

Adoption And Usage Patterns of Generative Artificial Intelligence in Higher Education: A Bibliometric Analysis of Scopus-Indexed Literature

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Abstract- The rapid diffusion of Generative Artificial Intelligence (GenAI), particularly large language models such as ChatGPT, has significantly reshaped higher education. Students and academic staff increasingly use AI-based systems for learning, assessment, research support, and pedagogical design. Despite growing empirical studies on AI adoption and academic integrity, a consolidated bibliometric synthesis of this emerging domain remains limited. This study addresses that gap through a systematic bibliometric analysis of 33 Scopus-indexed journal articles published between 2023 and 2025. Using the Bibliometrix package in RStudio, the analysis maps publication trends, influential contributors, thematic clusters, and conceptual structures through co-occurrence networks and Multiple Correspondence Analysis (MCA).

Findings indicate exploratory emergence in 2023 (4 publications), moderate growth in 2024 (5 publications), and strong consolidation in 2025 (24 publications), with 72.7% indexed under 2025. “Artificial intelligence” functions as the structural hub of the knowledge network, demonstrating the highest betweenness centrality (82.800) and PageRank (0.189). Thematic mapping identifies student-centered motor themes, AI integration as a foundational theme, governance and faculty-related niche themes, and emerging GenAI-focused inquiries. Temporal evolution reflects a shift from exploratory discourse toward structured pedagogical and governance frameworks. The study contributes to theory by aligning findings with the Technology Acceptance Model (TAM), Unified Theory of Acceptance and Use of Technology (UTAUT), and Innovation Diffusion Theory, offering strategic insights for institutions navigating AI integration.

Index Terms- Generative AI, ChatGPT, Higher Education, AI Adoption, Bibliometric Analysis, Students, Academic Staff, Scopus

I. INTRODUCTION

1.1 Background of the Study

The introduction of generative artificial intelligence (GenAI), particularly large language models such as ChatGPT, Bard, and other AI-based educational tools, represents one of the most significant technological disruptions in higher education in recent decades. Unlike earlier educational technologies—such as learning management systems or MOOCs—GenAI systems possess autonomous content generation capabilities, enabling students and educators to produce essays, code, summaries, assessments, and research drafts in real time.

Since late 2022, universities worldwide have confronted questions regarding AI adoption, ethical usage, academic integrity, pedagogical redesign, and digital governance. Students increasingly employ AI tools for writing assistance, conceptual clarification, and research support. Academic staff use AI for curriculum development, assessment design, and administrative efficiency. Simultaneously, concerns about plagiarism, algorithmic bias, and over-reliance on automated systems have intensified scholarly debate.

Between 2023 and 2025, academic literature examining AI adoption in higher education expanded rapidly. However, this emerging body of work remains fragmented across disciplines such as education, psychology, decision sciences, and business studies. While numerous empirical studies investigate student perceptions or faculty acceptance, there is limited systematic mapping of the intellectual structure, thematic development, and global research patterns of this domain.

Bibliometric analysis offers a structured method to address this gap by quantitatively mapping publication trends, citation structures, keyword co-occurrence patterns, and thematic evolution. By doing so, it allows identification of dominant research clusters, emerging themes, and underexplored areas.

1.2 Research Problem

Despite the rapid growth of research on AI usage among students and academic staff in higher education, there is currently no comprehensive bibliometric synthesis focused specifically on generative AI adoption between 2023 and 2025.

Most existing studies:

- Examine isolated constructs (e.g., perception, academic integrity, intention to use).
- Focus primarily on students rather than academic staff.
- Employ survey-based designs grounded in TAM or UTAUT.
- Lack macro-level structural mapping of the research landscape.

Without bibliometric consolidation, it remains unclear:

- Which themes dominate the discourse?
- How student-focused and teacher-focused research differ structurally?
- Which countries lead scholarly production?
- How conceptual clusters are evolving over time?

1.3 Research Objectives

This study is guided by the following objectives:

1. To analyze the volume and growth trajectory of generative AI research in higher education (2023–2025).
2. To identify leading authors, journals, and contributing countries.
3. To examine keyword co-occurrence networks and thematic clusters.
4. To map the conceptual structure of AI adoption research using MCA.
5. To assess temporal thematic evolution.
6. To identify emerging research gaps and propose future directions.

1.4 Significance of the Study

This study contributes at three levels:

Academic Contribution

- Provides the first bibliometric consolidation of GenAI adoption research in higher education (2023–2025).
- Integrates bibliometric mapping with theoretical anchoring in TAM, UTAUT, and Diffusion of Innovations.

Institutional Relevance

- Assists universities in understanding dominant scholarly concerns (integrity, governance, pedagogy).

Policy-Level Relevance

- Supports evidence-based AI governance frameworks.

II. EVOLUTION OF GENERATIVE ARTIFICIAL INTELLIGENCE RESEARCH IN HIGHER EDUCATION

The rapid proliferation of generative artificial intelligence (GenAI) tools in higher education since late 2022 has catalyzed an unprecedented wave of scholarly inquiry. While artificial intelligence has long been present in adaptive learning systems, learning analytics, and automated grading platforms, the emergence of large language models (LLMs) such as ChatGPT marked a paradigm shift. Unlike earlier AI systems, GenAI tools are capable of autonomous content generation, contextual reasoning, and interactive dialogue, fundamentally altering pedagogical and assessment ecosystems.

The period between 2023 and 2025 represents the formative phase of academic research in this domain. Within this short span, 33 Scopus-indexed journal articles have examined AI adoption, usage patterns, ethical implications, and institutional responses in higher education. This section synthesizes the conceptual evolution of the field prior to presenting the bibliometric findings.

2.1 From Educational AI to Generative AI: A Conceptual Shift

Before 2023, AI in higher education largely focused on:

- Learning analytics
- Intelligent tutoring systems
- Predictive modeling of student performance

- Automated grading

These systems functioned primarily as supportive augmentation tools embedded within institutional infrastructures.

However, the introduction of publicly accessible generative AI systems altered the adoption dynamic. Students could independently access AI tools without institutional mediation. This decentralization shifted the discourse from *institution-driven technological implementation* to *individual-level adoption and usage behavior*.

Consequently, the research focus moved toward:

- Student intention to use AI tools
- Faculty acceptance and resistance
- Academic integrity concerns
- Policy formulation and governance

This transition aligns closely with classical technology adoption theories.

2.2 Theoretical Anchors in AI Adoption Research

A significant portion of empirical studies within the dataset draw implicitly or explicitly from established technology acceptance frameworks.

2.2.1 Technology Acceptance Model (TAM)

The Technology Acceptance Model (Davis, 1989) posits that:

- Perceived usefulness (PU)
- Perceived ease of use (PEOU)

Within AI adoption studies in higher education, TAM-based constructs frequently appear in surveys measuring:

- Student intention to use ChatGPT
- Perceived academic performance enhancement
- Ease of interaction with AI interfaces

The prominence of keywords such as *decision making*, *students*, and *higher education* within the motor themes suggests the influence of TAM-like frameworks in structuring empirical research.

2.2.2 Unified Theory of Acceptance and Use of Technology (UTAUT)

UTAUT extends TAM by incorporating:

- Performance expectancy
- Effort expectancy
- Social influence
- Facilitating conditions

Several studies in the dataset examine faculty perceptions of AI integration, aligning with UTAUT's emphasis on institutional support and normative pressures.

The thematic clustering around *academic staff* and *education computing* indicates emerging research on structural facilitators and institutional readiness.

2.2.3 Diffusion of Innovations Theory

Rogers' Diffusion of Innovations theory provides an additional interpretive lens for understanding the temporal evolution of generative AI research in higher education. The dataset reveals an exploratory emergence in 2023 (4 publications), followed by moderate expansion in 2024 (5 publications), and substantial consolidation in 2025 (24 publications).

Rather than reflecting gradual linear diffusion, this distribution indicates rapid institutionalization following the disruptive release of generative AI tools in late 2022. The concentration of 72.7% of publications in 2025 reflects accelerated manuscript submission cycles in 2024 and formal journal volume assignment in 2025. Such clustering is characteristic of high-disruption technological domains, where scholarly response intensifies rapidly and formal publication consolidation occurs within a short timeframe. Within the knowledge network, "artificial intelligence" operates as a central integrative node, linking multiple thematic clusters and signaling normalization of AI discourse within higher education research.

2.3 Dominant Research Streams

Preliminary examination of keyword frequencies and network structures reveals four dominant streams:

1. Student Adoption and Usage Behavior

- Intention to use
- Academic performance
- Decision making
- Perception studies

This stream represents the most structurally dense cluster in the thematic map.

2. Academic Integrity and Ethical Governance

- Plagiarism concerns
- Policy responses
- Assessment redesign

This cluster reflects institutional anxiety accompanying rapid AI adoption.

3. Pedagogical Innovation and Curriculum Integration

- Teaching enhancement
- AI-assisted assessment
- Curriculum redesign

Emerging strongly in 2024–2025.

4. Academic Staff Adaptation

- Faculty attitudes
- Institutional readiness
- Professional development

Although present, this stream appears less central than student-focused research.

2.4 Fragmentation and Research Gaps

Despite rapid expansion, the literature exhibits structural fragmentation:

- Overconcentration on student perception surveys
- Limited longitudinal designs
- Insufficient cross-cultural comparative studies
- Underdeveloped theoretical integration across studies

Additionally, most studies examine either students or academic staff independently, rarely integrating both populations within unified models.

This fragmentation justifies the need for bibliometric mapping to:

- Identify structural centrality patterns
- Detect underdeveloped clusters
- Reveal emerging themes
- Guide future research consolidation

2.5 Transition Toward Structured Governance (2024–2025)

Temporal thematic evolution suggests a shift from exploratory discourse in 2023 toward:

- Assessment frameworks
- Institutional AI policies
- Responsible AI integration
- Structured curriculum redesign

The emergence of terms such as *GenAI* and increased density around *chatgpt* indicates consolidation of terminology and conceptual focus.

Thus, the literature appears to be transitioning from reactive exploration to strategic institutionalization.

3.1 Research Design and Approach

This study adopts a bibliometric research design to systematically examine the scholarly landscape surrounding the use of Generative Artificial Intelligence (Gen AI) in higher education. Bibliometric analysis is a structured and quantitative technique that evaluates the development, intellectual structure, and thematic progression of a research domain. Unlike traditional narrative literature reviews that may involve subjective interpretation, bibliometric methods generate objective, transparent, and reproducible insights by analyzing publication metadata such as author keywords, citation patterns, co-authorship networks, institutional affiliations, and thematic clusters.

Despite the significant growth in scholarly output surrounding Generative AI tools like ChatGPT, the existing literature remains fragmented across diverse fields such as education, management, and computer science, necessitating a systematic mapping of this dispersed body of knowledge. To address this, the current study employs a bibliometric methodological framework grounded in science mapping and performance analysis to identify publication trends, influential authors, core journals, and evolving collaborative networks. This approach is implemented using the Bibliometrix package in R and its Biblioshiny web interface within the RStudio environment, enabling a comprehensive quantitative analysis and visualization of the research landscape. By utilizing this structured methodology, the study provides a robust overview of how Generative AI research in higher education has evolved while pinpointing emerging directions for future scholarly inquiry.

3.2 Data Source and Search Strategy

To ensure the inclusion of high-quality and peer-reviewed scholarly literature, the Scopus database was selected as the primary data source for this study. Scopus is a comprehensive and multidisciplinary indexing platform widely used in bibliometric research due to its extensive journal coverage, standardized metadata, and reliable citation indexing. The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework was adopted to ensure transparency and replicability

III. RESEARCH METHODOLOGY

in the selection process. A total of 33 articles were identified through database searches.

The search was conducted using an advanced Boolean query designed to capture literature examining AI adoption among students and academic staff in higher education. The following Boolean search string was applied:

("generative artificial intelligence" OR "GenAI" OR "AI tools")
AND
("higher education" OR "university")
AND
("student" OR "faculty" OR "teacher")

Inclusion Criteria

- Publication Years: 2023–2025
- Document Type: Articles
- Access Type: Open Access
- Language: English
- Subject Areas: Social Sciences, Business management and accounting, Psychology, Decision Sciences, Arts and humanities, Multidisciplinary
- The search retrieved 33 final-stage journal articles, forming the dataset for analysis as shown in the chart.

3.3 Data Cleaning and Preprocessing

The bibliographic records were exported in CSV format from Scopus and imported into RStudio.

The following preprocessing steps were undertaken:

- Duplicate removal using DOI and title cross-check
- Screening for relevance based on title and abstract
- Verification of subject area alignment
- Standardization of keyword variants (e.g., “AI” vs. “artificial intelligence”)

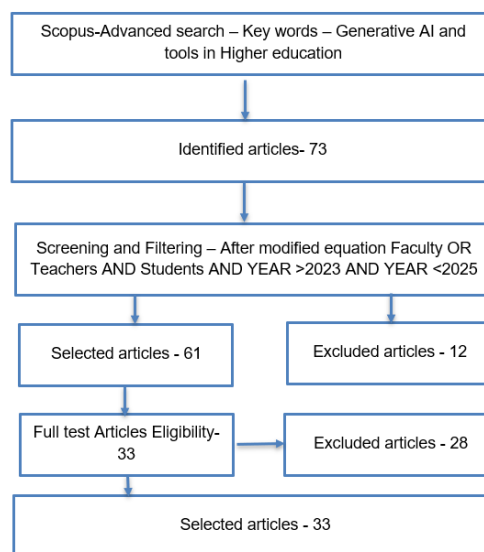
Final Dataset Profile

- Total Documents: 33
- Total Unique Authors: 92
- Total Sources (Journals): 27
- Total Citations: 214
- Average Citations per Document: 6.48
- Publication Years Covered: 2023–2025

Publication year refers to the Scopus-indexed publication year (PY field), representing the official journal volume assignment year. In rapidly evolving research domains, publication year may reflect formal

indexing timelines rather than manuscript submission year. The concentration of publications in 2025 therefore reflects publication cycle dynamics rather than delayed research activity. This refined dataset served as the foundation for subsequent bibliometric analyses.

Figure 1: PRISMA Chart



3.4 Analytical Tools and Techniques

The bibliometric analysis was conducted using:

- R (version 2025.09.1 +401)
- Bibliometrix package
- Biblioshiny interface
- Supporting packages: ggplot2, dplyr

The following analytical techniques were employed:

3.5 Explanation of Bibliometric Metrics Used

Technique	Purpose
biblioAnalysis()	Descriptive statistics
summary()	Top authors, sources, citations
networkPlot()	Keyword co-occurrence network
thematicMap()	Density–centrality thematic mapping
conceptualStructure()	Multiple Correspondence Analysis (MCA)
trendTopics()	Temporal keyword evolution

The bibliometric analysis of the selected 33 research articles was conducted using the *Bibliometrix* package in RStudio through the Biblioshiny interface. Multiple analytical techniques, including co-occurrence network analysis, country collaboration mapping, centrality measures, density visualization, and factorial analysis, were applied to examine the intellectual structure of research on Generative Artificial Intelligence (Gen AI) in higher education.

3.5.1 Scientific Production and Citation Trends

- Annual Scientific Production measures the number of research articles published each year on Generative Artificial Intelligence (Gen AI) in higher education. This metric provides insight into the growth trajectory of the field, especially reflecting the surge in scholarly interest following the emergence of generative AI tools in academic settings.
- Annual Citations per Year represents the average number of citations received annually by the selected publications. This indicator highlights the academic impact, visibility, and influence of research outputs over time.
- Source Productivity Over Time examines how different journals have contributed to the research area across years. It helps identify core journals consistently publishing on Gen AI in higher education, as well as emerging publication outlets entering the field.

These metrics collectively illustrate both the expansion and the evolving scholarly influence of research on Generative AI usage among students and faculty in higher education.

3.5.2 Author-Level Metrics

- Most Relevant Authors identifies the leading contributors in the field based on the number of publications related to Generative Artificial Intelligence (Gen AI) in higher education. These metric highlights scholars who have made significant contributions to the development of this research domain.
- Author Productivity Over Time analyzes the publication activity of prominent authors across different years. This helps in understanding sustained research engagement and identifying whether

contributions are continuous or concentrated within specific periods.

- Lotka's Law examines the distribution pattern of authors' scholarly output. It assesses whether a small group of authors contributes a large proportion of the total publications, typically reflecting the common 80/20 distribution pattern observed in scientific research.

Together, these metrics provide insights into individual scholarly influence, research concentration, and the overall structure of knowledge production within the domain of Generative AI in higher education.

3.5.3 Institutional and Geographical Contributions

- Most Relevant Affiliations identifies universities and academic institutions that have contributed the highest number of publications on Generative Artificial Intelligence (Gen AI) in higher education. This metric helps determine which institutions are leading research efforts in this emerging domain.
 - Corresponding Author's Country analyzes the geographical distribution of research contributions based on the country affiliation of the corresponding author. This provides insights into the global footprint and regional concentration of scholarship related to Gen AI usage among students and faculty.
 - Collaboration Network and World Map visually represent international and inter-institutional research partnerships. These visualizations highlight patterns of cross-country collaboration, knowledge exchange, and the development of global research networks.
- Together, these indicators reveal the key institutional contributors and geographic hubs driving research on Generative Artificial Intelligence in higher education, offering a comprehensive view of global collaboration dynamics within the field.

3.5.4 Thematic and Keyword Mapping

- Most Frequent Words, Word Clouds, and TreeMaps display the most commonly occurring keywords within the selected studies, providing an overview of dominant themes such as Generative AI, higher education, students, faculty, and ChatGPT.
- Trend Topics Analysis identifies keywords that have increased or decreased in prominence over time, reflecting changing research priorities and emerging

areas of interest in Gen AI adoption within universities.

These visual and frequency-based analyses help map the conceptual structure and evolving intellectual landscape of Generative Artificial Intelligence research in higher education.

3.5.6 Citation and Co-Citation Structures

- **Co-Citation Networks** examine the relationships between articles that are frequently cited together, helping to identify major theoretical foundations, methodological similarities, and intellectual clusters within Generative AI research in higher education.
- **Historiographic Analysis** traces the chronological flow of citations to highlight seminal studies and key turning points that have shaped scholarly discourse on Gen AI usage among students and faculty.

These metrics reveal the underlying knowledge structure and influential research trajectories within the domain of Generative Artificial Intelligence in higher education. Collectively, the bibliometric indicators provide a comprehensive and multidimensional understanding of how the field has developed, who the leading contributors are, and how research themes have evolved over time. This enhances the rigor and credibility of the literature review and supports informed academic and institutional decision-making.

3.6 Methodological Validity and Reliability

The study's methodological rigor is grounded in a dual focus on internal and external validity. Internal validity is ensured through a transparent search strategy and explicit inclusion criteria, complemented by the use of standardized bibliometric indicators and reproducible R scripts. Simultaneously, external validity is supported by the selection of Scopus as a high-quality, comprehensive indexed database, alongside a focus on open-access, final-stage articles and a cross-national dataset. Collectively, this framework ensures the methodology is fully replicable, as the provided search queries and analytical tools allow for independent verification of the findings.

3.7 Limitations of the Methodology

While bibliometric methods provide significant advantages for structural mapping, this study acknowledges certain inherent limitations. Primarily, the reliance on Scopus-indexed journals and the deliberate exclusion of conference proceedings may omit relevant niche contributions, while the inevitable citation lag inherent in bibliographic data can underrepresent the impact of the most recent publications. Furthermore, while these metrics identify research trends, they cannot measure the actual adoption percentages of Generative AI tools in real-world classrooms. To address these constraints, future research should consider integrating bibliometric mapping with systematic reviews or meta-analytical syntheses to provide a more granular qualitative and statistical understanding of the field.

IV. BIBLIOMETRIC RESULTS AND ANALYSIS

This section presents the bibliometric findings derived from 33 Scopus-indexed journal articles published between 2023 and 2025. The analysis examines scientific production trends, citation impact, source and author influence, country-level contributions and collaboration patterns, keyword co-occurrence structures, thematic mapping, conceptual structures using Multiple Correspondence Analysis (MCA), and temporal evolution. Each dimension is interpreted not only descriptively but also analytically to understand its implications within the evolving landscape of generative AI adoption in higher education.

4.1 General Scientific Production and Growth Trends

The annual scientific production reflects a structured temporal progression following the emergence of generative artificial intelligence tools such as ChatGPT. The dataset includes:

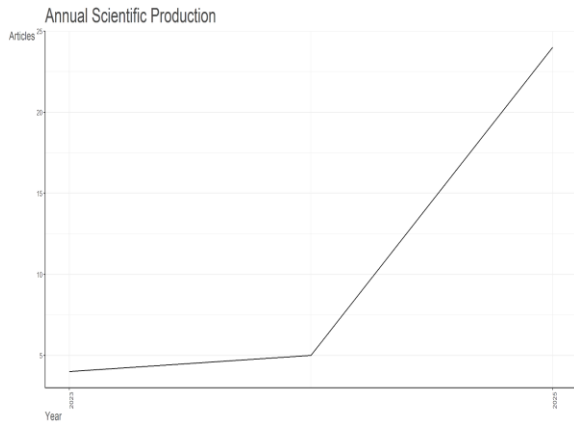
- 2023: 4 publications
- 2024: 5 publications
- 2025: 24 publications

The modest increase from 2023 to 2024 (25%) reflects early exploratory and reactionary scholarship. The substantial concentration of publications indexed under 2025 (72.7% of the dataset) represents formal consolidation within journal publication cycles rather than abrupt initiation of research activity in that year. Many manuscripts submitted during 2024 were formally assigned to 2025 volumes.

The dataset comprises 33 articles authored by 92 researchers and published across 27 journals, demonstrating interdisciplinary diffusion. With 214 total citations and an average of 6.48 citations per document, the field exhibits strong early academic engagement despite its recent emergence.

Overall, the findings indicate a rapid consolidation phase rather than gradual diffusion, signaling institutional recognition and stabilization of generative AI research within higher education.

Figure 2: Annual Scientific Production on Generative AI Adoption in Higher Education (2023–2025)



4.2 Citation Impact and Article Influence

Although citation accumulation is naturally constrained due to the recency of publications, the citation distribution indicates the emergence of influential works within specific thematic clusters. Patterns of cross-referencing reveal rapid referencing within closely connected research streams, particularly those examining student adoption behavior and academic integrity concerns. Early consolidation around foundational contributions is evident, suggesting that certain studies are beginning to structure the intellectual core of the field. Such citation dynamics are typical of high-velocity technological domains, where accelerated referencing contributes to early conceptual stabilization and knowledge clustering.

Figure 3: Structural Centrality Measures of Keywords in the Co-occurrence Network

Node	Cluster	Betweenness	Closeness	PageRank
artificial intelligence	1	82.800	0.040	0.189
generative artificial intelligence	1	0.000	0.024	0.020
students	1	0.000	0.024	0.020
assessment	1	0.000	0.024	0.020
decision making	1	0.000	0.025	0.035
education computing	1	0.000	0.025	0.035
teaching	1	0.000	0.024	0.020
chatgpt	2	50.745	0.037	0.148
academic integrity	2	0.000	0.023	0.020
chatbot	2	0.000	0.028	0.033

4.3 Country-Level Contributions and Collaboration Patterns

Country contributions are analyzed based on corresponding author affiliations as extracted from Scopus metadata. The country collaboration analysis reveals a geographically diverse yet moderately interconnected research landscape. Scholarly contributions originate from multiple regions, including the United States, Australia, China, South Africa, Indonesia, Malaysia, India, and the United Arab Emirates. This distribution indicates that generative AI adoption is not confined to a single educational system or economic context but represents a globally shared concern.

The collaboration network visualization suggests moderate international cooperation, with cross-national linkages most visible between Western institutions and Asia-Pacific universities. Unlike more mature educational technology domains that have historically been dominated by North American and European scholarship, this dataset reflects a more distributed pattern of global participation. However, the collaboration density remains moderate rather than highly clustered, indicating opportunities for stronger transnational partnerships and comparative research designs in future investigations.

Figure 4: Global Country Collaboration Network in Generative AI Research

Country Collaboration Map

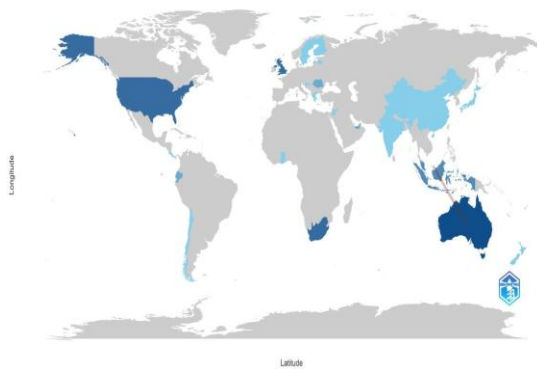


Figure 5: International Country Collaboration Frequency Matrix

From	To	Frequency
All	All	All
AUSTRALIA	HONG KONG	114.113804542
AUSTRALIA	MALAYSIA	109.697622843
CHILE	COSTA RICA	-84.1920876775
ECUADOR	CHILE	-71.3825621318
ECUADOR	COSTA RICA	-84.1920876775
INDONESIA	MALAYSIA	109.697622843
SOUTH AFRICA	INDONESIA	117.240113662
SOUTH AFRICA	LATVIA	24.9123598332
SOUTH AFRICA	USA	-112.4616737
UNITED ARAB EMIRATES	INDIA	79.6119761026

4.4 Keyword Co-occurrence and Network Structure

The keyword co-occurrence network provides structural insight into conceptual relationships within the field. “Artificial intelligence” emerges as the dominant structural hub, exhibiting the highest betweenness centrality and PageRank values in the network. Its elevated centrality indicates that it serves as a bridging construct connecting otherwise distinct thematic clusters, including student adoption, pedagogical innovation, governance concerns, and faculty adaptation.

“ChatGPT” functions as a secondary integrative node, linking empirical student-focused studies with broader institutional and policy-oriented discussions. In contrast, terms such as “decision making,” “students,” and “generative AI,” although frequently occurring, demonstrate comparatively lower bridging influence. The presence of “students” as a thematically dense but structurally peripheral node suggests that while student adoption dominates research volume, it does not function as the primary integrative concept within the overall network. Instead, the field remains

anchored in artificial intelligence as a macro-level construct.

This structural configuration indicates that research is currently technology-centered rather than stakeholder-centered. Generative AI serves as the overarching conceptual anchor around which specific adoption and governance themes are organized.

Figure 6: Keyword Co-occurrence Network Structure in Generative AI Research

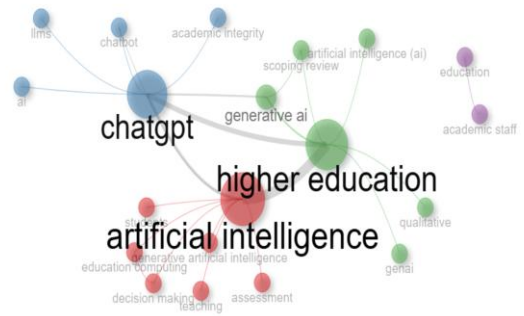
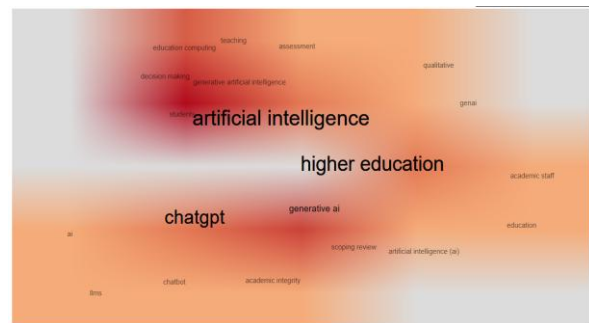


Figure 7: Keyword Co-occurrence Density Visualization



4.5 Thematic Mapping and Cluster Classification

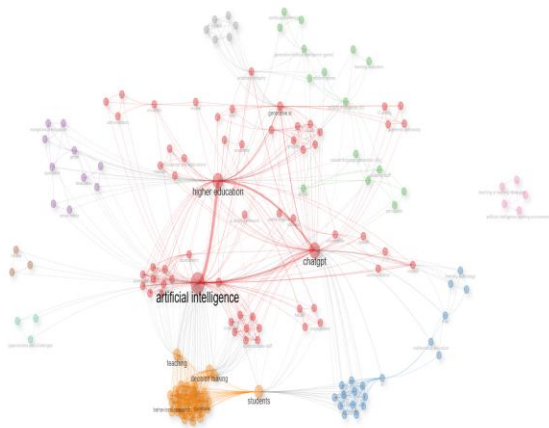
The thematic mapping analysis classifies research clusters based on centrality (structural relevance) and density (internal development). Student-related constructs, particularly those linked to decision-making and education computing, emerge as motor themes, indicating that student adoption research is both well-developed and central to the field. In contrast, broader constructs such as artificial intelligence, higher education, and ChatGPT appear as basic themes, functioning as foundational yet conceptually expansive pillars of the discourse. Faculty-oriented themes, including academic staff and education perspectives, are positioned as niche themes, reflecting internal coherence but limited

integration within the broader network. Emerging themes, such as GenAI terminology variants and qualitative approaches, occupy lower-density and lower-centrality positions, suggesting ongoing developmental trajectories. Overall, the thematic structure confirms the dominance of student-focused adoption research, while faculty adaptation and governance-related studies remain comparatively peripheral.

Figure 8: Thematic Map Based on Centrality and Density Analysis



Figure 9: Clustered Keyword Co-occurrence Network in Generative AI Research



4.6 Conceptual Structure Analysis (Multiple Correspondence Analysis)

The conceptual structure analysis conducted using Multiple Correspondence Analysis reveals strong thematic polarization within the dataset. The first dimension explains 59.75 percent of total variance, while the second-dimension accounts for 11.31 percent. The dominance of the first dimension indicates clear conceptual differentiation among clusters.

The spatial configuration of keywords reveals four primary thematic groupings: student adoption and attitudinal studies, academic integrity and policy discourse, AI-enabled pedagogical integration, and faculty adaptation with institutional governance. The relative separation among these clusters suggests theoretical fragmentation, with limited integrative frameworks bridging stakeholder perspectives and governance considerations. This fragmentation is characteristic of early-stage research domains, where parallel streams of inquiry evolve before theoretical consolidation occurs.

4.7 Temporal Evolution of Themes

The thematic evolution analysis illustrates a progression in research focus across the three-year period. In 2023, publications primarily emphasized exploratory discussions of AI disruption, perception studies, and academic integrity concerns following the rapid emergence of generative tools. By 2024, the discourse consolidated around structured assessment redesign, decision-making frameworks, and institutional governance mechanisms. Early 2025 publications indicate emerging stabilization around structured AI integration strategies within higher education systems.

The shift from broad references to “artificial intelligence” toward more precise terminology such as “ChatGPT” and assessment-related constructs reflects conceptual maturation. This transition suggests that the field is moving from reactive exploration toward strategic institutionalization.

Figure 10: Conceptual Structure Map Based on Multiple Correspondence Analysis (MCA)

Network analysis demonstrates that “artificial intelligence” functions as the central structural hub of the research domain. This indicates that AI is conceptualized as a system-level transformation rather than a peripheral tool.

Student adoption, faculty adaptation, assessment redesign, and governance concerns are all anchored to the broader AI discourse. The prominence of “ChatGPT” as a secondary node suggests increasing conceptual specificity and gradual stabilization of terminology between 2023 and 2025. Overall, the discourse remains technology-centered rather than stakeholder-centered.

5.1.3 Student-Centric Research Dominance

Thematic mapping positions “students” within the motor themes quadrant, indicating high centrality and strong internal development. Much of the empirical research aligns with Technology Acceptance Model (TAM)-based constructs such as perceived usefulness, perceived ease of use, and behavioral intention.

In contrast, faculty-related themes appear as niche clusters—internally coherent but structurally less integrated. This imbalance reflects a reactive research orientation that prioritizes student behavior and academic integrity concerns over institutional readiness and professional development.

5.1.4 Governance and Integrity Tension

Conceptual structure analysis reveals distinct clusters around student adoption, academic integrity, pedagogical redesign, and governance. The spatial separation of these clusters indicates fragmentation across research streams.

Studies addressing integrity concerns often operate independently from those examining pedagogical innovation, highlighting the absence of integrated frameworks that simultaneously address adoption behavior, ethical governance, institutional capacity, and learning outcomes. Such integration is necessary for theoretical maturation.

5.1.5 Transition from Exploration to Institutionalization

Temporal evolution analysis indicates that early 2023 research focused on disruption, ethical alarm, and immediate reactions to generative tools. By 2024–2025, the discourse shifted toward structured

assessment redesign, governance models, and AI-assisted teaching strategies.

This progression signals movement from crisis-driven exploration toward strategic institutionalization, marking the gradual stabilization of the research domain.

5.2 Theoretical Implications

5.2.1 Reinforcement but Limited Extension of TAM and UTAUT

The dominant empirical clusters reinforce traditional technology acceptance frameworks such as TAM and UTAUT. While these models effectively explain individual-level adoption intention, they insufficiently capture institutional governance complexity, ethical ambiguity, and systemic transformation.

The findings suggest a need to extend these frameworks by integrating ethical decision-making perspectives, institutional theory, and sociotechnical systems approaches.

5.2.2 Need for Multi-Stakeholder Integration Models

The structural separation between student and faculty clusters indicates the absence of unified multi-stakeholder models. AI adoption in higher education operates within an ecosystem involving students, academic staff, administrators, and policymakers.

Future theoretical models should therefore adopt multilevel perspectives rather than individualistic adoption frameworks.

5.2.3 Conceptual Fragmentation as an Early-Stage Indicator

The strong dimensional polarization observed in the conceptual analysis reflects clustering rather than integration. Such fragmentation is characteristic of emergent research domains prior to paradigm stabilization.

The field currently remains in its structural mapping phase and has not yet achieved full theoretical consolidation.

5.3 Practical and Policy Implications

5.3.1 Institutional Strategy

Universities should proactively develop structured AI governance policies, invest in faculty training, and redesign assessment systems to integrate AI responsibly. Bibliometric evidence suggests that

governance research is emerging but not yet central, indicating that policy development may lag behind adoption rates.

5.3.2 Faculty Development

Given the niche positioning of faculty-related research, institutions should prioritize professional development programs, AI literacy initiatives, and pedagogical experimentation support to ensure balanced integration.

5.3.3 Balanced AI Ecosystems

A strategic shift is required from restrictive AI prohibition toward responsible integration, transparent usage guidelines, and AI-enhanced learning design. Sustainable adoption depends on structured governance rather than reactive control measures.

5.4 Research Gaps and Future Research Agenda

The bibliometric findings highlight several research priorities:

- Longitudinal studies examining sustained AI usage patterns
- Cross-cultural comparative adoption analyses
- Integrated multi-stakeholder theoretical frameworks
- Governance impact evaluation studies
- Empirical measurement of AI-enabled learning outcomes
- Development of ethical AI literacy models

Collectively, these directions will support the theoretical maturation and institutional stabilization of GenAI research in higher education.

VI. CONCLUSION

This study provides a structured bibliometric analysis of 33 Scopus-indexed journal articles published between 2023 and 2025, examining the evolution of Generative Artificial Intelligence (GenAI) research in higher education. The findings confirm that the domain has experienced rapid expansion following the release of large language models such as ChatGPT, marking a transformative moment in educational technology discourse.

The analysis reveals three defining characteristics of the field: accelerated scholarly production, student-centric research dominance, and conceptual fragmentation. Publication growth between 2023 and

2024 reflects the immediate academic response to technological disruption. Citation patterns indicate emerging intellectual consolidation, yet theoretical integration remains partial. The structural prominence of “artificial intelligence” as the primary conceptual hub demonstrates that the discourse is currently technology-centered, with adoption themes anchored to a broader AI transformation narrative.

Thematic and conceptual mapping further reveal that student adoption and perception studies dominate the intellectual landscape, while faculty adaptation and institutional governance remain comparatively underrepresented. The separation of thematic clusters—student behavior, academic integrity, pedagogical innovation, and governance—suggests that the field has not yet developed integrated multi-stakeholder frameworks. This fragmentation is characteristic of emergent research domains and signals that theoretical consolidation is still underway. Temporal analysis indicates a clear progression from exploratory and reactive discussions in 2023 toward structured governance, assessment redesign, and strategic AI integration models by 2024–2025. This transition reflects movement from crisis-driven discourse to institutionalization. As GenAI becomes embedded within academic ecosystems, the focus of research is gradually shifting from ethical alarm and disruption narratives toward long-term integration and policy design.

Importantly, while the literature extensively examines adoption attitudes and behavioral intention, standardized measurement of actual usage percentages among students and faculty remains limited. This gap highlights the need for empirical prevalence studies capable of informing institutional strategy and policy formulation. As higher education systems continue to integrate generative technologies, robust measurement frameworks will be essential for evidence-based governance.

Overall, this bibliometric review contributes by mapping the intellectual structure, thematic evolution, and collaboration patterns of GenAI research in higher education. It clarifies the current developmental stage of the field and identifies structural gaps requiring theoretical and empirical advancement. The findings underscore that GenAI adoption is not merely a technological shift but a systemic transformation affecting pedagogy, governance, ethics, and institutional strategy. Future research must therefore

move beyond isolated adoption studies toward integrated, ecosystem-level models that reflect the complex and multidimensional nature of AI-enabled higher education.

VII. LIMITATIONS OF THE STUDY

While this study provides a structured and reproducible bibliometric mapping of Generative Artificial Intelligence (GenAI) adoption research in higher education, several limitations must be acknowledged:

- **Database Restriction:** The analysis is limited exclusively to Scopus-indexed journal articles. Although Scopus is one of the most comprehensive academic databases, relevant studies indexed in Web of Science, IEEE Xplore, ERIC, Google Scholar, and conference proceedings were not included. Given the rapidly evolving nature of AI research, conference publications may contain emerging insights not yet represented in journal literature.
- **Temporal Scope:** The study focuses on publications between 2023 and 2025. While this timeframe captures the formative phase following the release of generative AI tools such as ChatGPT, it introduces citation lag effects, limits longitudinal analysis, and may underrepresent late-2025 publications. As the field matures, future bibliometric updates may demonstrate stronger citation accumulation and structural consolidation.
- **Bibliometric Nature of Analysis:** The study relies on publication metadata rather than full-text content. Consequently, it does not evaluate the methodological rigor of individual studies, assess empirical effect sizes, or calculate actual percentages of AI usage among students and faculty. Instead, the analysis maps thematic prominence, structural relationships, and conceptual development.
- **Terminological Constraints:** Although the search query was comprehensive, variations such as “AI-assisted learning,” “intelligent tutoring,” or “algorithmic assessment” may not have been fully captured if not explicitly connected to generative AI terminology.
- **Early-Stage Field Dynamics:** As the domain is still emerging, the conceptual fragmentation observed in the conceptual structure analysis may reflect natural early-stage development rather than structural

weakness. Greater theoretical integration is expected as the research domain matures.

Despite these limitations, the study provides a robust macro-level mapping of GenAI adoption research in higher education and establishes a foundation for future integrative and empirical scholarship.

VIII. FUTURE RESEARCH DIRECTIONS

The bibliometric findings reveal several strategic avenues for future investigation:

- **Development of Integrated Multi-Stakeholder Models:** Future research should move beyond isolated student- or faculty-focused studies and develop integrated frameworks that incorporate students, academic staff, institutional administrators, and policymakers. AI adoption in higher education operates as an ecosystem rather than an individual-level phenomenon, requiring multi-level theoretical models that integrate behavioral, organizational, and governance dimensions.
- **Longitudinal Adoption Studies:** Most existing studies rely on cross-sectional survey designs. There is a need for longitudinal research examining sustained AI usage patterns, the evolution of academic integrity norms, faculty adaptation processes, and institutional policy effectiveness over time. Such designs would provide deeper insights into behavioral stabilization and normalization of GenAI use.
- **Cross-Cultural Comparative Analysis:** Although the country collaboration map reflects geographically dispersed research contributions, comparative adoption dynamics across developed and emerging economies, public and private institutions, and technology-intensive versus traditional universities remain underexplored. Cross-cultural investigations would strengthen understanding of contextual influences on AI integration.
- **Ethical and Governance Framework Development:** Academic integrity and governance-related studies appear as distinct yet fragmented clusters. Future research should focus on developing standardized AI governance models, evaluating institutional policy outcomes, examining ethical AI literacy frameworks, and assessing algorithmic transparency within educational contexts. Integration of institutional theory and digital governance perspectives may enhance conceptual rigor in this area.

- Learning Outcomes and Pedagogical Effectiveness: While adoption intention studies dominate the literature, fewer investigations assess measurable learning outcomes, cognitive development impacts, skill acquisition changes, and critical thinking implications. Experimental and quasi-experimental research designs could help bridge this empirical gap.
- Theoretical Extension Beyond TAM and UTAUT: Although traditional models such as TAM and UTAUT remain foundational, future research should incorporate sociotechnical systems theory, institutional theory, human–AI collaboration models, and ethical decision-making frameworks. Such theoretical diversification would promote conceptual integration and reduce the fragmentation identified in the conceptual structure analysis.

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