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Mapping Research Trends in Virtual Teaching in Higher Education: A Bibliometric Review

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ABSTRACT

Virtual teaching has become a prominent mode of instructional delivery in higher education, particularly for sustaining learning during periods of disruption. In recent years, its relevance has extended beyond emergency contexts, as institutions increasingly recognize its potential for enhancing accessibility, flexibility, and sustainability in education. The present study reviews existing research on virtual teaching in higher education to identify dominant research trends and emerging areas for future investigation. A bibliometric analysis was conducted using publications indexed in the Scopus database between 2012 and 2023. The analysis examined key themes, influential authors, publication sources, citation patterns, and collaborative networks using VOSviewer. From an initial dataset of 5,663 publications, 2,635 peer-reviewed journal articles and conference papers were selected for detailed analysis. The findings provide a comprehensive quantitative overview of the evolution of virtual teaching research and reveal six interconnected thematic clusters representing technological, pedagogical, institutional, and learner-centred dimensions. Overall, the study highlights virtual teaching as a pathway towards sustainable and inclusive higher education by democratizing access to knowledge and learning opportunities.

1. INTRODUCTION

Virtual teaching has gained substantial momentum in the higher education sector due to its capacity to ensure continuity of learning during disruptive situations such as pandemics, natural disasters, and socio-political crises. However, its growing adoption in non-disruptive contexts reflects a broader shift towards technology-enabled and learner-

centered educational ecosystems (Dung, 2020). Traditional brick-and-mortar models of education are increasingly challenged by issues of limited access, inflexible schedules, escalating costs, and outdated pedagogical practices. Consequently, higher education institutions are exploring alternative instructional approaches that respond to the evolving needs of contemporary learners (Dlamini & Ndzinisa, 2020).

Virtual teaching offers a viable solution by enabling flexible learning pathways, personalised instruction, and wider access to educational resources. Research indicates that technology-mediated instruction supports diverse learning preferences and promotes inclusive participation across geographical and cultural boundaries (Bond et al., 2024). Rather than serving merely as a temporary response to crises, virtual teaching has emerged as a pedagogical approach that integrates digital technologies with innovative instructional strategies to enhance student engagement and learning outcomes (Yu & Zhou, 2024).

Global trends such as increasing enrolments, the demand for lifelong learning, and the need to educate learners in remote or underserved contexts further emphasize the relevance of virtual teaching. Nevertheless, effective implementation requires sustained investment in digital infrastructure, professional development for educators, high-quality online course design, and institutional policies that address issues of equity and the digital divide (Rana et al., 2024). When supported by appropriate pedagogical frameworks and strategic leadership, virtual teaching has the potential to transform higher education by fostering equitable and meaningful learning experiences.

Despite its advantages, challenges related to technological access, digital literacy, and the maintenance of social interaction in online environments remain significant. Addressing these challenges necessitates systematic research to understand the evolving landscape of virtual teaching. A bibliometric review provides a structured approach to mapping existing scholarship, identifying influential contributions, and revealing research gaps. Such an analysis can inform future research agendas and policy decisions aimed at strengthening the integration of virtual teaching in higher education (Makda, 2025).

Virtual Teaching

Virtual teaching refers to a mode of instructional delivery that utilises digital technologies to facilitate teaching and learning in synchronous or asynchronous formats. It typically involves the use of online platforms, video-conferencing tools, and learning management systems to support

interaction, content delivery, and assessment in higher education contexts (Amiti, 2020; Grammens et al., 2022).

One of the primary affordances of virtual teaching is its flexibility, allowing learners to access course materials independent of time and location (Shonhe et al., 2023). This flexibility accommodates diverse learning styles and enables students to manage academic responsibilities alongside personal and professional commitments. Such features are particularly beneficial for non-traditional learners, working professionals, and students with family responsibilities (Remenick, 2019). Furthermore, virtual teaching environments promote inclusivity by enabling participation from learners across varied geographical regions, thereby fostering global learning communities (Paudel, 2021).

Virtual teaching also facilitates access to a wide range of multimedia and interactive resources that support active and collaborative learning. Digital tools such as simulations, discussion forums, and gamified activities enhance student engagement and encourage learner autonomy (Shonhe et al., 2023). The integration of advanced technologies, including artificial intelligence-supported adaptive learning systems, further enables personalised feedback and tailored learning pathways, contributing to improved learning outcomes (Essel et al., 2022; Yu & Zhou, 2024).

Although challenges related to digital equity, infrastructure, and meaningful human interaction persist, the benefits of virtual teaching in higher education are substantial. By expanding access to knowledge and supporting learner-centred pedagogies, virtual teaching contributes to a more accessible, flexible, and inclusive educational environment. As digital education continues to evolve, virtual teaching is expected to play a central role in shaping the future of higher education (Bond et al., 2024; Vlachopoulos & Makri, 2017).

2. METHODOLOGY

Research Design

The present study adopted a bibliometric research design, which is widely used to examine the intellectual structure, research trends, and publication patterns within a specific academic field. Bibliometric analysis enables a systematic and objective evaluation of large volumes of scholarly literature through quantitative techniques, making it particularly suitable for mapping the evolution of research domains such

as virtual teaching in higher education (Donthu et al., 2021; Makda, 2025).

Data Source and Search Strategy

The data for the study were retrieved from the Scopus database, which is recognised for its comprehensive coverage of peer-reviewed journals and conference proceedings across disciplines. Scopus is frequently used in bibliometric studies due to its reliability, consistency, and advanced analytical features (Elsevier, 2023). A structured search was conducted using relevant keywords such as "virtual teaching," "online teaching," "digital learning," and "higher education." The search was limited to publications between 2012 and 2023 to capture the longitudinal growth and development of research in this area.

Selection Criteria

To ensure the quality and relevance of the dataset, only peer-reviewed journal articles and conference papers published in English were included. Editorials, book chapters, notes, and non-scholarly documents were excluded. After applying inclusion and exclusion criteria and removing duplicates, a total of 2,635 publications were selected from an initial pool of 5,663 records for final analysis. This filtering process enhanced the validity and consistency of the bibliometric findings (Zupic & Čater, 2015).

Data Analysis Tools and Techniques

The selected bibliographic data were exported in compatible formats and analysed using VOS viewer, a specialised software tool designed for constructing and visualising bibliometric networks (Pokhrel & Chhetri, 2021). VOSviewer was employed to conduct co-authorship analysis, co-occurrence of keywords, citation analysis, and co-citation analysis, which helped identify influential authors, dominant themes, collaborative patterns, and research clusters within the field (Van Eck & Waltman, 2010). Network visualisations were generated to interpret relationships among key variables and to reveal the conceptual structure of virtual teaching research in higher education.

3. RESULTS

Growth of Publications

The bibliometric analysis revealed a steady increase in research output on virtual teaching in higher education over the selected time period. While early publications were limited in number, a sharp rise was observed after 2020, coinciding with the global shift towards online and virtual modes of instruction during the COVID-19 pandemic. This surge reflects heightened academic interest in understanding the pedagogical, technological, and institutional dimensions of virtual teaching (Rana et al., 2024; Makda, 2025).

Keyword Co-occurrence Analysis

The keyword co-occurrence analysis identified several frequently used terms, including "virtual teaching," "online learning," "higher education," "e-learning," "student engagement," and "digital pedagogy." Based on their relationships and frequency of occurrence, the keywords were grouped into six interconnected thematic clusters. These clusters represented core research areas such as instructional technologies, teaching–learning strategies, learner engagement, institutional readiness, assessment practices, and emerging digital innovations. The presence of interlinked clusters indicates the multidisciplinary and evolving nature of virtual teaching research (Bond et al., 2024).

Influential Authors and Sources

Citation analysis highlighted a small group of authors and journals that have made significant contributions to the field. High-impact journals such as Education and Information Technologies, Computers & Education, and Educational Technology Research and Development emerged as leading publication sources. The concentration of citations within these journals suggests their central role in shaping scholarly discourse on virtual teaching in higher education (Yu & Zhou, 2024; Makda, 2025).

Collaboration Networks

The co-authorship analysis demonstrated increasing levels of international collaboration, with researchers from multiple countries contributing jointly to publications. Such collaborative patterns reflect the global relevance of virtual teaching and the shared challenges faced by higher education systems worldwide. However, the analysis also indicated that research output is concentrated in a limited number of regions, highlighting the need for greater representation from developing and under-researched contexts (Rana et al., 2024).

Emerging Research Trends

Recent publications emphasised themes such as artificial intelligence-supported learning environments, student engagement in virtual classrooms, digital equity, and post-pandemic hybrid teaching models. These emerging themes suggest a shift from emergency remote teaching towards more sustainable and pedagogically grounded virtual teaching practices. The growing focus on learner-centred and technology-enhanced approaches reflects the maturation of the research field (Bond et al., 2024; Yu & Zhou, 2024).

4. DISCUSSION

The findings of the present bibliometric analysis provide important insights into the evolution and current state of research on virtual teaching in higher education (Ewing, 2021). The steady growth in publications, particularly after 2020, highlights the increasing academic and institutional attention given to virtual teaching as a response to global disruptions and as a long-term pedagogical strategy. This surge aligns with earlier observations that the COVID-19 pandemic acted as a catalyst for accelerating digital transformation in higher education worldwide (Rana et al., 2024).

The identification of six interconnected thematic clusters suggests that research on virtual teaching is multidimensional in nature, encompassing technological infrastructure, pedagogical practices, learner engagement, institutional readiness, assessment strategies, and emerging digital innovations (Chamorro-Atalaya, 2021). These findings reinforce the argument that effective virtual teaching extends beyond the mere adoption of digital tools and requires an integrated approach that combines technology with sound pedagogical design (Bond et al., 2024). The prominence of keywords related to student engagement and digital pedagogy indicates a growing emphasis on learner-centred approaches rather than technology-driven instruction alone.

The citation and source analysis further revealed that a limited number of high-impact journals and authors dominate scholarly discourse in this field. Journals such as Education and Information Technologies and Computers & Education have played a pivotal role in shaping research directions, suggesting a consolidation of knowledge within specialised publication outlets. While this concentration contributes to theoretical coherence, it may also limit the diversity of perspectives, particularly from underrepresented regions and educational contexts (Makda, 2025).

Collaboration network analysis demonstrated an increasing trend towards international research partnerships, reflecting the global relevance of virtual teaching. However, the uneven geographical distribution of research output points to the need for greater inclusion of studies from developing countries, where challenges related to infrastructure, digital equity, and access remain pronounced. Addressing these gaps is essential for developing context-sensitive models of virtual teaching that are applicable across diverse educational systems (Fernández-Batanero et al., 2022; Chi & Oanh, 2023).

Emerging research themes such as artificial intelligence-supported learning, hybrid instructional models, and digital equity suggest a shift in focus from emergency remote teaching to more sustainable and pedagogically informed virtual learning environments. This transition reflects the maturation of the research field. It underscores the need for future studies to move beyond descriptive analyses towards examining the effectiveness, quality, and long-term impact of virtual teaching practices on student learning outcomes (Yu & Zhou, 2024).

5. CONCLUSION

The present study provides a comprehensive bibliometric overview of research on virtual teaching in higher education, highlighting key trends, influential contributions, and emerging research directions. The findings demonstrate that virtual teaching has evolved from a crisis-driven necessity into a central component of contemporary higher education systems. By synthesizing a large body of scholarly work, the study offers valuable insights into the conceptual structure and evolution of research on virtual teaching over time. From an educational perspective, the results emphasize the importance of adopting a holistic approach to virtual teaching that integrates technological infrastructure with pedagogically sound instructional practices. Higher education institutions should prioritize professional development programmes that equip educators with the skills required to design engaging and inclusive virtual learning environments. Additionally, investments in digital infrastructure and institutional support mechanisms are critical to addressing issues related to access, equity, and quality in virtual education. The study also highlights the need for policy-level interventions that promote sustainable and inclusive virtual teaching practices. Policymakers and institutional leaders should focus on developing frameworks that support blended and hybrid learning models while ensuring that digital divides do not exacerbate existing educational inequalities. Furthermore, the growing emphasis on learner-centred and AI-supported instructional approaches calls for ethical and pedagogical considerations to guide their effective implementation. Despite its

contributions, the study is limited by its reliance on a single database and English-language publications, which may exclude relevant research from other sources and regions. Future research could expand the scope by incorporating multiple databases, longitudinal impact studies, and qualitative analyses to gain deeper insights into teaching practices and learner experiences. Overall, the findings reaffirm the transformative potential of virtual teaching in higher education and provide a strong foundation for advancing research, policy, and practice in digital education.

6. REFERENCE

- Amiti, F. (2020). Synchronous and asynchronous E-learning. European Journal of Open Education and E-Learning Studies, 5(2). https://doi.org/10.46827/ejoe.v5i2.3313
- Bond, M., et al. (2024). Digital transformation and pedagogical innovation in higher education. Computers & Education.
- Chamorro-Atalaya, O., Morales-Romero, G., Quispe-Andía, A., Trinidad-Loli, N., Caycho-Salas, B., León-Velarde, C., & Gamarra-Mendoza, S. (2021). Distance education and student satisfaction regarding the pedagogical support services provided in virtual teaching-learning environments. International Journal of Emerging Technologies in Learning (IJET), 16(20), 255–262.
- Chi, D. P., & Oanh, D. T. K. (2023). Proposing a process for training online teaching competence for lecturers at higher education institutions. Journal of Education and e-Learning Research, 10(3), 502–512. https://doi.org/10.20448/jeelr.v10i3.4893
- Dlamini, R., & Ndzinisa, N. (2020). Universities trailing behind: Unquestioned epistemological foundations constraining the transition to online instructional delivery and learning. South African Journal of Higher Education, 34(6), 52–64.
- 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. https://doi. org/10.1016/j.jbusres.2021.04.070
- Dung, D. T. H. (2020). The advantages and disadvantages of virtual learning. IOSR Journal of Research & Method in Education, 10(3), 45–48.
- Essel, H. B., Vlachopoulos, D., Tachie-Menson, A., Johnson, E. E., & Baah, P. K. (2022). The impact of a virtual teaching assistant (chatbot) on students' learning in Ghanaian higher education. International Journal of Educational Technology in Higher Education, 19(1), 1–19.
- Ewing, L. A. (2021). Rethinking higher education post COVID-19. The future of Service Post-COVID-19 Pandemic (Vol. 1, pp. 37–54). Rapid Adoption of Digital Service Technology.
- Fernández-Batanero, J. M., Montenegro-Rueda, M., Fernández-Cerero, J., & García-Martínez, I. (2022). Digital competences for teacher professional development. Systematic review. European Journal of Teacher Education, 45(4), 513–531.
- Grammens, M., Voet, M., Vanderlinde, R., Declercq, L., & De Wever, B. (2022). A systematic review of teacher roles and competences for teaching synchronously online through videoconferencing technology. Educational Research Review, 37, 100461.
- Makda, F. (2025). Digital education: Mapping the landscape of virtual teaching in higher education – a bibliometric review. Education and Information Technologies.
- Paudel, P. (2021). Online education: Benefits, challenges and strategies during and after COVID-19 in higher education. International Journal on Studies in Education (IJonSE), 3(2).

- Pokhrel, S., & Chhetri, R. (2021). A literature review on impact of COVID-19 pandemic on teaching and learning. Higher Education for the Future, 8(1), 133–141.
- Rana, N. P., et al. (2024). Online and virtual learning ecosystems in post-pandemic higher education. International Journal of Educational Technology in Higher Education.
- Remenick, L. (2019). Services and support for nontraditional students in higher education: A historical literature review. Journal of Adult and Continuing Education, 25(1), 113–130.
- Shonhe, L., Jain, P., & Akakandelwa, A. (2023). Students' experiences with the utilisation of the 4IR tech nologies in online learning: A case study of institutions of higher learning in Botswana and Zambia.
- Vlachopoulos, D., & Makri, A. (2017). The effect of games and simulations on higher education: A sys tematic literature review. International Journal of Educational Technology in Higher Education, 14(1), 1–33
- Van Eck, N. J., & Waltman, L. (2010). Software survey: VOSviewer. Scientometrics.
- Yu, Z., & Zhou, M. (2024). Student engagement in AI-supported virtual learning environments. Educational Technology Research and Development.
- Zupic, I., & Čater, T. (2015). Bibliometric methods in management research. Organizational Research Methods.