Ernie, Hugging Chat, Perplexity, Jasper, Llama, Open Assistant, Tongyi Qianwen, YouChat, ChatPDF, and Elicit. In the development of chatGPT, chatGPT 4 can use image generative AI as a prompt.

Image generative AI and music generative AI use an ANN generative adversarial network (GAN) that can also be combined with variational autoencoders (UNESCO, 2023). Examples of Image-generative AI are Craiyon, DALL E 3, Midjourney, Adobe Firefly, Generative AI by Getty, and Stable Diffusion (Guinness, 2024). Examples of Music generative AI are Aiva, Boomy, Soundraw, Magenta Studio, Synthesizer V, Voicemod, Image to Sound Effect, and Melobytes (Sharma, 2023). Examples of AI generative videos are Elai, GliaCloud, Pictory, and Runway,(Alfred, 2023).

Many publications discuss vocational learning with generative AI. Various articles can be accessed via Google Scholar or directly on the Google search engine. Several previous publications have conducted research on learning with generative AI in vocational schools, Commented [A2]: Sudah ditambahkan sitasi

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such as that undertaken by Rahman, Sembiring, Aulia, Dafitri, & Liza (2023) stated that using ChatGPT provides significant benefits for students and teachers, with ChatGPT's ability to answer questions, summarize documents, translate text, and understand program code. ChatGPT is effective in meeting the learning needs of students at SMK Negeri 1 Pantai Labu. Arisanti et al. (2024) showed that the use of AI in learning can provide optimal learning experiences, develop creativity and professional skills of educators, design learning strategies that are innovative and responsive to changing educational needs, and increase teaching effectiveness. Zulfikar et al. (2023) showed that Quillbot, a Generative AI, can improve teacher writing skills in the aspects of coherence, grammar, and structure. Although many authors have published publications related to learning with generative AI, until now, no one has carried out mapping using bibliometric analysis of related publications indexed by Scopus with the help of VOSviewer.

The more diverse generative AI becomes, the more researchers are researching generative AI. From the research potential above, the objectives of this research are 1) analyzing the number of articles per year and their types, 2) analyzing the five articles with the most citations, 3) analyzing keywords in the data collected, and 4) analyzing the relationship between authors.

#### **METHOD**

Analysis is part of the research evaluation method and from the various literature that has been produced, it is possible to carry out bibliometric analysis using its method (Ellegaard & Wallin, 2015). The method used was bibliometric analysis to help researchers in studying bibliographic content and citation analysis of each article taken from the Harzing's Publish or Perish (PoP) 8 database. The data was taken from Scopus January 2018-2024 with the title, "Learning using generative AI" in English. The maximum number of articles accessed is 500 articles. The collected articles are stored in CSV and RIS format. Articles filtered according to analysis needs. VOSviewer 1.6.18 can visualize predefined article searches; the steps can be summarized as follows: determine search keywords, perform article search, filter and process search result data according to needs, collect and compile statistical data on search results, as well as conduct bibliometric analysis (Iskandar, 2023). Meanwhile, according to research Julia et al. (2020), the four stages of the bibliographic study are: (1) search processes; (2) bibliographic filters; (3) complete bibliography; and (4) bibliometric analysis.

Forty-four manuscripts and 72 citations were harvested using PoP 8 until early 2024. The data were saved in CSV format for Microsoft Excel and RIS format for VOSviewer software.

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Figure 1. Manuscript Harvest Results Using PoP

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CSV file on Ms. Excel and RIS files in Mendeley were selected one by one to see whether the content matches the title learning using generative AI. If something does not match the title, the data is deleted. Of the 44 existing manuscripts, 29 manuscripts were found that matched the title. In Mendeley, the 29 manuscripts were completed with the contents by writing down all the authors and entering author keywords.

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Figure 2. RIS File Opened in Mendeley

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Figure 3. The CSV File Opened in MS Excel

#### **RESULTS AND DISCUSSION**

The data in Excel was filtered in tables. The table title "year" was used to group the year the manuscript was published. Type headings were used to group publication types. The results of grouping publication years showed that in 2018-2021, there were no manuscripts published; in 2022, there was one manuscript; in 2023, there were 27 manuscripts published; and in 2024, there was one manuscript published. The results of grouping the forms of published manuscripts show that ten manuscripts were published in conference proceedings, 14 articles in journals, and five manuscripts in edited books.

		Table 1. The Top 5		ripts	
Cites	Authors	Titles	Years	Sources	Publishers
8	Suh, S. & An, P.	Leveraging Generative Conversational AI to Develop a Creative Learning Environment for Computational Thinking	2022	International Conference on Intelligent User Interfaces, Proceedings IUI	АСМ
7	Popenici, S., Rudolph, J., Tan, S., & Tan, S.	A critical perspective on generative AI and learning futures. An interview with Stefan Popenici	2023	Journal of Applied Learning and Teaching	Simon Fraser University
5	Crosthwaite, P. & Baisa, V.	Generative AI and the end of corpus-assisted data- driven learning? Not so fast!	2023	Applied Corpus Linguistics	Science Direct, Elsevier B.V.
3	Kim, B.	ChatGPT and Generative AI Tools for Learning and Research	2023	Computers in Libraries	Information Today, Inc.
2	Chan, C.K.Y & Lee, K. K. W.	The AI generation gap: Are Gen Z students more interested in adopting generative AI such as ChatGPT in teaching and learning than their Gen X and millennial generation teachers?	2023	Smart Learning Environments	Springer Nature

From the data above, it can be seen that 80% of the articles cited came from journals, while the rest came from conference proceedings. However, articles published in conference proceedings had the highest number of citations, with eight citations. The article was written by Suh & An (2022). This article can be accessed at the ACM Digital Library. This is because articles published in conference proceedings are open access, whereas, in journals, there is usually a fee to access them (AlRyalat et al., 2019; Pranckutė, 2021).

The edited RIS data was then opened using VosViewer. The analysis used in VosViewer was based on keywords and authors. The analysis procedure was to click "create," and then a popup appears to select the type of data. Click "Create a map based on bibliographic data" and click "Next." Then, a pop-up would appear to choose the data source. Clicked "read data from reference management files" and click "Next." Then, a pop-up would appear to select the file. Clicked ris and select the ris file that has been edited using Mendeley, then click "next." Then, a pop-up would appear to choose the type of analysis and counting method. There are two types of analysis methods, namely Co-authorship and Cooccurrence. Co-authorship is used to analyze authors writing in the same network, whether directly or indirectly. Co-occurrence is used to analyze keywords (University of Illinois Chicago, 2023). Choose one analysis method. When you have finished visualizing the data, choose another analysis method. In the counting method, select full counting and click "next." Then, a pop-up would appear to select the threshold. Wrote the number 1 so that all authors or keywords appear in the visualization, then click "next." Wrote down the number of all authors or keywords and clicked "finish."

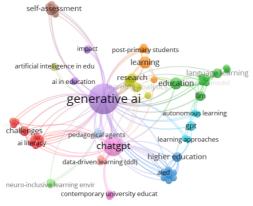


Figure 4. Network Visualization of Co-occurrence

Co-occurrence analysis displays network visualization between keywords. The larger the node, the greater the number of keywords that appear (Zakaria et al., 2022). Edge connects between nodes and the strength of the relationship. The closer the distance between one node and another node is, the higher the relationship between the nodes is (Aribowo, 2019). Figure 4 shows a network visualization of co-occurrence. The keyword that appears most often is generative AI. Colored nodes indicate how many clusters there are. There are 13 clusters in the network visualization of co-occurrence. Cluster 1-8 is the dominant cluster because the keywords appear a lot, while cluster 9-1 is the dominant cluster because the keywords rarely appear.

#### Table 2. Keywords of Cluster 1-8

Clusters	Keywords
1 (red)	Advantages, AI literacy, benefits, challenges, competencies, holistic,
	opportunities, reinforcement learning, risks, state-of-the-art
2 (green)	auto-generated course units, bias, diffusion model, education, equality,
	generative AI models, language learning, LLM, personalized learning
3 (blue)	Aided, algorithmic bias, artificial intelligence (AI), big tech, education
	technology, fascism, higher education, superintelligence
4 (yellow)	Editorial, genai, learning analytics, practice, research, user-centered
	research
5 (purple)	AI in education, ai-generated learning content, impact
6 (arctic)	Autonomous learning, Flipped classroom, GPT, learning approaches,
	student agency.
7 (orange)	Learning, new literacies, post-primary students, python programming
8 (grape)	Chatbot, gpt-4, quizizz ai, self assessment

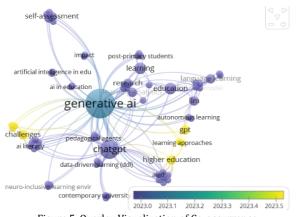


Figure 5. Overlay Visualization of Co-occurrence

Figure 5 displays an overlay visualization of co-occurrence. Visualization of co-occurrence aims to intuitively understand the research development trends and predict future orientations and hotspots (Martínez-Heredia et al., 2022). This figure displays possible future research trends. The bluer the node, the earlier the year of publication; conversely, the more recent the publication, the yellower the node. Possible future research topics include GPT, student agency, learning approaches, higher education, state-of-the-art, reinforcement learning, opportunities, and challenges.

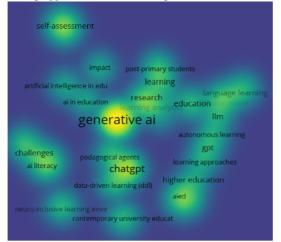


Figure 6. Density Visualization of Co-occurrence

Figure 5 displays a density visualization of co-occurrence. This image is a topic that still needs to be used regarding generative AI. Hotspots on the map that are increasingly yellow indicate that more keywords are being used, while the darker the color, the more

research using these keywords is rarely carried out (Soesanto & Handalani, 2023). Potential future research could use keywords that have yet to be widely used, including pedagogy, simulations, Socratic tutors, teaching methods, neuro-inclusive learning, and metacognition.

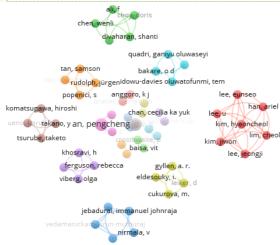


Figure 7. Network Visualization of Co-authorship

Co-authorship analysis to see author networks. Co-authorship analysis is useful to see the mapping of research topics through relationships or collaborations between authors (Putri et al., 2023). In this study, 65 authors from 29 manuscripts met the requirements for analysis. Which means there are 2.24 authors per manuscript. Data visualization shows that cluster 1 has a network of writers outside the group consisting of Han, Ariel; Leu, U; Leu, Eunso; Lim, Cheoil; Kim, Hyeoncheol; Lee, Jeongji; Kim, Jiwon is the cluster with the highest relationship between nodes. Other authors collaborate with teammates or even research individually.

#### **CONCLUSION**

The development of learning using generative AI research in the last five years has been analyzed using bibliometric methods. In 2022, there was one manuscript; in 2023, there were 27 manuscripts; and in 2024, there was one manuscript published. There are ten manuscripts published in conference proceedings, 14 articles in journals, and five manuscripts in edited books. Suh, Popenici, Crosthwaite, Kim, and Chan wrote the 5 most cited articles. Future research topics include GPT, student agency, learning approaches, higher education, state-of-the-art, reinforcement learning, opportunities, and challenges. Potential future research (novelty) could use keywords that are not yet widely used, including pedagogy, simulations, socratic tutors, teaching methods, neuro-inclusive learning, and metacognition. a network of writers outside the group consisting of Han, Ariel; Leu, U; Leu, Eunso; Lim, Cheoil; Kim, Hyeoncheol; Lee, Jeongji; Kim, Jiwon is the cluster with the highest relationship between nodes. Commented [A11]: sudah direvisi ditambahkan diskusi

**Commented** [A13]: sudah direvisi. Sudah menjawab tujuan penelitian pada introduction

Commented [A12]: sudah direvisi. Ditambahkan diskusi

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