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# NEW AGE EDUCATION VIA ARTIFICIAL INTELLIGENCE: A BIBLIOMETRIC ANALYSIS

**James Kanda**

*Assistant Professor, GBS, GNA University*
*Email:- kandajames@gmail.com*

## *Abstract*

*The integration of Artificial Intelligence (AI) in education is a speedily growing arena. But for knowing the long-term outcomes, significant efforts are required to study the status of trends and their development. To study research trends in this area, a bibliometric analysis was conducted and data for the same was extracted from Scopus for the years 2010 to 2024. The data of 151 research papers extracted from Scopus was analysed using R Studio. The research offers a novel approach with a complete bibliometric study, identifying the significant authors, nations, educational institutions, sources, keywords, and journals in AI in education. The search inquiries comprise all the article's terms Artificial Intelligence", "Machine Learning", "Education", "Students", and "Learning Systems" in the title. The study discloses that research has proliferated in many countries but the United Kingdom, Australia, and India are the major research countries with maximum publications.*

***Keywords:*** *Artificial Intelligence, Education, Machine Learning, Automation, IOT, Bibliometrix, Biblioshiny, Descriptive Analysis*

## 1. INTRODUCTION

Education is vital for long-term societal expansion and conserving human potential. It is a complex and developing field that entails continuous improvement (Yu, 2024). Artificial Intelligence (AI) has appeared as a powerful force and become a fundamental constituent of modern life, touching all aspects of society, including personal and military use; the education sector is also reshaping its traditional pedagogical approaches and offering new paths for custom-made, efficient, and data-driven learning experiences with AI (Gill et al., 2024). AI refers to intelligent systems that can systematize tasks conventionally accepted by humans " and transform industries around the world . Integrating technologies in education is not just a trend but a significant change toward a more customized and accessible educational landscape (Abgaryan et al., 2023). AI technologies have been applied to the education industry throughout the last twenty years (Neha, 2020) . This expansion explores the various dimensions in which AI and ML influence education, including personalized learning, automation of administrative tasks, predictive analytics, and the promotion of educational equity (Abuhassna et al., 2024 ) Educators, academicians, and policymakers suggest that AI and ML

have the potential to refine teaching pedagogy, enhancing the customized experience and educational outcomes (Neo et al., 2022). Substantial usage of AI results in the expansion of Intelligent Tutoring Systems (ITS) by using AI systems to tailor content study material and provide personalized supervision, nurturing more engagement and learning (Ma et al., 2014). Analytical tools of AI allow educators to make educated choices, and NLP helps assist in leveling and delivering responses, dropping the load on educators (Rokade et al., 2018). It can transform the education sector by using AI and algorithms that analyze data, and identify the patterns that enable educators to enhance personal learning for each student (Farooq Khan et al., 2022). Personalized learning is AI's most effective feature, which will help to enhance students' learning and ultimately result in better outcomes (Harry, 2023). AI in education has improved college students' learning settings and interactive experiences over the years (Gill et al., 2024). AI can make education more accessible and inclusive, allowing students from diverse backgrounds to get a high-quality education (Yeruva et al., 2023).

Using AI in education is not devoid of blockades and many concerns like privacy, and the digital gap is still there, raising alarm towards impartial obtainability of AI-powered instructive tools (Jiniu, 2005). The digital gap is also a reason for not having equitable access to AI-powered education tools (Jiniu, 2005). No doubt there is a bright future for AI and ML in the education sector and it will help students and teachers (Pokrivcakova, 2019).

Following are the research questions stated to address the objectives of this paper:

- To Conduct a descriptive analysis to identify the utmost vigorous journals, authors, educational institutions, nations, and referenced publications in artificial intelligence and sustainability research.
- To Conduct a co-word investigation to identify probable sub-topics in the sector.
- To Analyse the association between writers, institutions, and countries in AI and education.

## 2. REVIEW OF STUDIES

The face of education is speedily fluctuating with developments in technology which results in a mounting demand for tailored education (Walkington & Bernacki, 2020). To meet these requirements, there is a mounting concentration on listing modified and personalized learning practices presented on request ( Fake & Dabbagh, 2020). According to ( Cropley, 2019), developing human skills like communication, creativity, and problem-solving need more than just technology and textbooks. Interactive dealings are crucial for developing societal, emotive, and intellectual skills ( Ferreira et al., 2020). Deliberation would be ended due to the effect of developing know-how like AI on student-teacher relations in online education atmospheres (Huston & Ceballos, 2023). Although AI systems can personalize learning, automate mundane tasks, and provide adaptive valuations, there is scant study on how they affect student-teacher relationships (Seo et al., 2021). Human interaction is vital in the education system (Chen, Xieling et al., 2023). Many studies indicated that students who

participated in conventional educational environments with individual interaction were able to improve their interpersonal abilities than those who relied only on AI-driven teaching. (Hughey, 2020). Soft skill development among students is more crucial for employment opportunities as companies prefer individuals with a mix of technical and soft abilities (Majid et al., 2019). As a result, teachers must be mindful of incorporating old-style ways to teach with artificial brain technology to ensure students get a holistic education that prepares them with both the soft and technical abilities essential to future success.(Li, 2022).

The impression of AI on primary education demonstrated that it can give children a tailored and fascinating learning experience. (Xu et al., 2021). However, the research indicates that the extreme reliance on AI in learning could result in a loss of pupils' creativity and critical thinking skills. When introducing artificial intelligence into the classroom, educators must be cautious and evaluate the possible undesirable consequences on students' talents (Kasneci et al., 2023) and they must evaluate the continuing influence of AI on their mental growth and safeguard that technology is used to augment rather than substitute human contact in education (Zhang et al., 2020).

## 3. RESEARCH METHODOLOGY

Scopus is a searchable database that permits you to conduct a wide-ranging search for peer-reviewed papers on artificial intelligence and education. The research study was performed on August 13, 2024. First, an analysis of the bibliography was done, with an initial investigation of the Scopus platform generating 5,117 results. The findings' mapping and occurrences were visualized in R Studio.

## 4. RESULTS DISCUSSION

Processing data in bibliometric analysis comprises both vivid and network analyses. The descriptive evaluation presents a critically important information set and addresses the key attributes of bibliographic data using institution, authorship, and analysis of documents. Networking analysis evaluates theoretical, rational, and societal networks through co-word, co-citation, and collaboration studies.

Figure 4.1 depicts a large growth in the average per year of publications on artificial intelligence in education, from two in 2015 to fifty by 2023. In this sector, the standard number of article referrals increased every year mainly in the year 2021 (Figure 4.2). As a result, we infer that the discipline is rapidly expanding.

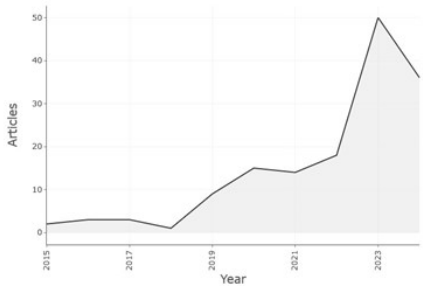

*Figure 4.1. Trends in Artificial Intelligence and Education: Annual Publications from 2015 to 2023*

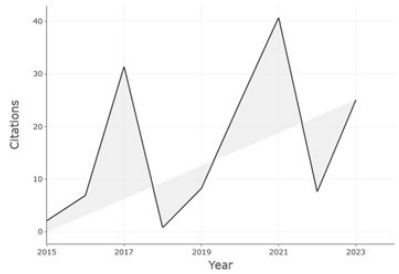


**Figure 4.2. Average annual article citations**

### *Journals that are currently active*

After determining the data sources, we noticed that the 151 documents incorporated into the study existed in around 133 journals. Figure 4.3 lists the most popular 20 journals with their total number of releases. A maximum of the papers i.e. 13 are printed in the Technology in Society, followed by the Technological Forecasting and Social Change and TEM Journal with 7 publications, Issues in Information Systems (6 publications), and Big Data and Cognitive Computing (5 publications).

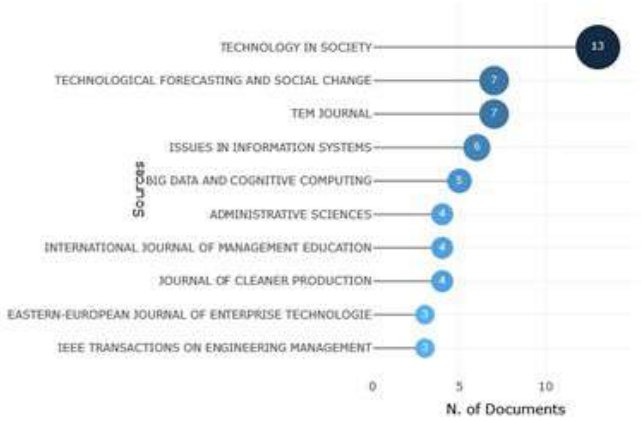


**Figure 4.3. Most pertinent sources**

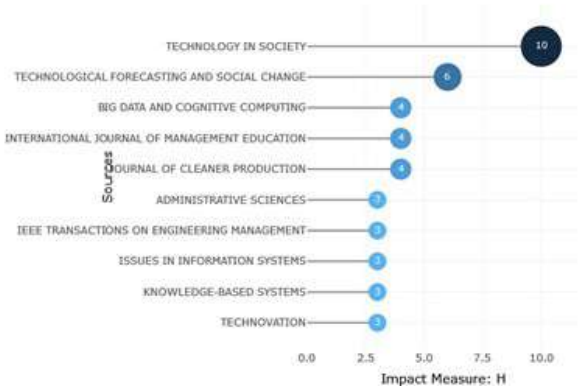


**Figure 4.4. Total Citation Index's Source Impact**

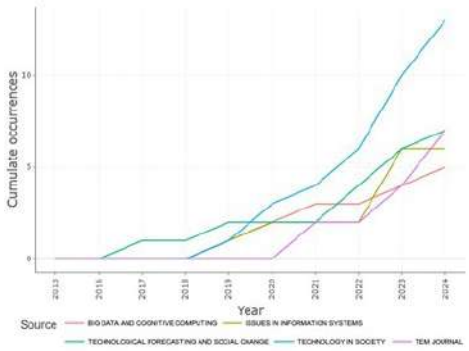


**Figure 4.5 Growth of Artificial Intelligence and Education Research from 2015 to 2024.**

The Journal of Technology in Society, Technological Forecasting, and Big Data and Cognitive Computing are the top three influential scholarly journals with h-indexes of 10, 6, and 4 indexes respectively.

Figure 4.5 shows that Big Data and Cognitive Computing, Issues in Information Systems, Technological Forecasting and Social Change, and Technology in Society are the most rapidly expanding sources in this sector.

### *Active Authors*

809 authors contributed to 864 documents. Figure 4.6 indicates the top twenty most relevant writers. Ivanov S, Luo J, and Raman R were found to be the two most prolific writers in AI and Education research, each with 3 works, followed by Ababneh M, Aljarrah A, Cheng X, Coobs C, Duan Y, Dwivedi YK, and Haleem A, each with two.

The entire h-index analysis (Figure 4.7) revealed that Ivanov S and Luo J were the most impactful authors, having the highest H index

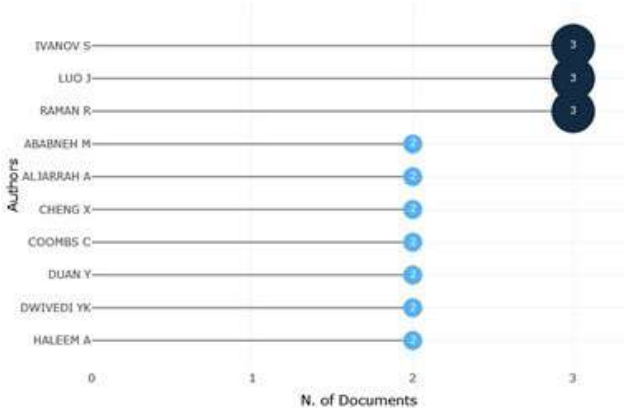


**Figure 4.6. The most relevant authors**

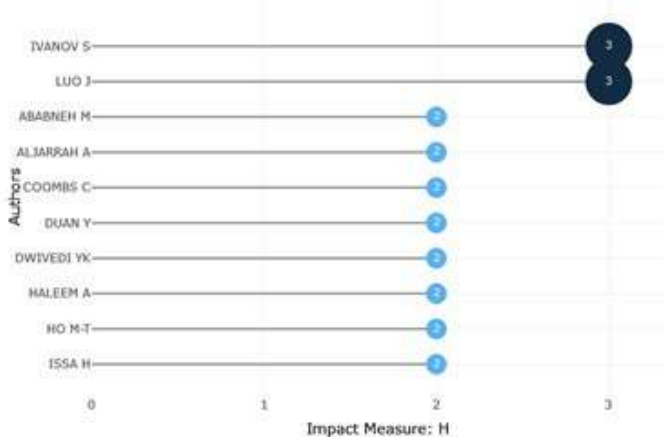


**Figure 4.7. H Index's Impact on Authors**

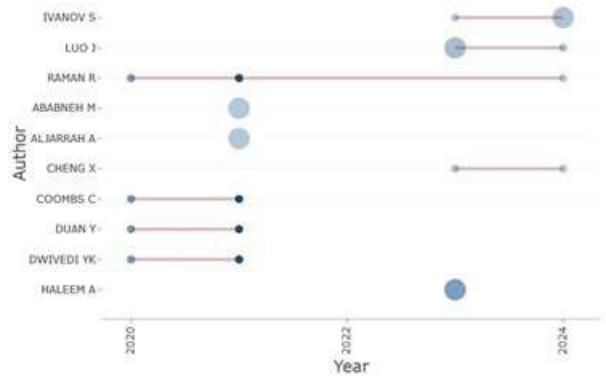


**Figure 4.8. Production of Top Authors between 2020 and 2024**

Figure 4.8 depicts the top writers' production from 2020 to 2024, with Ivanov S and Luo J leading the way.

**Countries and Active Institutions**

Depending on the number of published publications, Swansea University (12 articles) rated first, followed by Multimedia University (10 articles), Imam Abdulrahman Bin Faisal University (9 articles), Near East University (8 articles), University of Seville (7 articles), Bucharest University of Economic Studies, Universitat Politechnica De Valencia and University of Bradford (6 articles), as revealed in figure 4.9.

Looking at performance over time by association, we can see from Figure 4.10 that Swansea University was more active from 2021 to 2024, with 11 and 12 publications per year, respectively, while the University of Seville boosted its publications in 2021. Since 2022, the Multimedia University has been actively publishing on the education of artificial intelligence.

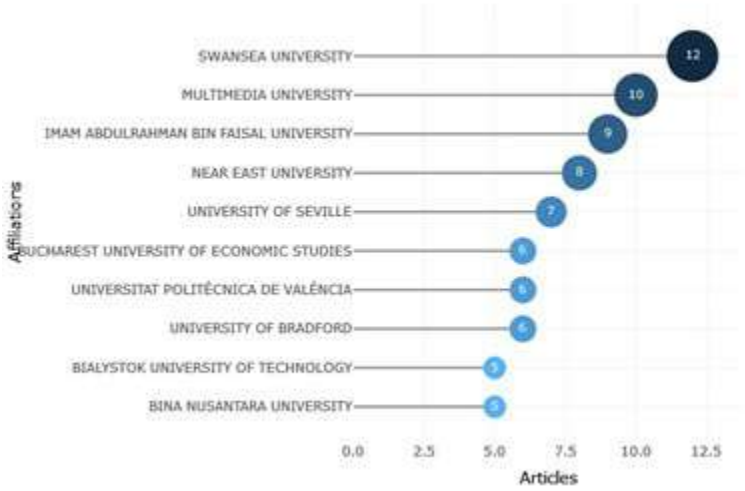


**Figure 4.9. The most relevant affiliations**

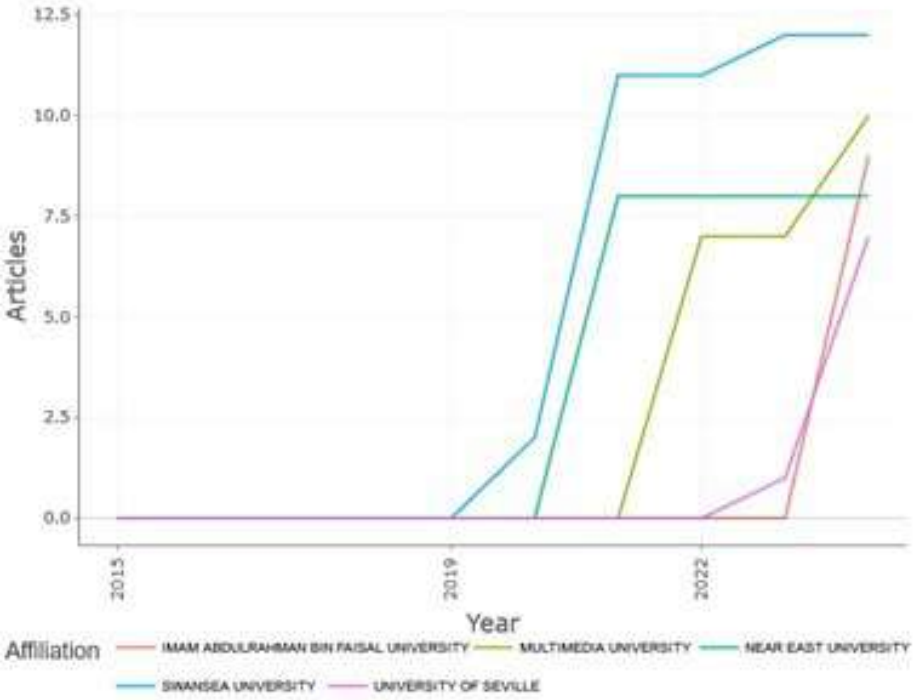


**Figure 4.10. Timeline of Affiliation Production**

The United States placed top in terms of the number of publications published (267), followed by the United Kingdom in terms of citations (2182) (figures 4.11 and 4.12).

**Figure 4.11. Country's Production throughout Time**

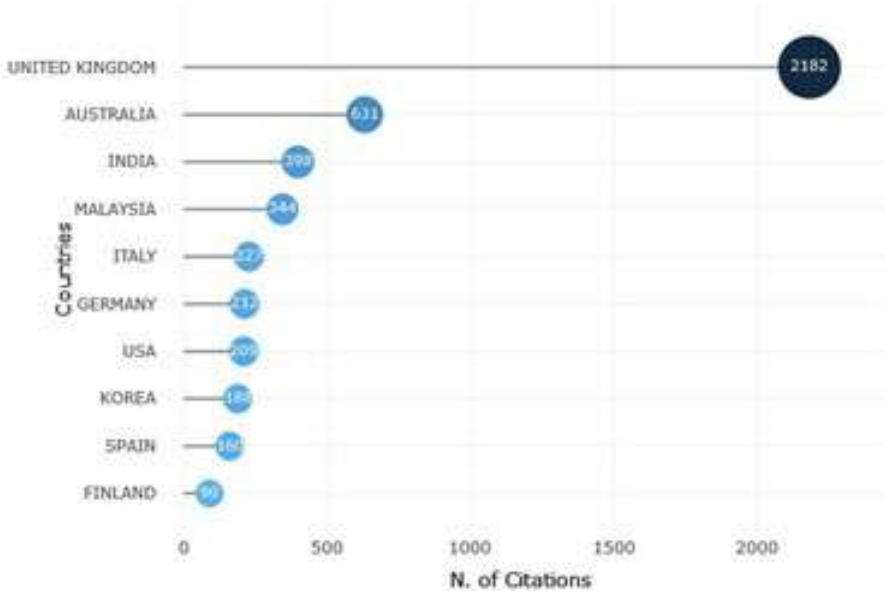


**Figure 4.12. Frequently cited countries**

**Table I Country's Scientific Production**

| Country | Frequency | Total Citations | Average Citations |
|---|---|---|---|
| USA | 283 | 209 | 34.83 |
| UK | 55 | 2182 | 242.4 |
| AUSTRALIA | 40 | 631 | 70.11 |
| INDIA | 38 | 398 | 56.86 |
| SPAIN | 29 | 160 | 20.0 |
| MALAYSIA | 18 | 344 | 68.80 |
| ITALY | 15 | 227 | 37.83 |

Every one of these countries has more than ten publications. The United Kingdom received the most citations (2182) followed by Australia (631) and India (398). Table I, which represents the country's scientific productivity, indicates that the USA contributed the most in terms of publications (267), whereas the UK scored first in terms of citations (based on average citations per article).

### *Most Widespread Documents*

The most internationally cited papers were those written by Dwivedi YK and Popenici Sad, with 1341 and 657 worldwide citations, respectively (Figure 4.13).

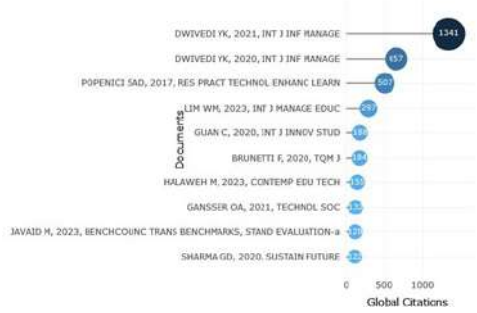


**Figure 4.13. Most Globally Cited Documents.**

## *Network Analysis*

### Co-Word Analysis

Co-word analysis examines the theoretical construction of a research field by using the most essential keywords in papers and word co-occurrence networks (Aria & Cuccurullo, 2017). The word scrutiny revealed that "artificial intelligence" was the most pertinent word, appearing 64 times, tailed by engineering education, students, decision making, education, learning system, and me. Figure 4.14 depicts machine learning.

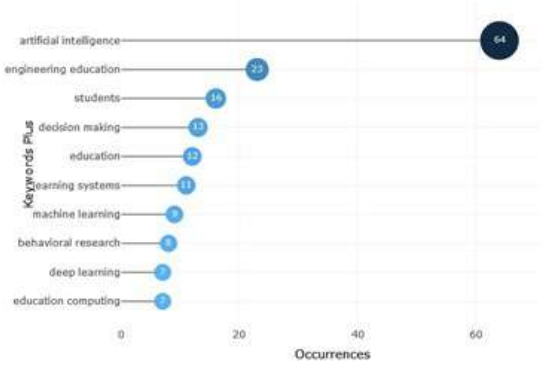


**Figure 4.14 Most Relevant Words**

It has been discovered that writers are related to numerous additional keywords, such as machine learning, higher education, learning, technology adoption, sustainable development, etc. (Figure 4.15).

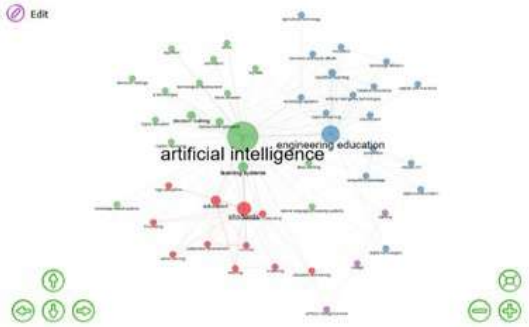

**Figure 4.15 Co-occurrence Network based on Author's Keyword**

Figure 4.16 provides more graphic evidence about the keywords; terms with greater volumes and compactness appear in a larger and more prominent position.


**Figure 4.16 World Cloud**

***Analysis of Collaboration***

It illustrates interrelationships and collaborations between different authors, institutions, and countries, as well as the societal structure. This network is made up of distinct groups of nodes that illustrate the relationships between them, meaning author/institution/country. Figure 4.17 depicts collaboration among diverse authors.

In the group with orange bumps, Sharma SK, Dwivedi YK, Raman R, Misra S, Rana NP, Duan Y, Coombs, Aarts G and Jones P collaborated. Another cluster with Purple shows Wood Da, Admas MT, Long JH, Loraas T, Cheng X, and Inger K worked together. Many more authors have also collaborated, albeit in tiny groups.

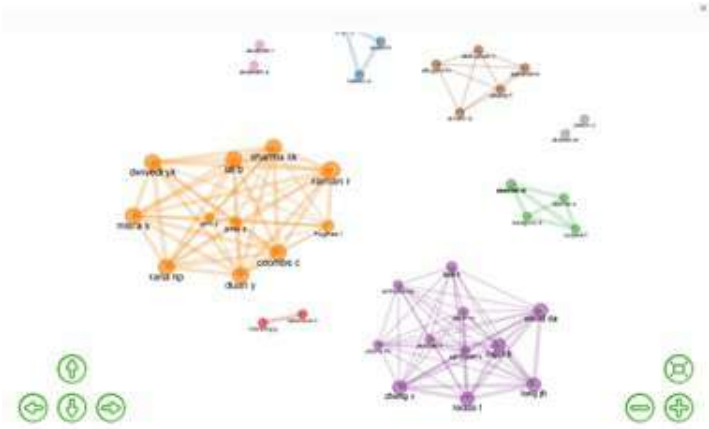

**Figure 4.17 Collaboration Network among Authors**

We constructed scientific maps of journals, authors, countries, institutions, documents, and keyword co-occurrence networks to keep track of advances in this area. According to our findings, (1) AI has expanded a great deal of attention in the education business. The significant growth in the number of publications, as well as the rising trend in the number of average article citations, suggest that experts are interested in the subject. (2) With the ongoing expansion in worldwide publication trends, AI has been a popular subject among researchers in recent years. (3) The Journal of Technology in Society and Technological Forecasting and Social Change were found to be the most active periodicals. (4) The most active authors in this theme were identified as Ivanov S, Raman R, and Luo J, with Ivanov S and Luo J's documents being the most popular. (5) The United States and United Kingdom, as well as Swansea and Near East University, made the most significant contributions to this discipline. (6) According to the collaboration analysis, many authors, institutions, and countries are working together to build the social structure, and many more are entering the sector to further develop it.

The study found that the use of artificial intelligence in education highlights the significance of this dynamic research area in industry reform and improvement. The growing number of studies on this subject indicates the scientific community's ambition to apply AI and ML technology in education.

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