Trends and Insights in Educational Technology Adoption: A Bibliometric Analysis

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Abstract: Over the past few decades, educational technology adoption has changed the lives of educators and learners. The present study unveils the current status of educational technology adoption using a bibliometric analysis of the publications retrieved from the two well-known databases, Scopus and Web of Science (WoS) using the R bibliometric package '*bibliomatrix()*'. A step-by-step process is followed to retrieve the published literature on technology adoption in higher education, viz. retrieving and shortlisting applicable articles based on well-known keywords, applying filters to extract only relevant articles, and selecting bibliometric and network mapping tools for analysis. The findings provide a deeper insight into the trends, techniques, and methodologies considered for educational technology adoption, highlighting the significance of ongoing research and development in the area. The findings stress the requirement for infrastructure support provided by the institution in addressing technology adoption concerns, especially in India.
Keywords: Technology adoption, educational technology, technology acceptance, TAM, UTAUT etc.

1. Introduction

In today's fast-paced, ever-evolving world, technology has become an essential component of many facets of our lives, revolutionizing industries, boosting productivity, and creating previously unimaginable opportunities [1, 2]. Education has not been exempt from this transformation. Over recent years, there has been a significant increase in the use of technology in education, driven by a recognition of its potential to enhance educational practices and transform teaching and learning processes [3, 4]. The term "Technology Adoption" in education refers to integrating digital tools, platforms, and resources into educational practices to improve administrative, teaching, and learning procedures. Particularly in higher education, this trend has fundamentally changed how educators teach and how students learn, driven by factors such as the demand for accessible learning experiences, advancements in digital technologies, and the need to prepare students for the modern workforce [5, 6].

One of the primary benefits of technology adoption in higher education is its ability to enhance the learning experience. By incorporating technology into teaching methodologies, educators can create more interactive and engaging learning environments. Multimedia presentations, including videos, animations, and interactive infographics, help convey complex concepts more comprehensibly, enhancing student comprehension, retention, and engagement. Additionally, technology adoption streamlines administrative processes, reducing reliance on paperwork and manual tasks, thereby increasing efficiency. The future of technology in higher education looks promising, with educators exploring new frontiers like augmented reality, virtual reality, and artificial intelligence to further enhance learning experiences and equip students with the skills needed to thrive in the digital age.

Understanding the dynamics of technology adoption in education requires a grasp of current trends and insights into emerging technologies, pedagogical approaches, and implementation strategies. Bibliometric analysis offers a systematic approach to uncovering these trends by examining patterns of scholarly communication, collaboration, and citation within the field of educational technology adoption. By quantifying these patterns, bibliometrics provides insights into knowledge dissemination and scholarly impact, helping researchers, institutions, and funding agencies assess the significance and visibility of research outputs. This study explores trends and insights through a bibliometric analysis of scholarly literature on educational technology adoption, aiming to uncover key trends, emerging topics, and influential works shaping the discourse. Using tools like VOSviewer, Biblioshiny, and Bibliometrix, this research offers valuable insights into past research output, prospective future directions, and collaborative partnerships, aiding the continuous adaptation and enhancement of educational practices through technology integration.

2. Materials and Methods

The present study deals with the literature review methodology suggested by Rowley and Slack [7], which has been widely accepted in bibliometric research [11] across various fields. The procedure involves several steps to assess the research literature on technology adoption in teaching and learning [8, 9, 10]. Initially, relevant keywords were identified to shortlist research papers. The initial dataset was then filtered to ensure the relevance of selected papers, and bibliometric and network mapping tools were chosen for the analysis. The first step involved identifying and selecting databases for the literature search, with Scopus and Web of Science-Core Collection (WoS) databases being selected for their comprehensive coverage of scholarly literature. These databases enable efficient trend analysis, citation tracking, and collaboration assessment within specific research domains. Advanced search features of these databases facilitated the identification of pertinent research based on keywords, authors, and publication dates, ensuring academic prestige and visibility.

Next, keywords were carefully selected to ensure a comprehensive search, utilizing terms like "theor*", "Model", "technolog*", "Adoption", "Acceptance", "Education*", and "Learn*". The search was conducted on March 3, 2024, covering the period from 1950 to 2024. Initial searches in Scopus and WoS yielded 456 and 314 articles, respectively, which were then narrowed to titles only. Subsequent filters included limiting to English-language articles and focusing on papers from 2000 onwards. After removing duplicates, the final dataset comprised 530 research papers from Scopus. The analysis was conducted using the R-studio bibliometric package 'Biblioshiny'. This tool enabled data retrieval, loading, conversion, and cleansing, followed by descriptive and citation analyses to reveal underlying patterns. The insights were visualized through conceptual maps, keyword clusters, co-occurrence networks, histography networks, and country-based affiliation networks, ensuring a comprehensive bibliometric analysis.

3. Results and Discussion

The main information graph visually represents key bibliometric data, offering insights into the structure, relationships, and trends within a specific research domain. It enables researchers and readers to quickly understand important information about publication outputs, citation patterns, collaboration networks, and other relevant metrics. The Figure 1 highlights a steady and significant increase in the integration and adoption of technology in higher education from 2000 to 2024. A total of 530 publications were reviewed, involving contributions from 1,344 authors affiliated with 350 different sources.
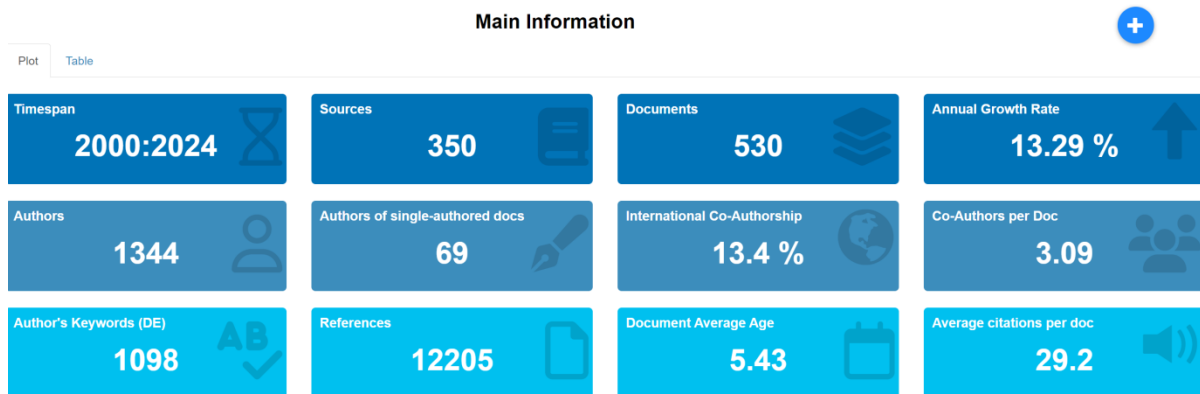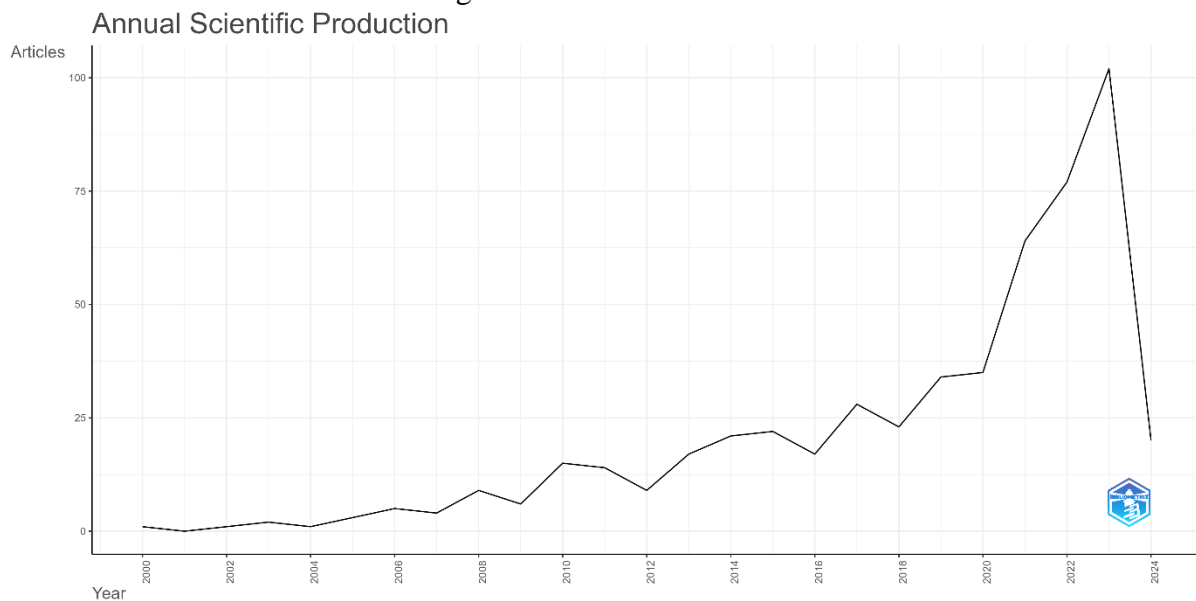

Figure 1: Main Information

Figure 2: Annual Scientific Production

The annual scientific production indicates a modest beginning, with only two publications addressing technology adoption in higher education in 2000. The figure shows a notable increase, peaking in 2023 with 103 publications. This significant rise reflects growing interest and engagement among higher education stakeholders in understanding the integration and impact of technology. Consequently, technology adoption in higher education is evolving and gaining relevance, leading to an increasing number of related publications.

Figure 3: Word Cloud

In Figure 3, the word cloud visually represents the most frequently used terms in publications on technology adoption in higher education. The terms "User acceptance," "information technology," "adoption," "perceived usefulness," "behavioral intention," and "technology acceptance model" emerge as the most commonly employed keywords in the literature. The word cloud is organized so that the size of each word corresponds to its frequency of occurrence, with the most crucial terms positioned in the middle to enhance their visibility. The deliberate disarray of the word cloud visually depicts the relative significance of individual terms according to their size and central location. This representation offers a concise and clear synopsis of the major themes present in the literature. The word cloud serves as a visual summary of the most common concepts and topics within the body of research on technology adoption in higher education, highlighting the overarching themes of "User acceptance," "information technology," "adoption," "perceived usefulness," "behavioral intention," and "technology acceptance model."
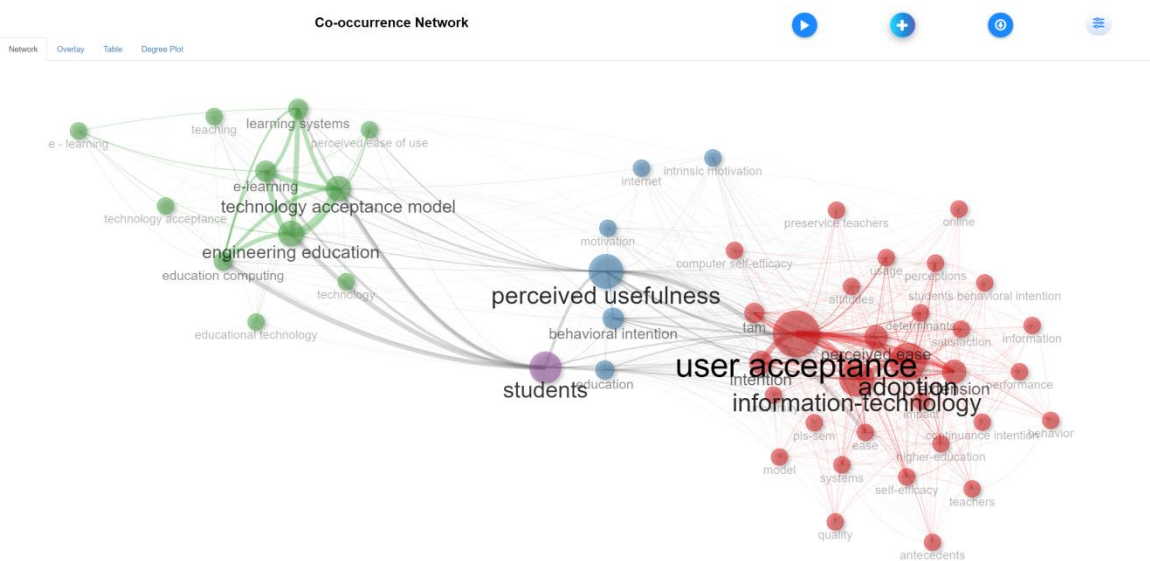

Figure 4: Co-occuerance Network

In Figure 4, a shorter distance between nodes at higher densities signifies a closer association or co-occurrence. This visual depiction provides a comprehensive view of the research landscape and the connections between key elements in the area of technology adoption in higher education. It aids researchers in identifying primary themes, recurrent concepts, and the interrelated nature of keywords. The presence of blue, red, and green nodes likely indicates different clusters or groups of related keywords within the network.
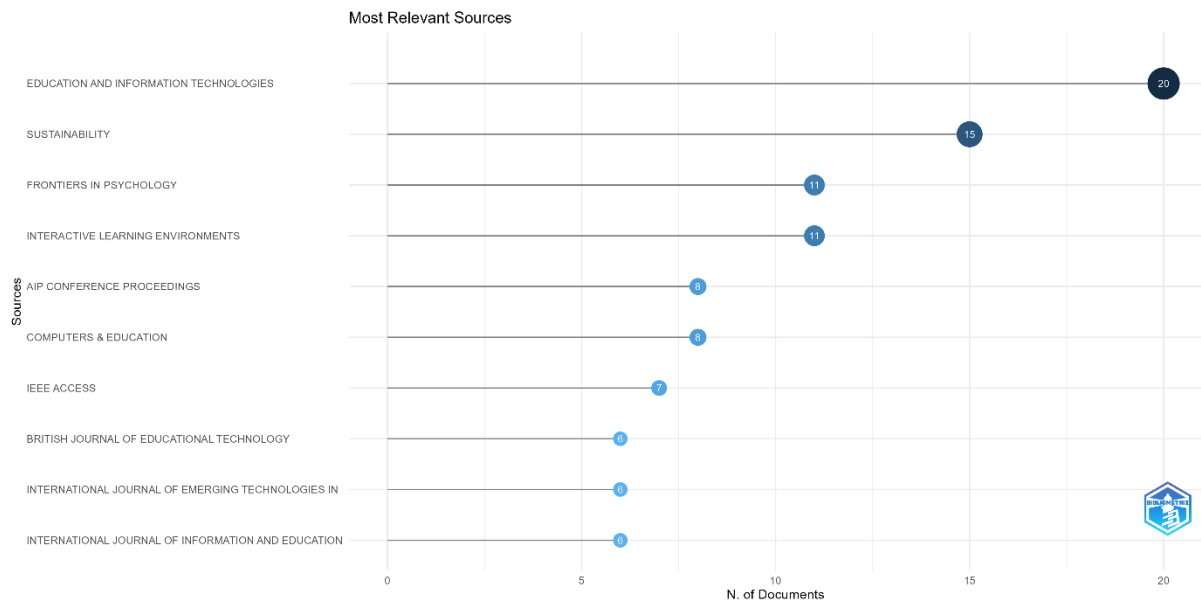

Figure 5: Most Relevant Sources

Figure 5 summarizes the research findings from the articles that were included in the study, according to the source (most relevant source, source growth, source local impact by h index, and most local cited sources). This graphic illustrates which source publishes articles about technology adoption in the most relevant way. The research included articles that were most frequently published in Education & Information Technologies (N = 20), Sustainability (N = 15), Frontiers in Technology & Interactive Learning Environments (N = 11), AIP Conference Proceedings & Computers in Education (N = 8), IEEE Access (n = 95) and other journals when the adoption of technology in education and psychology was examined. The following figure displays these journals' H index sequences.
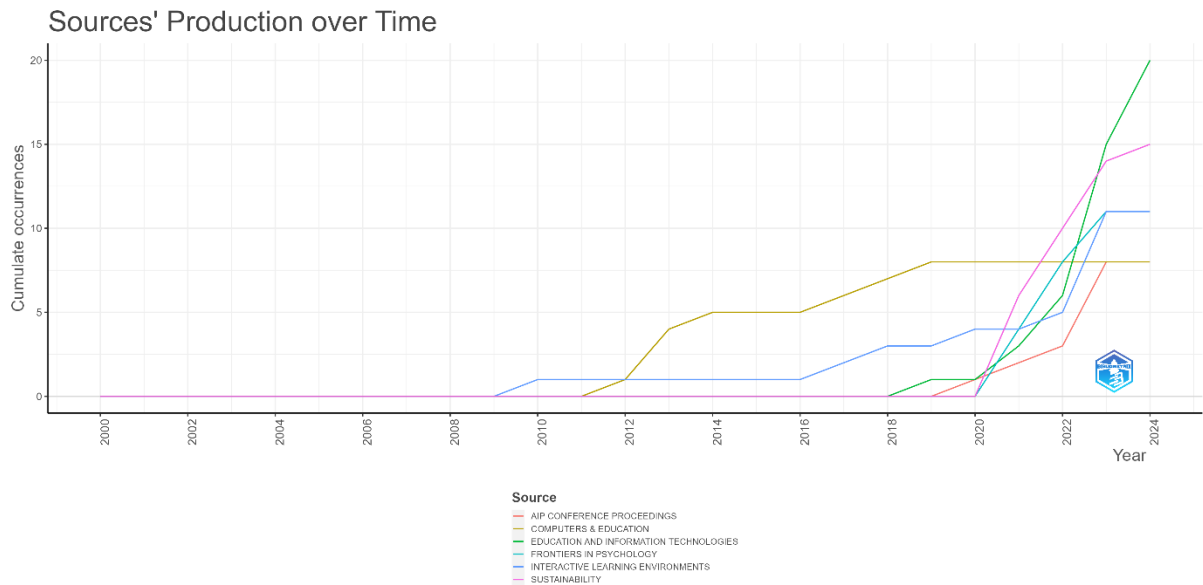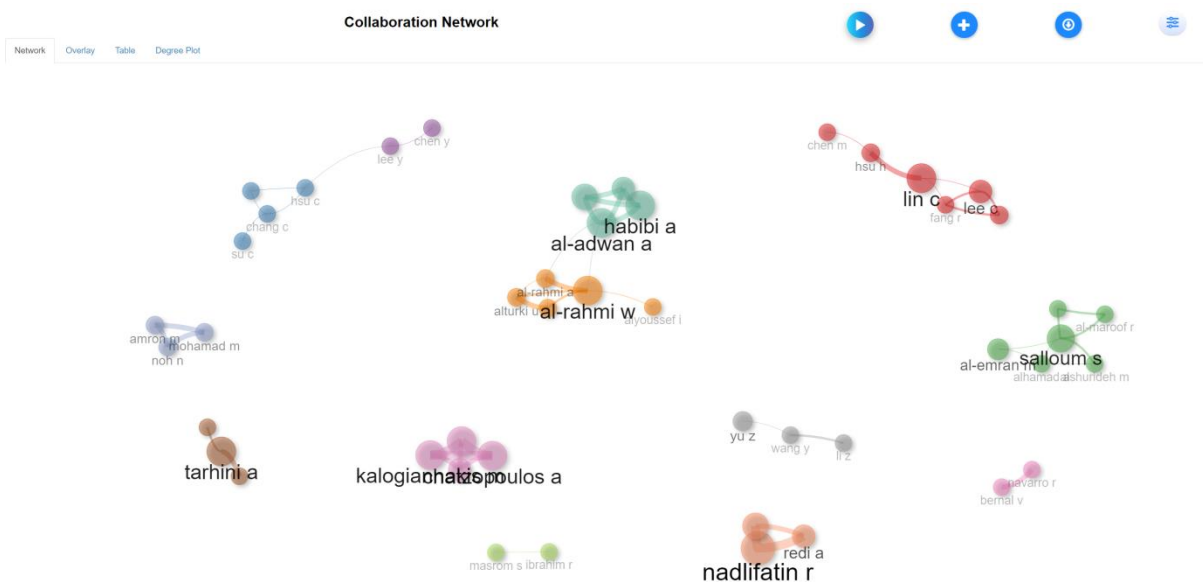
Figure 7: Source Production Over Time

Figure 8: Collaboration Network

This graph illustrates the relationships and collaborations between authors or institutions based on co-authorship or co-affiliation in scholarly publications. It visualizes the connections between entities and highlights collaboration patterns within the field of technology adoption. The figure showcases the collaboration network, revealing distinct and identifiable groups. This approach was selected to avoid the complexity that would arise if a larger word cloud were used, which would include a much greater number of individual authors, making the network too intricate to understand.

Conclusion

In conclusion, this bibliometric analysis has provided valuable insights into the trends and patterns of educational technology adoption over time. Through the examination of a wide range of scholarly articles, we have identified key themes, influential authors, and emerging areas of interest within the field. Our findings highlight the increasing importance of

technology in education and its transformative impact on teaching and learning practices. It is crucial to remain vigilant of these trends to harness the potential of educational technology for the benefit of learners worldwide. Educators, researchers, and policymakers must collaborate to develop innovative ways to leverage educational technology effectively. Staying informed and adaptive will ensure that our educational systems remain current with the rapidly changing technological landscape, thereby enhancing learning experiences and outcomes for students.

Acknowledgments

References

1. Garza-Reyes, J. A. (2015). Lean and green–a systematic review of the state of the art literature. Journal of cleaner production, 102, 18-29.
2. Ahmi, A. (2022). Bibliometric analysis using R for non-coders. Malaysia. mechanism. Journal of Family Business Management, 12(1), 67-89.
3. Oyewola, D. O., & Dada, E. G. (2022). Exploring machine learning: a scientometrics approach using bibliometrix and VOSviewer. SN Applied Sciences, 4(5), 143.
4. Moral-Muñoz, J. A., Herrera-Viedma, E., Santisteban-Espejo, A., &Cobo, M. J. (2020). Software tools for conducting bibliometric analysis in science: An up-to-date review. Profesional de la información/Information Professional, 29(1).
5. Donthu, N., Kumar, S., Mukherjee, D., Pandey, N., & Lim, W. M. (2021). How to conduct a bibliometric analysis: An overview and guidelines. Journal of business research, 133, 285-296.
6. AlRyalat, S. A. S., Malkawi, L. W., & Momani, S. M. (2019). Comparing bibliometric analysis using PubMed, Scopus, and Web of Science databases. JoVE (Journal of Visualized Experiments), (152), e58494.
7. Rowley, J., & Slack, F. (2004). Conducting a literature review. Management research news, 27(6), 31-39.
8. Mahadevan, K., & Joshi, S. (2022). Omnichannel retailing: a bibliometric and network visualization analysis. Benchmarking: an international journal, 29(4), 1113-1136.
9. Pinto dos Santos, D., Giese, D., Brodehl, S., Chon, S. H., Staab, W., Kleinert, R., ...&Baeßler, B. (2019). Medical students' attitude towards artificial intelligence: a multicentre survey. European radiology, 29, 1640-1646.
10. Falagas, M. E., Pitsouni, E. I., Malietzis, G. A., & Pappas, G. (2008). Comparison of PubMed, Scopus, web of science, and Google scholar: strengths and weaknesses. The FASEB journal, 22(2), 338-342.
11. Aria, M., &Cuccurullo, C. (2017). bibliometrix: An R-tool for comprehensive science mapping analysis. Journal of informetrics, 11(4), 959-975.