Visualizing the Connections of Artificial Intelligence and Teachers: A Bibliometric Analysis

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Abstract

Unification of Artificial Intelligence (AI) revamped the attributes of teaching-learning processes. It equips teacher with the tools to transform conventional practices to meet the latest requirements. The present study delves into researches concentrated on "Artificial Intelligence and Teachers" from 1991-2025 by adopting bibliometric method. 263 journal articles were retrieved from the SCOPUS database. These articles were examined based on citations with reference to source, document, countries and authors as a unit of analysis. In addition to this, co-occurrence of all the keywords were looked into for the purpose of identifying relationship between underlying key-concepts of the stated area. The findings obtained from the data revealed the list of top 10 most cited authors and top 10 journals who have promising contribution in the area of AI and teachers based educational researches. United States and China are the highly cited countries in the stated domain. The co-occurrence of the keyword uncovered that Artificial Intelligence, teachers, teaching and ChatGPT used frequently in the researches undertaken. The visualizations pictures formed by VOSviewer foster understanding in connection with the patterns of collaboration among contributors by forming clusters. The study also demarcates the research trends in the stated area and also pave the ways for future researches and collaborations. The study can be useful to address the gaps to generate economy of research-driven knowledge to benefit the people of academia.

Keywords: *Artificial Intelligence, NEP-2020, Teacher, Bibliometric Methods, Co-occurrence, Citation.*

Introduction:

Teachers being the backbone of the society, shape the future of the nation, act as guide, facilitator and unconditional supporter of the students. Teacher is an integral and the most significant part of the learning process. Earlier it was considered that teacher being the only transmitting unit for students. This can be well understood through this shloka:

गुरौनप्राप्यतेयत्तन्नान्यत्रापिहिलभ्यते।
गुरुप्रसादातसर्वंतुप्राप्नोत्येवनसंशयः।।

The meaning inferred from this shloka is whatever you are not getting from your teacher, that can't be obtained from any other source, one can get anything under the blessings of teacher. There is no question regarding the position of teachers, however, due to the developments, there has been certainly shift in the roles and responsibilities of teachers occurred with time and development. Technology has changed the picture and after the arrival of artificial intelligence (AI), situation turned out to be upside down. Artificial Intelligence has been highlighted as the

pressing need of the century which demands the skilled manpower in the context of multi-disciplinarity. From inclusion of AI at different stages of education to match the potential of adopting AI in various profession has been placed as the alarming need (Ministry of Human Resource Development, Government of India, 2020). Learners are now scrolling tools of AI for learning and even for testing teachers' knowledge. Teachers are employing AI for designing and offering learning experiences to the learners by making it more inclusive, interactive and diversified. Students' dependency on teachers for seeking knowledge has been reduced to an extent. Teachers through AI tools can make the learning content more student-centric and smart. To derive maximal benefits from AI, teacher requires to be provided knowledge and skills training which result into development of technological competencies (Tang, 2024). The functions of AI can be applied to make prediction regarding elements of learning such as performance, assessment and evaluation, customize the learning program, creating tutorials. Integration of AI requires privacy, security, trustworthiness, abiding laws and cause no harm to any(Airaj, 2024). This all concern can be handled well by teachers when they have willingness to integrate AI into educational processes, however, despite having favourable attitude, teachers unable to implement it as they lack adequate training for applying AI. This calls for a need to ensure that teacher should learn AI integration while they are in profession(Fakhar, 2024). Teachers were optimist regarding their future perspectives of AI. Perception towards AI is in evolving stage as AI potential is also in developing phase. Socially responsible ways of AI implementation are needed(Gayed, 2025).

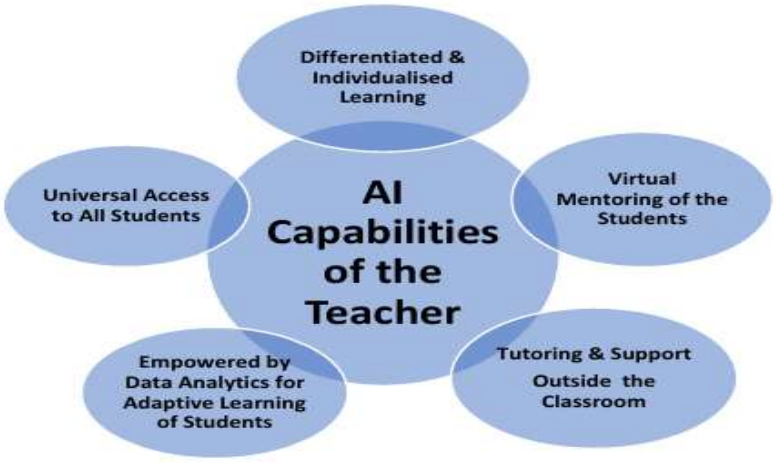


Figure 1: AI Capabilities of the Teacher.
Source: Adopted from CBSE School Curriculum, 2019

There is an urgency to work upon development of competencies and pedagogies to foster learning with AI, along with sufficient infrastructural and technological support for AI integration. Each unit of learning be it a teacher, student or any stakeholders needs motivation

and autonomy for accruing its benefits(Karan & Angadi, 2023). Research exploration can be the guiding framework for this, not from those available in localized settings but also derive practices from international world of researches. It is utmost significant to understand how the researches related to AI and teachers have been conducted so far. Teachers and AI in relation to perception, perspective, usage, ethical concern, designing learning processes etc. were explored through researches. The present aimed to identify the influential work, countries, journals and authors in the domain of teacher and AI. The repeated occurrence of key-words will foster the understanding of themes that been already researched and their extent of operationalization in the conducted studies. The influential aspects emerged out as an outcome of the study would be helpful in learning from the perspectives of theirs and aid in designing the upcoming researchable facets. This study would contribute in understanding research trends and gaps to a certain degree. Citation dynamics reveals the pattern of collaboration and helped to identify the potential links to be created.

Objectives of the study:

1. To find out the top 10 research documents related to the artificial intelligence and teachers from last 25 years.
2. To enumerate top 10 journals published the researches of artificial intelligence and teachers from last 25 years.
3. To list out the top 10 authors worked in the field of artificial intelligence and teachers from last 25 years.
4. To specify the top 10 countries worked in the field of artificial intelligence and teachers from last 25 years.
5. To identify the top 20 keywords frequently adopted in the researches of artificial intelligence and teachers from last 25 years.
6. To understand the collaboration between top 10 research documents, journals, countries and keywords.

Methodology:

The present employed bibliometric analysis to examine the existing researches of AI and teacher available on the SCOPUS database. The quantitative bent was adopted by the software to analyses the researches to answer the raised questions.

Data collection:

The data for bibliometric analysis pertaining to researches of the area "Artificial Intelligence and teachers" was retrieved from the SCOPUS database. Researcher selected SCOPUS as the database due to its content quality, reliability and comprehensiveness. Keyword search was used to search the articles. In the database search field, search within the article titles was opted. In the search bar, keywords Artificial Intelligence and Teachers was placed. Boolean operator AND was used. Upon applying the filter of time-period of 1990 to 2025, the string automatically switches to 1991-2025, might be due to the non-availability of the work prior to

1991. Document type was restricted to articles only, English was the only language of the work favored for the further selection. The source type filter was set on journal. These filters application resulted into 263 articles which were proceeded further for analysis. These articles were exported in the form of comma-separated value (.CSV) file. This file was opened using MS Excel. VOSviewer was used to perform the analysis. Before proceeding for analysis, file was checked for repetition, duplication, missing and irrelevant information. All the required components were found to be complete and 263 articles remained intact for further analysis.

Table 1: Process of data collection

Topic: Researches connected to Artificial Intelligence and Teacher
Database: SCOPUS; Time Period: 1991-2025; Search within: Article titles **Language: English; Document type: Article; Source type: Journal**
Keywords & search string: artificial intelligence AND teacher
Retrieval Date: 22 March 2025
Record Obtained: 263
Record for Analysis: 263

Data Analysis:

The present study of bibliometric analysis attempted to find out the trends in the educational researches of Artificial Intelligence and Teachers based on citations and co-occurrence. The open-source software VOSviewer was used to perform the analysis. Visual maps were created using network and overlay visualizations. The tables were generated with the help of this tool to list out top authors, countries, documents, journals and keywords of the stated domain. Cluster formations were given by VOSviewer to enable the understanding of collaboration between the units of analysis with respect to AI and teachers. Full counting method was adopted in analysis keywords which culminated into top 20 keywords. Link and Total link strength were embedded features adopted for analysis. Link referred to the number of appearances of two components together whereas total link strength is the sum of strength of all links between two units.

Results and Findings:

Citation analysis by taking document as unit of analysis:

The present study employed journals as the only document. The maximum number of retrieved articles were 263, however, to proceed further, minimum number of citations of a document was limit to 1. Thus, only 171 documents meet the criteria. Since the investigator tried to see the top 10 documents related to AI and teachers, therefore, 10 documents with largest number of citation links were opted out of 171 documents. Citation link has been defined as the linkage between two items where one is cited by other. The software doesn't discriminate between citation between A to B and B to A. This feature of citation link was used to list out top 10 documents.

Table 2: Top 10 documents/articles based on citation links

Document	Author	Citations	Links
Reshaping curriculum adaptation in the age of artificial intelligence: Mapping teachers' AI-driven curriculum adaptation pattern	Karataş, F., Eriçok, B., & Tanrikulu, L. (2025)	3	3
Factors Affecting the Adoption of AI-Based Applications in Higher Education: An Analysis of Teachers Perspectives Using Structural Equation Modeling	Wang, Y., Liu, C., & Tu, Y. F. (2021)	136	2
Teachers' AI digital competencies and twenty-first century skills in the post-pandemic world	Ng, D. T. K., Leung, J. K. L., Su, J., Ng, R. C. W., & Chu, S. K. W. (2023)	172	2
Generative AI and Teachers' Perspectives on Its Implementation in Education	Kaplan-Rakowski, R., Grotewold, K., Hartwick, P., & Papin, K. (2023)	77	2
Teachers' trust in AI-powered educational technology and a professional development program to improve it	Nazaretsky, T., Ariely, M., Cukurova, M., & Alexandron, G. (2022)	170	2
Analyzing teacher competency with TPACK for K-12 AI education	Kim, S., Jang, Y., Choi, S., Kim, W., Jung, H., Kim, S., & Kim, H. (2021)	57	1
I, teacher: Using artificial intelligence (AI) and social robots in communication and instruction	Edwards, C., Edwards, A., Spence, P. R., & Lin, X. (2018).	99	1
Learning design to support student-AI collaboration: Perspectives of leading teachers for AI in education	Kim, J., Lee, H., & Cho, Y. H. (2022)	176	1
AI and education: the importance of teacher and student relations	Guilherme, A. (2019)	113	0
Co-designing a real-time classroom orchestration tool to support teacher-AI complementarity	Holstein, K., McLaren, B. M., & Aleven, V. (2019)	179	0

On proceeding further, it was showing that 8 documents were connected with each other, whereas two were separate.

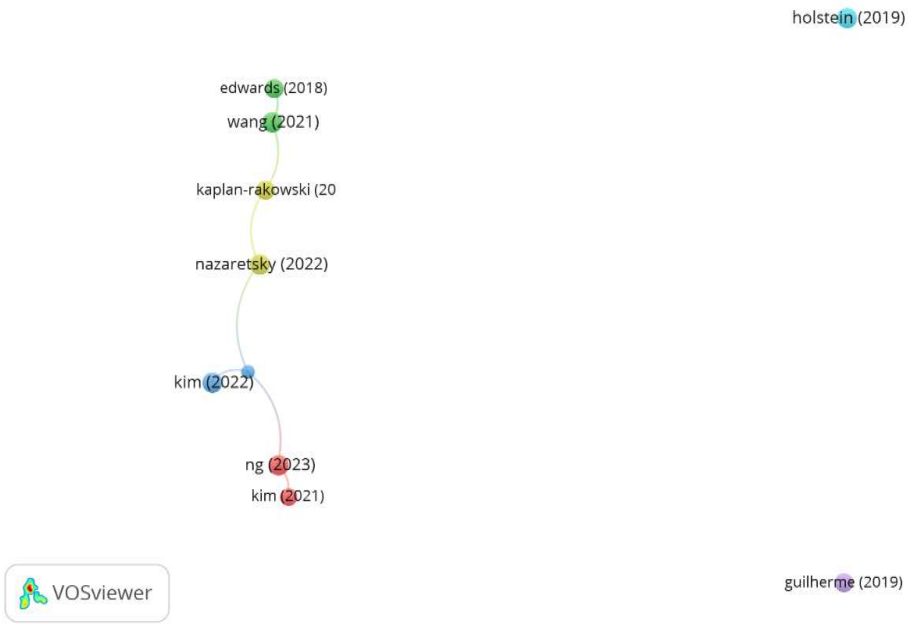


Figure 2: Network Visualization of Top 10 documents related to AI and teachers

Six clusters can be easily identified from the visual where two documents were seen distinct in two separate clusters whereas four clusters comprised two documents in each. This reflected their collaboration and networking.

Citation analysis by taking source as unit of analysis:

The present study includes source type as the journal only. This form of analysis would be helpful to determine the influential journal in the field of teacher and artificial intelligence. The criteria which were applied to minimum number of citation and minimum number of documents was 1. This result into selection of journals from 148 to 103 which were proceed for further analysis. Out of these, 10 sources were selected again to list top 10 sources out of all. It was sorted based on greatest link strength.

Table 3: Top 10 sources based on total links strength

Source	Documents	Citations	Total Link Strength
Education and Information Technologies	31	509	18
British Journal of Educational Technologies	5	198	11
Education Sciences	13	123	11
Computers and Education: Artificial Intelligence	9	121	10
Educational Technology and Society	2	158	10

Educational Technology Research and Development	3	173	9
KI - Kunstliche Intelligenz	1	57	7
Journal of Digital Learning in Teacher Education	4	8	6
Journal of Interactive Learning Research	1	77	6
Communication Education	1	99	2

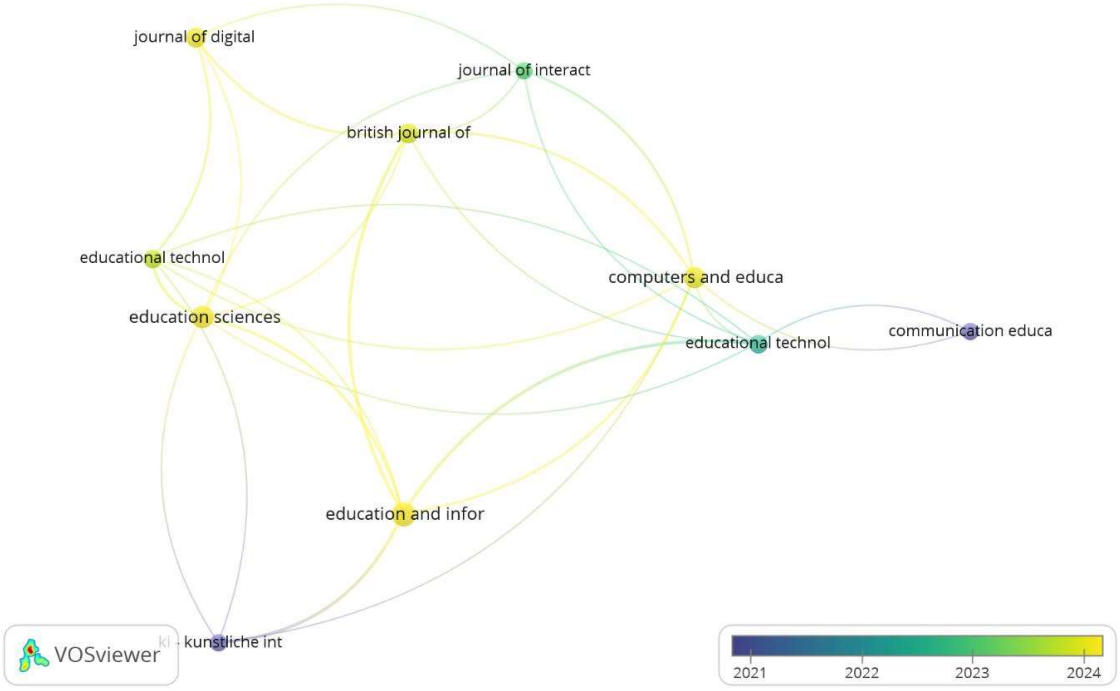


Figure 3: Overlay Visualization of Top 10 sources

From the overlay visualization figure, it was found that three clusters were formed in which four documents were being the part of one cluster and same goes with cluster 2. Cluster 3 included the networking of only 2 documents.

Cluster 1 included Computers and Education: Artificial Intelligence, Communication Education, Journal of Interactive Learning Research &Educational Technology and Society.

Cluster 2 was made by the networking of Journal of Digital Learning in Teacher Education, British Journal of Educational Technologies, Education Sciences &Educational Technology Research and Development

Cluster3 was formed by Education and Information Technologies and KI - Kunstliche Intelligenz.

Citation analysis by taking author as unit of analysis:

This analysis was performed to find out the top influential authors working in the domain of AI and teachers based on the work indexed in SCOPUS journals. The maximum number of authors per article was restricted to 10. Studies included more than 10 authors were not counted. Minimum number of documents of an author was kept at 2 and minimum number of citations of an author was 5 which resulted into selection of 50 authors out of 737 for proceeding the analysis. From these 50 authors, only 10 were selected based on link strength.

Table 4: Top 10 authors based on total links strength

Authors	Documents	Citations	Total Link Strength
Jihyun Kim	3	192	13
Kelly Merrill	3	192	13
Deanna Sellnow	3	192	13
Kun Xu	3	192	13
Jinhee Kim	4	240	8
Fatih Karatas	2	10	6
Vincent Aleven	3	200	5
Kenneth Holstein	2	187	4
Preeti Bhaskar	2	70	2
Jiahong Su	2	174	1

Citation analysis by taking countries as unit of analysis:

The limit of countries involved in a document was set to be 10. It was pre-fixed through option that each country had contributed through atleast 2 documents and 5 were limited as minimum number of citations of a country. This filter resulted into 39 countries which were considered further for analysis. Out of these 39 countries, top 10 countries.

Table 5: Top 10 countries based on total links strength

Countries	Documents	Citations	Total Link Strength
China	54	606	64
United States	46	831	44
Hong Kong	20	667	38
Israel	8	179	35
United Kingdom	10	285	32
Taiwan	7	176	28
South Korea	17	317	25
Turkey	13	36	12
Canada	3	85	11
Palestine	3	7	9

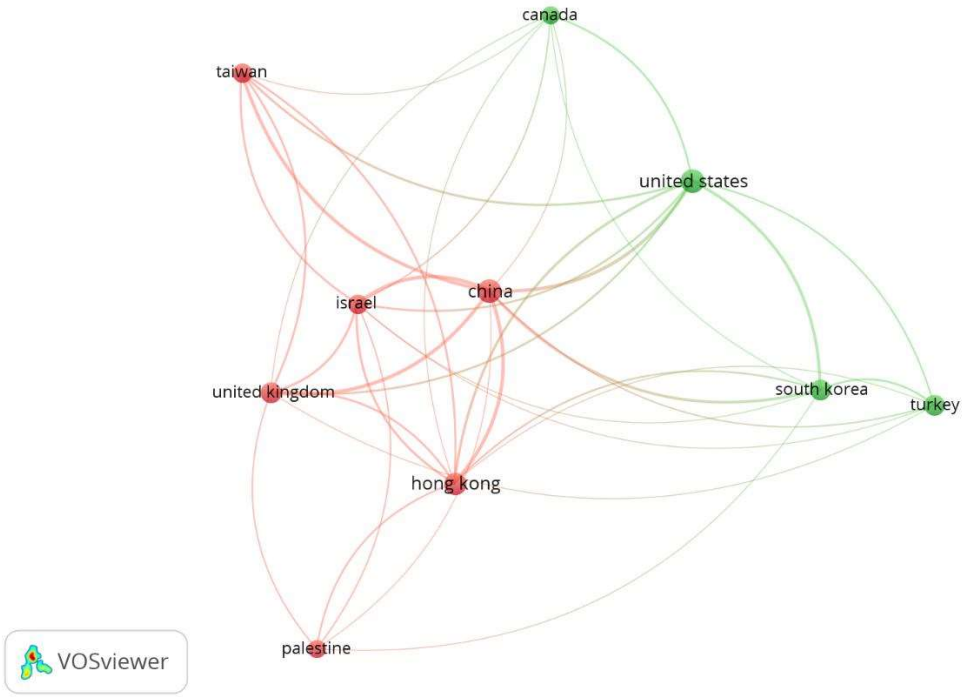


Figure 4: Overlay Visualization of top 10 countries

This visual indicates the collaboration between China, Hong Kong, United Kingdom, Palestine, Israel and Taiwan in the researches pertaining to Artificial Intelligence and Teachers whereas Canada, United States, South Korea and Turkey worked together.

Citation analysis by taking co-occurrence as unit of analysis:

This analysis was done by considering all the keywords included in the journals. Full counting method was used for this. The total number of occurrences of the keywords was fixed to 5. This selected the 43 keywords out of 1121 keywords. Out of these 43 keywords, top 20 keywords were listed. The total link-strength was used to find out these co-occurrences.

Table 6: Top 20 Keywords

Keyword	Citations	Total Link Strength
Teachers'	34	106
Artificial Intelligence	79	85
Teaching	21	75
ChatGPT	36	53
Generative AI	23	52
Students	15	48
Teachers	19	41
Contrastive Learning	8	38

Adversarial Machine Learning	7	32
Personnel Training	7	29
Integration	6	28
Teacher Training	12	28
Education	12	27
Self-Efficacy	6	27
Generative Artificial Intelligence	15	26
Generative Adversarial Networks	5	23
Professional Aspects	5	22
Teacher Education	13	22
Higher Education	16	21
AI Literacy	16	19

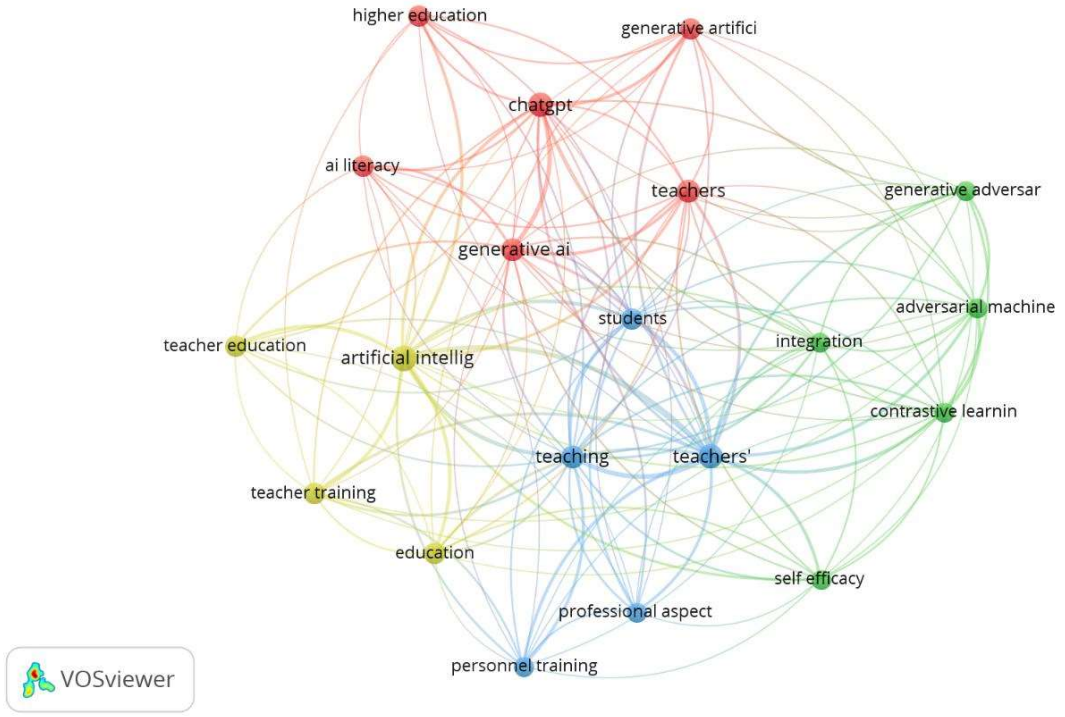


Figure 5: Network Visualization of top 20 keywords

This picture revealed that Ai is linked with maximum other key themes of the area such as teacher education, teacher training, education, which signifies that these are the explored area. Other tie-ups through research can be created by linking the non-linked with each other like AI literacy and professional aspects and many others. Based on citations, AI was on the top list of keywords whereas total link strength placed teachers on the top.

Conclusion:

Since the data of the study was taken from a single database and it can't be generalized but the findings still support researchers working in the area concerning AI and teachers. The present study tried to capture the collaborative tie-ups among the various units such as countries, authors, journal and documents/articles by adopting citation analysis feature under bibliometric analysis. The findings of the data came up by utilizing VOSviewer states that Holstein et al. (2019) and Guilherme (2019) works were not connected with any other articles emerged under top 10 through analysis. This signifies that more connection can be developed between such prominent author to give significant contributions to research world and academia. The contributions of top authors in the top-notch journal can be referred by other to guide further practices of research. China and United States being the top influential countries can serve as learning examples for others. Jihyun Kim and Kelly Merrill works emerged as top 2 authors. Through co-occurrence analysis, people can understand that the trend of research in AI and teacher hitting teaching, ChatGPT, teacher training, self-efficacy and such other keywords, however it can be estimated what else can be the gap to be explored through research.

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