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Bibliometric Analysis using Vos Viewer with Publish or Perish of Intelligent Tutoring System in Private Universities

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ABSTRACTS

The objective of this study is to analyze the development of intelligent tutoring systems in private universities. We conducted the analysis using bibliometric methods, utilizing the Publish or Perish and VOSviewer applications. Data was obtained by using the publish or perish application with the keyword "intelligent tutoring system in private university" from the Google Scholar database from 2019 to 2024. According to search results, the number of research papers has decreased from 117 to 23 from 2020 to 2024. Mapping using VOSviewer application produces three types of visualization, namely network, overlay, and density visualization. In its conclusion, this research notes a decrease in the number of studies discussing in private universities since 2020, but still shows great potential for development by other researchers.

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1. INTRODUCTION

In private universities, the Intelligent Tutor System (ITS) has become an indispensable component of the learning environment. An ITS-customized platform enhances students' education more efficiently. By utilizing data analysis and artificial intelligence technology, Intelligent Tutor System (ITS) is able to tailor educational materials to the individual requirements and abilities of each student. For example, Intelligent Tutor System (ITS) can provide additional practice for students who struggle to comprehend specific material or further difficulty for students who have already achieved a high level of proficiency. The implementation of Intelligent Tutor System (ITS) in private universities has resulted in significant improvements in students' academic achievement and retention rates.

Intelligent Tutoring Systems (ITS) have attracted great attention in private universities environments due to their ability to provide individualized instruction and improve learning outcomes (Ma *et al.*, 2014). Research has shown that Intelligent Tutor System (ITS) can be as effective as human tutoring and other tutoring systems, and in some cases, even more effective in raising test scores and improving student performance (Kulik & Fletcher, 2016). Additionally, Intelligent Tutor System (ITS) has been recognized for its ability to provide personalized instruction tailored to each student, thereby revolutionizing online education (Mitrovic *et al.*, 2007). The integration of Intelligent Tutor System (ITS) in university collaboration information systems has been proven feasible and effective (Laaziri *et al.*, 2018). Additionally, Intelligent Tutor System (ITS) has been shown to be effective in improving students' reading comprehension and providing consistent and measurable instruction (Xu *et al.*, 2019).

The explanation above leaves room for further research on intelligent tutoring systems in private universities. Several previous studies have focused on intelligent tutoring systems in private universities, but none have analyzed research trends using a bibliometric analysis approach and mapping visualization. Presently, bibliometric analysis is often used to ascertain research trends (Nandiyanto *et al.*, 2023; Niknejad *et al.*, 2021; Kim *et al.*, 2021; Ragadhita & Nandiyanto, 2022; Suprapto *et al.*, 2021). Table 1 displays a collection of prior studies that used bibliometric analytic techniques to examine the progression or pattern of a study subject in more depth. This study aims to investigate the development of intelligent tutoring systems in private universities using bibliometric analysis methods supported by mapping analysis. To analyze this research, we used the Publish or Perish and VOSviewer applications. In addition, this study examines the advancements in research and the growth in citations in the field of intelligent tutoring systems in private universities. We utilize mapping visualizations produced by the VOSviewer application to identify keywords that frequently appear in research on intelligent tutoring systems in private universities. Data was obtained using the publish or perish application using the keyword "intelligent tutoring system in private universities" from the Google Scholar database from 2019 to 2024.

Table 1. Previous research employed bibliometric analysis to discuss research trends.

No	Subject	Data source	Range	Application	Ref
1	Intelligent Tutoring System in Army	IEEExplore, Google Schoolar, Semantic, ACM, Taylor & Francis	1993-2022	Ms. Excel, VOSviewer	Kurniawan *et al.* (2023)
2	Artificial Intelligent in Higher Education	Scopus	2012-2021	VOSviewer	Mamphosa *et al.* (2023)
3	Artificial Intelligent in Language Learning	Scopus	2017-2023	VOSviewer	Rahman *et al.* (2024)
4	Artificial Intelligent in Education	Web of Science	2001-2021	VOSviewer	Talan (2021)
5	Teaching Method using Artificial Intelligent in Education	Scopus	1978-2023	VOSviewer	Garcia *et al.* (2024)

2. METHOD

This research includes bibliometric analysis. The process consists of many steps, starting with collecting article data related to the topic "Intelligent Tutoring System in Private Universities". The data searched covered the time period from 2019 to 2024 and were collected from Google Scholar using Publish or Perish software, resulting in a total of 499 papers for analysis. Data is saved in CSV and RIS format for analysis using Microsoft Excel and VOSviewer applications. After collecting the data, the articles were screened to verify that the data were comprehensive, including examining components such as year of publication. We subsequently visualized the article data using VOSviewer and analyzed it in Microsoft Excel. Further elaboration on the procedural aspects of the analysis can be found in our previous research (Al Husaeni & Nandiyanto, 2022).

3. RESULTS AND DISCUSSION

3.1. Intelligent Tutoring System Development in Private University Publications from 2019 to 2024

Table 2 shows the results of research published between 2019 and 2024 on the topic "Intelligent Tutoring System in Private Universities" Both national and international journals have published these articles. According to statistical data, the cumulative count of research unearthed over the last five years amounts to 499 documents. The quantity of research on "Intelligent Tutoring System in Private Universities" fluctuates annually. The quantity of research articles on "Intelligent Tutoring System in Private Universities" is as stated: In 2019, there were 72 papers, accounting for 14.43% of the total. In 2020, there were 117 documents, representing 23.45% of the total. In 2021, there were 113 documents,

making up 22.65% of the total. In 2022, there were 96 documents, accounting for 19.24% of the total. In 2023, there were 78 documents, representing 15.63% of the total. Finally, in 2024, there will be 24 documents, making up 4.61% of the total.

According to the annual research document count, there has been a decrease in publications focused on "Intelligent Tutoring Systems in Private Universities" from 2020 to 2024. Fig 1 presents a graph that clearly shows the decrease in the number of articles on "Intelligent Tutoring Systems in Private Universities". Between 2019 and 2024, 2020 had the most research studies conducted on this subject, with a total of 117 documents. On the other hand, the year with the fewest number of studies was 2024, with just 23 documents. There is a regular annual drop in the quantity of papers, while there was a specific rise of around 45 documents from 2019 to 2020.

Intelligent tutoring systems (ITS) are essential in higher education since they enhance the quality of teaching and improve student learning experiences. This system provides a personalized and adaptive learning approach that caters to the unique needs and understanding of each student. By utilizing advanced technology such as artificial intelligence and data analysis, intelligent tutoring systems (ITS) can provide direct and measurable feedback to students and data analysis, helping them understand the material more efficiently. In addition, Intelligent Tutoring System (ITS) allows educational institutions to enhance their use of human resources by offering organized and effective learning methods. Furthermore, Intelligent Tutor System (ITS) helps to improve student retention rates by providing individualized and targeted educational services. Therefore, Intelligent Tutoring System (ITS) play a crucial role in enhancing the educational standards of private universities and facilitating the attainment of superior educational objectives for both students and educational institutions. Hence, the objective of this study is to provide a literature evaluation pertaining to intelligent tutoring systems in private universities.

Table 2. Report Research on "Intelligent Tutoring System in Private Universities".

Year	Documents	Percentages (%)
2019	72	14.43
2020	117	23.45
2021	113	22.65
2022	96	19.24
2023	78	15.63
2024	23	4.61
Total	**499**	**100**

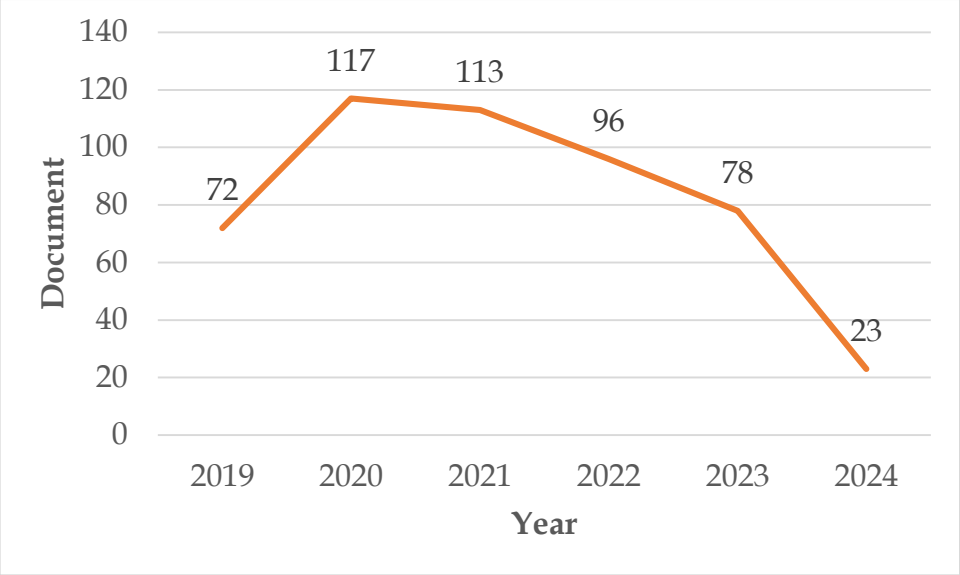

Fig. 1. Research Developments about "Intelligent Tutoring System in Private Universities"

3.2. Trend of Intelligent Tutoring System in Private Universities Research Citations 2013-2023

This study comprises 15 publications focused on intelligent tutoring systems in private universities with the most significant amount of citations. Table 3 displays the information of the articles that have received the most citations. Table 3 reveals that the work titled "Systematic review of research on artificial intelligence applications in higher education–where are the educators?" was authored by Zawacki-Richter *et al*. The most frequently referenced article in 2019 was a literature review on the use of artificial intelligence applications in higher education. It received a total of 1763 citations, with an average of 352.6 citations each year. The study by Deng *et al.* (2020) is one of the most frequently cited articles. In their study, Deng *et al*. (2020) explore the concept of Edge intelligence, which aims to address critical issues in edge computing by using widely-used and efficient AI technologies. The paper authored by Deng *et al*. (2020) has received a total of 782 citations since 2020, with an annual average of 195.5 citations. Table 3 reveals that authors from eleven different countries wrote the publications that received the highest number of citations on different test statistics. Saudi Arabia (3 articles), India (2 articles), Pakistan (2 articles), Greece (1 article), the United States (1 article), Canada (1 article), Germany (1 article), Italy (1 article), Nigeria (1 article), and South Korea (1 article).

Table 3. Disparity between intelligent tutoring systems at private universities and those with the highest number of citations.

No	Cites	Title	Year	Cites Per Year	Cites Per Author	Country	Ref
1	1763	Systematic review of research on artificial intelligence applications in higher education–where are the educators?	2019	352.6	441	Germany	Zawacki-Richter *et al.* (2019)
2	782	Edge intelligence: The confluence of edge computing and artificial intelligence	2020	195.5	156	China	Deng *et al.* (2020)
3	564	Social isolation and acceptance of the learning management system (LMS) in the time of COVID-19 pandemic: an expansion of the UTAUT model	2021	188	141	Pakistan	Raza *et al.* (2021)
4	445	Curriculum learning for reinforcement learning domains: A framework and survey	2020	111.25	89	United States	Narvekar *et al.* (2020)
5	441	Possibilities and challenges of compounding artificial intelligence in India's educational landscape	2020	110.25	441	India	Alam (2020)
6	405	Seven HCI grand challenges	2019	81	101	Greece	Stephanidis *et al.* (2019)
7	389	Students satisfaction with online learning experiences during the COVID-19 pandemic	2020	97.25	195	Saudi Arabia	Almusharraf *et al.* (2020)
8	329	Digital transformation challenges: strategies emerging from a multi-stakeholder approach	2020	82.25	66	Italia	Brunetti *et al.* (2020)
9	318	Digital response during the COVID-19 pandemic in Saudi Arabia	2020	79.5	106	Saudi Arabia	Hassounah *et al.* (2020)
10	292	E-Learning during the period of pandemic (COVID-19) in the kingdom of Saudi Arabia: an empirical study	2020	73	292	Saudi Arabia	Hoq (2020)
11	252	The impact of artificial intelligence on learner–instructor interaction in online learning	2021	84	50	South Korea	Seo *et al.* (2021)

No	Cites	Title	Year	Cites Per Year	Cites Per Author	Country	Ref
12	242	Impact of COVID-19 on the higher institutions development in Nigeria	2020	60.5	81	Nigeria	Jacob *et al.* (2020)
13	204	Impact of COVID-19 on academic activities and way forward in Indian Optometry	2020	51	51	India	Rajhans *et al.* (2020)
14	200	A review of content-based and context-based recommendation systems	2021	66.67	40	Pakistan	Javed *et al.* (2021)
15	193	Can artificial intelligence transform higher education?	2020	48.25	48	Canada	Bates *et al.* (2020)

3.3. Mapping and Visualization of Research Data Relating to Intelligent Tutoring Systems in Private Universities

The data analyzed using VOSviewer application produces three visualization formats: network visualization (Fig 2), overlay visualization (Fig 3), and density visualization (Fig 4). The network visualization reveals the presence of six distinct clusters, with a total of 82 items. We form these clusters based on the classification of phrases extracted from abstracts and keywords, which we consider related to the original keywords used during data collection. Every individual item in these clusters has unique connections, their overall strength, and the number of times they occur. To summarize, the network visualization shows a cumulative link strength of 3951, with a total of 1327 linkages. Further elaboration on each cluster is provided below:

a. Cluster 1 (red) consists of 21 items, including analysis, case study, college, effectiveness, evidence, influence, intellectual capital, participant, perfomance, present study, private university, program, public university, relationship, respondent, sample, school, student, study, university, and university student.
b. Cluster 2 (green) consists of 20 items, including addition, ai technology, artificial intelligence, assesment, education, future, innovation, instruction, intelligence, intelligent tutor, intelligent tutoring, intelligent tutoring system, its, itss, research, teacher, teaching, technology, tutor, and web.
c. Cluster 3 (blue) consists of 18 items, including application, big data, blockchain, concept, feedback, framework, implementation, information, internet, iot, learning, machine, online learning, service, support, survey, system, and term.
d. Cluster 4 (yellow) consists of 12 items, including course, data, development, intelligent, knowledge, learner, model, online, platform, private college, software, and systematic review.

e. Cluster 5 (purple) consists of 7 items, including e learning, higher education, higher education, higher education institution, lms, pedagogy, perspective, trend.

f. Cluster 6 (light blue) consists of 4 items, including benefit, private supplementary tutoring, private tutoring, and shadow education.

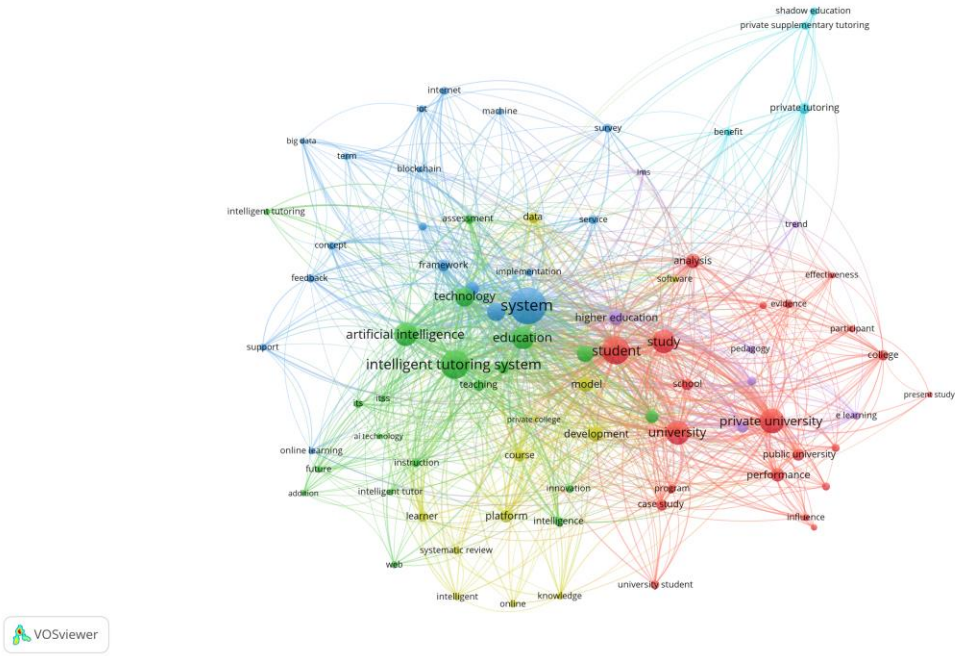

Fig. 2. Network visualization

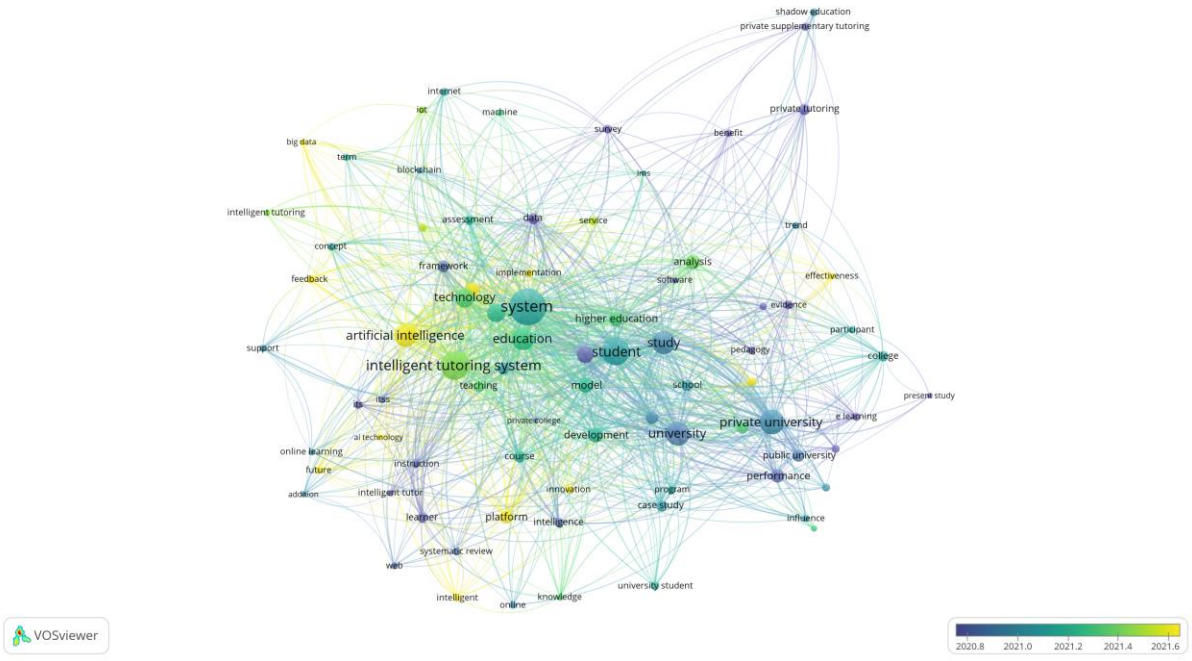

Fig. 3. Overlay visualization

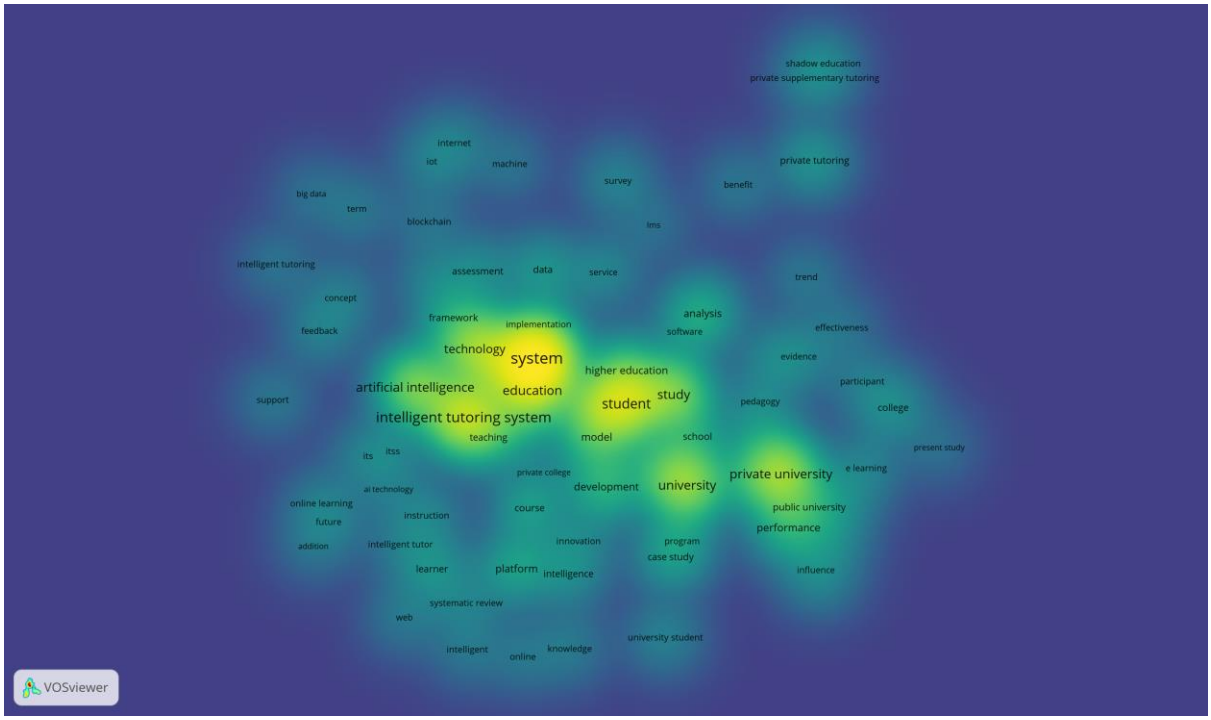

Fig. 4. Density visualization

The overlay visualization (Fig 3) displays the time range (in years) for each examined term, if cluster groups and the connections between items deemed suitable and relevant to the article search are visible in the network visualization. As an illustration, the phrase "intelligent tutoring system" is the most frequently used term in 2021, as indicated by the green overlay visualization. On the other hand, the purple color indicates a higher usage of the term "university" in 2020. Additionally, the yellow color indicates the widespread use of the phrase "artificial intelligence" in 2021. Figure 4 shows density visualization, in contrast to network and overlay views, uses color to represent the frequency of phrases. The brightness of a term's color corresponds to its frequency of use.

4. CONCLUSION

The objective of this study is to examine the progress of intelligent tutoring systems at private universities. Analysis was carried out using bibliometric methods using the Publish Or Perish and VOSviewer applications. There have been a total of 499 publications on the topic of "Intelligent tutoring systems in private universities" from 2019 to 2024. The study on "Intelligent tutoring systems in private universities" has seen a decline from 2020. In 2020, there were a record-breaking 117 articles published. The number steadily declines until 2024, with corresponding figures of 113 articles (23,45%) in 2020, 113 articles (22,65%) in 2021, 96 articles (19,24%) in 2022, 78 articles (15,63%) in 2023, and 23 articles (4,61%) in 2024. According to the bibliometric and VOSviewer analyses, it is evident that the

advancement of intelligent tutoring system technology at private universities is decreasing from 2020 to 2024. However, there is still a high probability of developing mapping and visual representations of relevant topics using VOS Viewer in clusters 4, 5, and 6. This development aims to enhance the Learning Management System (LMS) by incorporating an intelligent learning system to assess individual students' abilities, a feature currently lacking.

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