

Artificial Intelligence and the Future of Learning: A Research-Based Perspective on Higher Education

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ABSTRACT

This study aimed to explore the evolving role of Artificial Intelligence (AI) in higher education through a comprehensive bibliometric analysis. Using the Scopus database and the PRISMA method, 464 documents published between 2010 and 2025 were systematically identified and analyzed to uncover key trends, thematic developments, and research gaps. Biblioshiny-R was employed to visualize thematic maps, thematic evolution, and trend topics. The findings revealed a significant annual growth rate of 34.15% in AI-related publications, increasing international collaboration and emphasizing user-centric themes such as adaptive learning, trust in AI, and ethical considerations. Traditional frameworks like the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT) remained influential but required expansion to address regulatory and social dimensions. Thematic mapping highlighted underexplored areas in AI ethics and governance, indicating a need for integrative and interdisciplinary approaches. This research provided valuable insights for policymakers, educators, and researchers by delineating established and emerging directions in AI integration, informing strategic planning, and responsible adoption in higher education.

Keywords: Artificial Intelligence, Bibliometric, Higher Education, Scopus, Prisma

1. INTRODUCTION

The rapid evolution of artificial intelligence (AI) technologies has dramatically reshaped multiple sectors, with higher education emerging as a critical domain for their application. In recent years, studies have increasingly focused on how AI can transform learning processes and academic management, as evidenced by a surge of bibliometric analyses that map the intellectual structure of AI research in education (Hinojo-Lucena et al., 2019; Kaban, 2023; Li & Wong, 2023; Prahani et al., 2022; Talan, 2021). This phenomenon reflects growing academic and practical interest in integrating AI-driven tools and personalized learning systems to enhance educational outcomes.

Despite this upsurge, a clear research problem persists: understanding the nuanced dynamics between AI advancements and the future trajectory of learning in higher education. Previous investigations have primarily addressed AI in specific educational contexts, such as computational thinking (Prahani et al., 2022; Talan, 2021) or personalized learning environments (Li & Wong, 2023) while others have provided comprehensive overviews of AI applications globally within higher education (Li & Rohayati, 2025); However, these studies often focus on isolated clusters, such as intelligent tutoring systems or adaptive learning technologies, without holistically considering the future implications for higher educational practices at large (Li & Wong, 2023; Li & Rohayati, 2025). Moreover, while prior research has documented technological trends and methodological approaches, there remains a gap in synthesizing these insights to outline a unified path forward for higher education in an era increasingly dominated by AI advances (Kavitha et al., 2024).

The disruptive influence of generative AI tools such as ChatGPT is highlighted. These tools reshape traditional teaching methods while necessitating structured curricular strategies to enhance AI literacy among educators and learners (Lin, 2024; Ray, 2023). Thus, synthesizing past findings and emerging trends, researchers advocate for coherent, ethically grounded strategies that harness AI's capabilities while addressing its multifaceted challenges (Lin, 2024; Ray, 2023).

Furthermore, research demonstrates that AI-driven tools can automate assessments and customize instruction to individual learner needs, enhancing academic performance and engagement (Grassini, 2023; Thong et al., 2023). These advances, however, also raise important ethical, social, and logistical challenges, emphasizing the necessity for

responsible AI integration and robust teacher training programs (Eden et al., 2024; Tapalova & Zhiyenbayeva, 2022). The current body of evidence collectively underscores that while AI promises significant educational benefits, its practical implementation requires a balanced approach that combines technological innovation with careful consideration of ethical and pedagogical imperatives ((Eden et al., 2024; Grassini, 2023).

Prior work has extensively examined AI's transformative role in education by exploring intelligent tutoring systems, data-driven assessments, personalized learning, and administrative efficiency (Al-Badi et al., 2022; Anuyahong et al., 2023; Lin, 2024; Pratama et al., 2023). Comprehensive reviews articulate the promises and challenges of integrating AI, prompting institutions to reevaluate curriculum design, faculty development, and technological infrastructure (Ray, 2023). Emerging studies reveal a gap in synthesizing these fragmented insights into a unified framework that addresses ethical dilemmas and sustainable implementation practices (Tapalova & Zhiyenbayeva, 2022).

Addressing this research gap represents the novelty of the current study. Unlike previous literature that has examined discrete aspects of AI in education, this research adopts a research-based perspective that integrates bibliometric analysis to delineate trends, challenges, and opportunities for AI implementation in higher education. By leveraging data from the Scopus database and employing systematic mapping and co-citation techniques, the study aims to comprehensively visualize how AI technologies are reshaping educational paradigms (Kavitha et al., 2024; Li & Rohayati, 2025). In doing so, it will highlight the evolution of AI-related research and offer evidence-based insights into the potential disruptive forces that may redefine teaching, learning, and institutional management in higher education.

Thus, the primary purpose of this study is to illuminate the evolving landscape of AI in higher education through a rigorous bibliometric analysis. It seeks to merge insights from previous studies with emerging trends, offering stakeholders—ranging from policymakers to academic practitioners—a research-based perspective on harnessing AI for future educational innovations.

2. METHODOLOGY

This study employed a systematic, transparent, reproducible methodology to map the research landscape on artificial intelligence (AI) adoption in higher education. The methodology is structured into three interconnected stages: data sourcing, selection, and analysis (Aria & Cuccurullo, 2017). The Scopus database was identified as the primary data source due to its extensive coverage and scholarly reliability, ensuring the inclusion of high-quality publications such as journals, conference proceedings, books, and book chapters. This robust selection of academic outputs facilitates a comprehensive analysis of pioneering and emerging scholarship (Zhao et al., 2024). The strategic use of Scopus reflects current trends in publication volume and research collaboration and enhances the academic validity of the subsequent bibliometric mapping.

Following data sourcing, the study implemented a systematic data selection process guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) methodology. This rigorous screening involved a broad keyword-based search, de-duplication, and the application of well-defined inclusion and exclusion criteria. Specifically, the analysis was confined to English-language documents from 2010 to 2023, ensuring relevance and quality while capturing the evolution of research trends over the specified period. Once the relevant dataset was curated, bibliometric analysis was conducted using Biblioshiny-R. This advanced tool facilitated the visualization and evaluation of publication patterns, thematic evolutions, and interrelationships among key concepts in the literature. The process, which includes cluster mapping, overlay visualizations, and density analysis, builds on the methodologies established in previous studies that have successfully applied similar approaches in digital transformation and AI research (Traymbak et al., 2024). This methodical approach not only corroborates established bibliometric practices but also provides innovative insights into the multidimensional impact of AI on higher education.

3. RESULT AND DISCUSSION

3.1. Main Information

Figure 1 presents a bibliometric overview of 464 documents published between 2010 and 2025 from 259 sources. One thousand three hundred seventy-nine authors contributed, with an average of 3.44 co-authors per document and 34.7% international co-authorship, indicating strong collaborative efforts. Only 47 documents are single-authored, highlighting a preference for teamwork. The average citation per document is 18.73, suggesting moderate impact. The field is growing rapidly, with an annual growth rate of 34.15%. The author keywords (1,370 entries) reflect diverse research themes, while the average document age of 1.5 years indicates recent and up-to-date contributions. Notably, no references are listed, possibly due to data extraction limits.

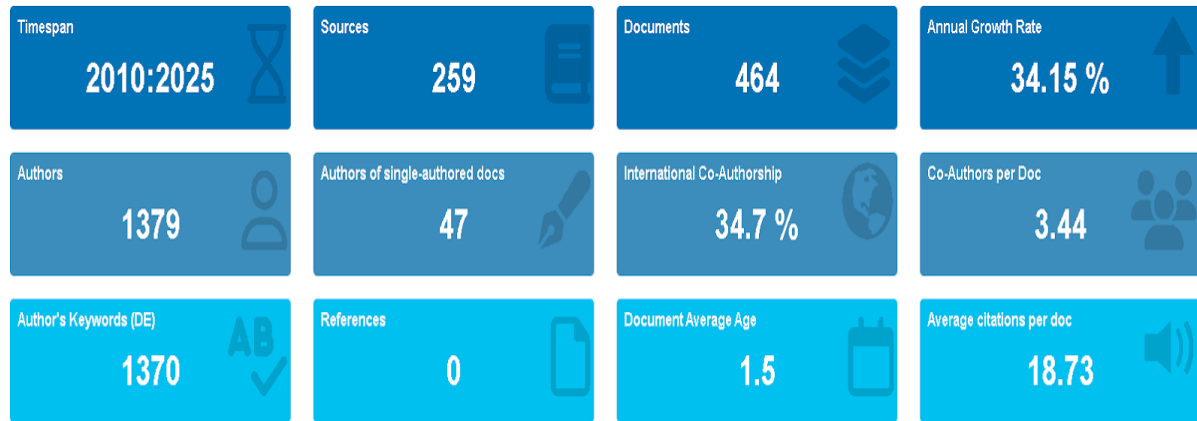


Figure 1 Main Information Data Research (Source; Biblioshiny-R, 2025)

3.2. Thematic Map

The thematic map in bibliometric analysis is pivotal for clarifying the position and interrelation of research themes concerning AI adoption in higher education. This mapping tool classifies themes into four quadrants—niche, motor, emerging/declining, and basic—offering insight into theme evolution and relevance. Dominant motor themes, such as the Technology Acceptance Model (TAM) and AI in education, underscore that traditional theories like TAM still drive comprehension of AI adoption through constructs like perceived usefulness and ease of use (Jia et al., 2024; Kartal & Yeşilyurt, 2024; Okulich-Kazarin et al., 2024). These findings confirm previous studies that highlight these models' centrality in framing academic discussions on technological integration.

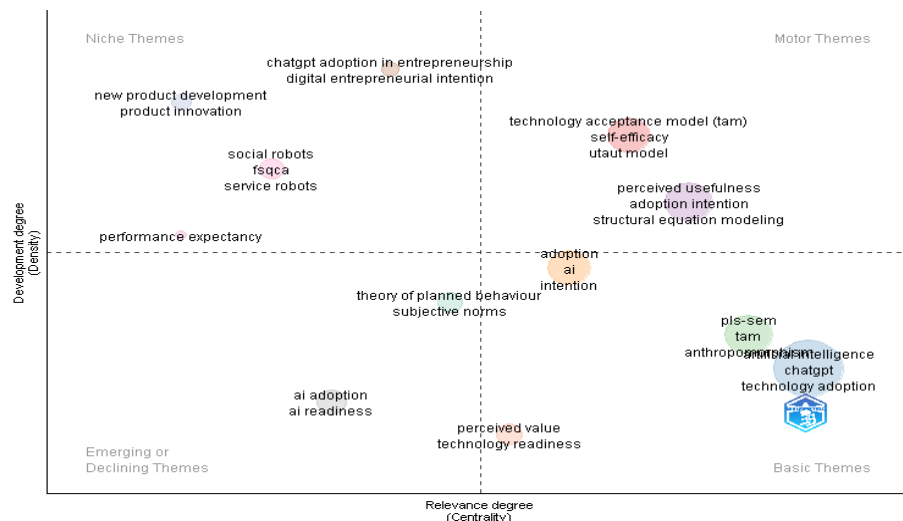


Figure 2 Thematic Map (Source: Biblioshiny-R, 2025)

Critically, the thematic map also revealed underexplored areas, particularly in ethics and regulatory frameworks of AI in academic contexts. While technical and behavioral aspects of AI have received considerable focus, ethical and policy considerations remain nascent or declining, highlighting a significant research gap ((Eden et al., 2024; Thong et al., 2023). This imbalance suggests that despite rapid technological advancements, comprehensive evaluation of social and regulatory impacts is insufficiently addressed. Hence, future research must rebalance its scope to integrate sustainability, regulatory frameworks, and social implications to form a holistic understanding of AI adoption in higher education. Such recalibration would enhance strategic decision-making and policy development in this dynamic field (Grassini, 2023).

3.3. Thematic Evolution

Early studies (2000–2010) predominantly applied models such as the Technology Acceptance Model (TAM) and the Theory of Planned Behavior (TPB) to examine technical determinants like ease of use and perceived benefits. However, from 2011 to 2020, the focus shifted to include user experience, student engagement, and the integration of AI into pedagogy, thereby broadening the scope of inquiry beyond mere technical attributes.

In the most recent period (2021–2024), research themes have expanded to incorporate ethical considerations, user trust, and AI's role in academic decision-making. This evolution indicates that the field now recognizes the importance of social, psychological, and policy dimensions in understanding AI adoption intentions—notably, studies by Traymbak et al. (2024), Crompton and Burke (2023) and Ivanov (2023) critically document this trajectory, highlighting a fragmented theoretical landscape that still relies on traditional models, even as new dimensions emerge. This critical analysis revealed a pressing research gap: the need for integrated conceptual models that bridge established technology acceptance theories with underexplored areas such as ethics and regulatory implications. Future research should address this gap to explain AI adoption in higher education more holistically.

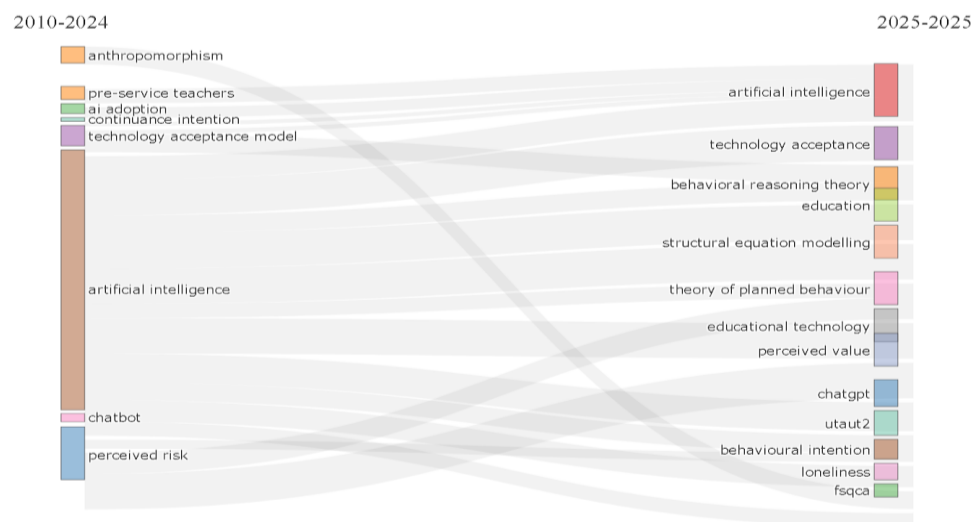


Figure 3 Thematic Evolution (Source: Biblioshiny-R, 2025)

3.4. Trend Topics

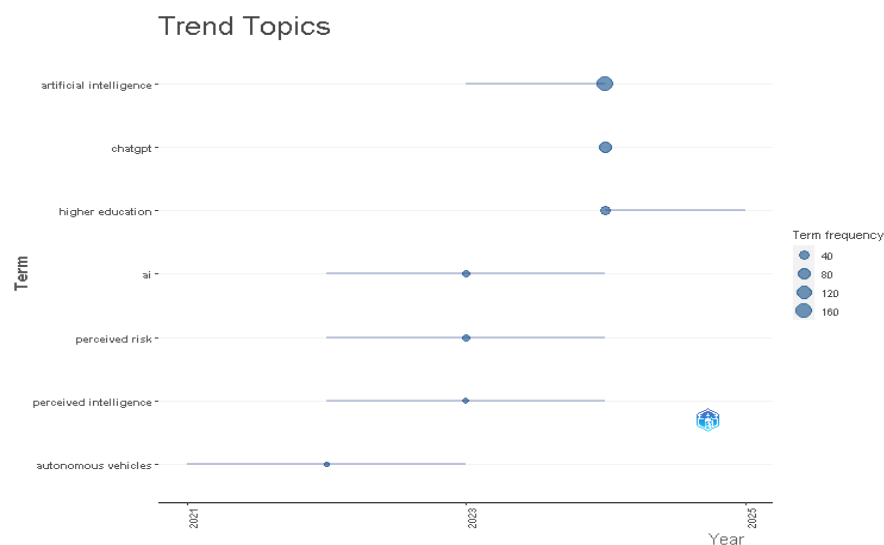


Figure 4 Trend Topics (Source: Biblioshiny-R, 2025)

Over the past decade, technical subjects—intense learning, machine learning, student engagement, and adaptive learning—have experienced a marked increase in publications. This trend underscores that technological advancements

have improved educational outcomes by enhancing personalization and interactivity and redefined research priorities, as noted by Delcea et al. (2024). However, our critical analysis revealed that despite their high utility, themes such as trust in AI, algorithm transparency, and educational sustainability remain insufficiently explored. These underdeveloped areas are particularly significant given the growing importance of ethical and regulatory considerations in technology integration.

Previous studies, such as (Mohsin et al., 2024), confirmed that while the technical mechanisms driving AI's educational applications are robustly documented, the broader socio-technical implications lack comprehensive treatment. Similarly, Kavitha and Joshith (2024) highlighted that current research barely bridges technical innovations with crucial psychological, social, and policy dimensions. Therefore, future inquiries must adopt a multidisciplinary approach that deepens the investigation into technical contributions and integrates critical assessments of ethical, transparent, and sustainable AI practices in higher education.

4. CONCLUSION

This study presents an in-depth bibliometric analysis of trends in AI adoption intentions in higher education using Scopus data and the PRISMA method. The analysis reveals significant publication growth over the past two decades, underscoring increasing academic focus on integrating AI into education. Thematic mapping shows a shift from solely assessing users' readiness to exploring AI's broader impact on pedagogy, social interaction, and governance of academic institutions. Critical trend analysis identifies emerging topics such as deep learning, adaptive learning, and trust in AI, even though technological aspects—like artificial intelligence and technology adoption—still dominate. At the same time, ethical and regulatory dimensions are underexplored. Within established frameworks, TAM remains pertinent, with perceived usefulness and ease of use as key factors, yet there is a need to incorporate trust and social impact. Similarly, UTAUT's emphasis on Performance expectations and social influence requires expansion to address policy factors, and DOI confirms AI's efficiency benefits despite inherent complexities.

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