

STRATEGIC MANAGEMENT OF DIGITAL SKILLS DEVELOPMENT AMONG UNIVERSITY LECTURERS: EVIDENCE FROM SCOPUS AND AI-ENABLED BIBLIOMETRICS

GESTÃO ESTRATÉGICA DO DESENVOLVIMENTO DE COMPETÊNCIAS DIGITAIS ENTRE PROFESSORES UNIVERSITÁRIOS: EVIDÊNCIAS DA SCOPUS E DA BIBLIOMETRIA BASEADA EM IA

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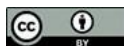
The authors declare that there is no conflict of interest

Abstract

This study investigates how universities can strategically enhance lecturers' digital skills by integrating a curated Scopus database with an AI-powered Bibliometrix workflow. Analyzing publications from 2016 to 2026, the research maps 751 documents from 524 sources, showing a yearly growth rate of 6.49 percent, an average article age of 3.34 years, and 16.81 citations per document. Collaboration patterns include an average of 3.19 authors per paper and 22.24 percent international co-authorship. Science-mapping uncovers a triadic structure connecting classroom practice, organizational enablers, and system-level change. Co-word networks and thematic maps reveal a cluster focused on pedagogy and platforms centered on teaching, students, and e-learning, alongside a core capability driven by digital competence and transformation. A contextual cluster, grounded in higher education, reflects regional signals pertinent to Vietnam. Factorial analysis positions these themes along axes distinguishing institutional capabilities from classroom implementation, while highlighting bridging roles for leadership, knowledge management, and artificial intelligence. The study suggests a strategic pathway: invest in pedagogy-led upskilling where impact is greatest, institutionalize gains through leadership development and knowledge routines, and oversee progress with lightweight bibliometric dashboards that align incentives, funding, and evidence. These findings transform fragmented efforts into a coherent capability framework, offering a practical portfolio for universities

Resumo

Este estudo investiga como as universidades podem aprimorar estrategicamente as competências digitais dos professores, integrando uma base de dados Scopus selecionada com um fluxo de trabalho Bibliometrix baseado em IA. Ao analisar publicações de 2016 a 2026, a pesquisa mapeia 751 documentos provenientes de 524 fontes, revelando uma taxa de crescimento anual de 6,49%, uma idade média dos artigos de 3,34 anos e 16,81 citações por documento. Os padrões de colaboração incluem uma média de 3,19 autores por artigo e 22,24% de coautoria internacional. O mapeamento científico revela uma estrutura triádica que conecta a prática em sala de aula, facilitadores organizacionais e mudanças no nível do sistema. Redes de co-palavras e mapas temáticos revelam um cluster focado em pedagogia e plataformas centradas no ensino, nos alunos e no e-learning, juntamente com uma capacidade central impulsionada pela competência digital e pela transformação. Um cluster contextual, fundamentado no ensino superior, reflete sinais regionais pertinentes ao Vietnã. A análise fatorial posiciona esses temas ao longo de eixos que distinguem as capacidades institucionais da implementação em sala de aula, ao mesmo tempo em que destaca papéis de ponte para a liderança, gestão do conhecimento e inteligência artificial. O estudo sugere um caminho estratégico: investir na qualificação profissional orientada pela pedagogia onde o impacto é maior, institucionalizar os ganhos por meio do desenvolvimento de liderança e rotinas



aiming for sustainable, responsible, and measurable growth in lecturers' digital competence.

Keywords: Digital Capability. Ai-Enabled Bibliometrics. Higher Education. University Lecturers. Strategic Management.

de conhecimento, e supervisionar o progresso com painéis bibliométricos leves que alinham incentivos, financiamento e evidências. Essas descobertas transformam esforços fragmentados em uma estrutura de capacidade coerente, oferecendo um portfólio prático para universidades que buscam um crescimento sustentável, responsável e mensurável na competência digital dos professores.

Palavras-chave: Capacidade Digital. Bibliometria Habilitada Por Ia. Ensino Superior. Professores Universitários. Gestão Estratégica.

1 INTRODUCTION

Across higher education systems, universities have come to see lecturers' digital skills not as minor abilities but as essential capabilities that support teaching quality, institutional resilience, and innovation. The COVID-19 disruption highlighted this on a large scale: as courses shifted online, institutions faced uneven levels in instructional design, assessment, and engagement, along with infrastructural challenges that led many public universities to repurpose social networking applications as makeshift learning platforms. Evidence indicates that such strategic use of social media can boost academic performance when intentionally aligned with pedagogy, but it also revealed policy, capacity, and quality assurance gaps that university leaders had to address in real time (Sobaih *et al.*, 2022). Similarly, lecturers' acceptance of learning management systems (Moodle) depended on performance expectations and facilitating conditions, with time pressure and learning demands affecting actual usage, reminding administrators that digital adoption involves not only tools but also work design and support (Taamneh *et al.*, 2023).

Beyond emergency continuity, digitalization redefines what "competence" means in academic work. Studies in Vietnamese and international contexts position digital skills within a broader capability system where knowledge management (KM) enablers such as rewards, culture, self-efficacy, and leadership behaviors convert individual competencies into university-level performance and productivity (Pham *et al.*, 2023; Kelder *et al.*, 2025). Meanwhile, the rapid spread of generative AI has increased demands for

reliability, explainability, and control in tools used by educators, shaping adoption strategies that go beyond technological enthusiasm to include governance and academic integrity (Hennekeuser *et al.*, 2025).

Against this backdrop, AI-powered bibliometrics can serve as a decision-making framework for university leaders. Using science-mapping (Bibliometrix), institutions can turn large Scopus collections into dashboards that monitor sources, identify trending topics, reveal collaboration networks, and track thematic development linking research output with what strategic managers need to fund, organize, and evaluate. The current study employs such an AI-driven workflow to analyze the field of lecturers' digital skills, interpret its patterns through a strategic management lens, and identify governance strategies for developing capabilities, especially focusing on Vietnam and similar emerging systems where readiness, incentives, and policy alignment are critical.

The post-pandemic decade calls for universities to manage lecturers' digital skills as an evolving and strategically governed capability. The evidence reviewed here presents three practical implications. First, effective digital teaching involves more than just access to platforms; it relies on the social and temporal organization of work. Institutions that invest in relevant performance training, reduce time barriers, and provide stable support conditions see higher adoption rates and better student outcomes (Taamneh *et al.*, 2023; Sobaih *et al.*, 2022). Second, capability improves when leadership and knowledge management (KM) are deliberate. Genuine digital leadership behaviors boost preparedness and productivity, while cultures and KM processes that align incentives help improve university performance (Kelder *et al.*, 2025; Pham *et al.*, 2023). Third, AI presents both opportunities and risks. Adoption depends on trustworthy system features and lecturer self-confidence, which universities can influence through AI education programs, testing environments, and governance frameworks (Hennekeuser *et al.*, 2025; Nowiński *et al.*, 2025).

Crucially, AI-enabled bibliometrics provides the measurement backbone for this agenda: by transforming scattered publications into navigable maps and trendlines, it supports adaptive governance, helping universities align professional learning with emerging themes, match incentives to evidenced needs, and track portfolio performance over time (Aria & Cuccurullo, 2017). For Vietnam and similar higher education systems, the path forward is clear: move beyond brief "tool training" and focus on system-level

capability building, anchored in leadership development, knowledge management practices, and data-driven decision routines that can keep pace with platform shifts and the evolving ethics of AI-supported teaching (Pham *et al.*, 2023; Kelder *et al.*, 2025). When managed strategically, lecturers' digital skills become a renewable institutional resource, one that enhances quality teaching, facilitates responsible AI integration, and boosts the university's adaptive capacity in a changing digital landscape.

The purpose of this study is to translate AI-enabled bibliometric evidence into practical strategies for managing the development of digital skills among university lecturers. It begins by systematically mapping the knowledge base on lecturer digital skills development through an AI-enabled Bibliometrix workflow applied to a curated Scopus corpus. This profiling uncovers the sources, thematic trends, and collaboration structures that shape the current intellectual landscape of the field (Aria & Cuccurullo, 2017). Next, the study aims to synthesize thematic clusters linking online teaching practices, leadership behaviors, knowledge-management processes, and AI-adoption dynamics. It explains how these connected domains influence capability-building pathways within universities, particularly in Vietnam and similar systems where institutional incentives, resource constraints, and readiness disparities significantly impact digital transformation outcomes (Pham *et al.*, 2023; Kelder *et al.*, 2025; Taamneh *et al.*, 2023). Finally, this research seeks to develop governance strategies that improve the strategic management of lecturers' digital skills development, including competency-based professional learning models, incentive-alignment mechanisms like recognition systems and workload redistribution, cross-institutional partnership strategies, and real-time monitoring with bibliometric dashboards. These tools help universities target investments more effectively and assess capability improvements beyond superficial training metrics (Sobaih *et al.*, 2022; Ayyash & Salah, 2025; Aria & Cuccurullo, 2017).

2 LITERATURE REVIEW

2.1 Digital teaching, platforms, and the post-pandemic capability agenda

The pandemic prompted a large-scale experiment in digital teaching, revealing two related findings. First, platform adoption depends on intention and conditions: a

structural model tested during COVID-19 shows that lecturers' behavioral intention was mainly influenced by performance expectancy, and actual use was supported by facilitating conditions (institutional support). At the same time, increased time pressure and learning demands led to greater reliance on the LMS (Taamneh *et al.*, 2023). Second, in areas where LMS infrastructure was lacking, using social network applications like WhatsApp and Facebook could still yield positive results if universities presented them as official, evaluated channels rather than optional extras (Sobaih *et al.*, 2022). These two insights support a strategic view of capability that combines individual skills with process and policy supports.

Despite rapid adaptation, capability gaps remain. In Industry 4.0 fields, where curricula require instructors to teach data, automation, and cyber-physical systems, evidence from multiple sites in Malaysia shows low readiness across both public and private universities, with no significant differences based on sector or discipline (Chew *et al.*, 2024). This suggests that universities should not assume that proximity to engineering disciplines automatically guarantees pedagogical readiness for emerging technologies. Instead, they need to invest in focused professional development that combines content knowledge, teaching methods, and assessment strategies.

2.2 Leadership, culture, and knowledge management as capability multipliers

Digital transformation is influenced by “soft” managerial infrastructure. A cross-cultural model with university staff shows that authentic leader behaviors enhance digital capability and readiness to teach or work effectively within digital ecosystems, thereby boosting productivity (Kelder *et al.*, 2025). In Vietnam, KM processes, shaped by organizational rewards, culture, and knowledge self-efficacy, mediate the relationship between enablers and university performance, highlighting the importance of incentive structures and learning cultures that sustain digital practices (Pham *et al.*, 2023). Collectively, these findings reposition digital skills as an organizational outcome: leadership and KM convert dispersed, individual competencies into collective capabilities.

The rise of generative AI intensifies leadership challenges. User-centered studies with educators show a willingness to use LLM-based assistants when systems are reliable,

explainable, and controllable. These qualities depend on good governance, transparency, and responsible AI practices integrated into academic workflows (Hennekeuser *et al.*, 2025). Meanwhile, research on incorporating AI into business and economics curricula highlights the importance of prior AI education and personal use in shaping attitudes and self-efficacy, two psychological factors that influence the intention to include AI in courses (Nowiński *et al.*, 2025). Strategically, this points to two key approaches for deans and learning leaders: (i) developing structured AI education pathways for faculty and (ii) creating safe-to-try sandbox environments that foster self-efficacy.

2.3 Digitalization beyond the classroom: performance and sustainability linkages

While the lecturer's digital toolkit is linked to the classroom environment, the surrounding institutional ecosystem also impacts performance. For example, when AI adoption is framed as a way to promote sustainability (campus energy management), lecturers' intentions and their subsequent use depend on technological readiness, perceived benefits, and awareness. This emphasizes the complementary roles of infrastructure, communication, and capability-building (Ayyash & Salah, 2025). Similarly, broader organizational literature shows that digital leadership, culture, and transformation pathways mediate performance outcomes. Although these studies focus on companies, their mechanisms, leadership predictability, vision driving transformation, and performance can be directly applied to university settings as complex knowledge organizations (Senadjki *et al.*, 2024; Kelder *et al.*, 2025).

In short, the literature converges on a layered capability model: (1) individual (digital literacy, pedagogical design, AI self-efficacy), (2) organizational (leadership, rewards, culture, KM), and (3) ecosystem (infrastructure, policy, partnerships). Strategic management of lecturers' digital skills must coordinate all three layers to shift from sporadic adoption to institution-wide transformation (Pham *et al.*, 2023; Kelder *et al.*, 2025).

2.4 Why AI-enabled bibliometrics matters for strategy

Traditional narrative reviews struggle to keep up with a rapidly evolving knowledge base. Science mapping with Bibliometrix enables universities to quantify the field by identifying prolific sources, high-velocity topics (“digital capability,” “AI in higher education,” “authentic/digital leadership”), and co-authorship networks. This helps leaders prioritize journals for dissemination, recognize emerging capability areas, and facilitate collaborations that speed up learning (Aria & Cuccurullo, 2017). Integrating these analytics into a dashboard culture supports “evidence-responsive” faculty development: the range of workshops, micro-credentials, and mentoring can be adapted as topics gain popularity (e.g., assessment with gen-AI) or decline (e.g., emergency remote teaching), directing resources toward initiatives with the greatest strategic impact.

3 METHODOLOGY

3.1 Design and approach

This study uses an AI-enabled bibliometric approach to provide comprehensive, field-specific evidence on how universities can strategically develop lecturers’ digital skills. We apply a science-mapping workflow in Bibliometrix (R) to conduct performance and intellectual/social structure analyses on a Scopus dataset, enhanced by an AI layer for entity disambiguation and topic labeling. This method follows established bibliometric procedures and utilizes Bibliometrix’s features for source, author, keyword, and network analysis (Aria & Cuccurullo, 2017).

3.2 Data source and retrieval

The evidence base was compiled from Scopus and exported as a structured CSV file that contains full bibliographic records, including authors, titles, abstracts, keywords, affiliations, citations, and DOIs. The time frame centers on the period of increased digitalization in higher education (post-2016), while also including earlier precursors when available. The working manuscript shows that, from 2016 to 2026, the field

comprises several hundred documents across journals, conferences, and books with clear annual growth and collaboration patterns, providing enough volume and diversity for stable science mapping.

3.3 Screening, cleaning, and normalization

(1) Scope filtering. Records were kept if they focused on lecturers or academic staff and any of the following topics: digital capability or competence, online teaching or LMS adoption, AI adoption in teaching or management, digital leadership or culture, or knowledge-management enablers. This scope reflects the main concepts in the corpus (LMS acceptance, SNA-mediated learning, authentic or digital leadership, KM processes). (2) Deduplication. Duplicates were eliminated through DOI and title matching. (3) Authority control. We standardized names for authors, institutions, and countries; an AI-assisted process flagged high-ambiguity cases for manual review. (4) Keyword unification. Variants such as “digital capability or capabilities,” “e-learning or online learning,” and “AI or Artificial Intelligence or GenAI” were consolidated into standard tokens to improve co-word precision (Aria & Cuccurullo, 2017).

3.4 Analytical framework

We analyzed annual scientific output, source influence, authorship trends, collaboration rates, and citation patterns to assess the field’s maturity and growth. This reflects the descriptive “Main Information” and “Annual Scientific Production” diagnostics in the working manuscript and guides where managerial focus should be directed (e.g., outlet portfolios, partnership density).

We conducted (i) co-word analysis on Author Keywords and Keywords Plus to capture cognitive structure; (ii) thematic mapping/evolution to position clusters by centrality and density across periods; (iii) co-authorship networks at the country and institution levels to reveal collaboration systems; and (iv) source growth analysis to identify journals and proceedings that anchor or accelerate discourse (Aria & Cuccurullo, 2017). The thematic interpretation was guided by constructs repeatedly evidenced in the corpus: platform acceptance under UTAUT conditions (e.g., Moodle adoption, time

pressure, facilitating conditions), leadership and culture effects on digital capability, and KM's mediating role in university performance (Taamneh *et al.*, 2023; Kelder *et al.*, 2025; Pham *et al.*, 2023).

3.5 AI-enabled enhancements

Three AI supports were integrated: (a) entity disambiguation, which uses transformer-based similarity on names and affiliations to reduce fragmentation in network nodes; (b) topic labeling, where short-text embeddings over keyword and abstract segments helped assign human-readable labels to clusters (“AI-supported pedagogy,” “authentic leadership & digital capability”); and (c) anomaly checks, flagging improbable country and source attributions for human review. These steps enhanced precision and recall in the maps while maintaining expert judgment (Aria & Cuccurullo, 2017; corpus constructs).

3.6 Validity and robustness checks

We cross-checked emergent themes against validated frameworks documented in the corpus, LMS acceptance (UTAUT), leadership-to-capability pathways, and KM mediations to prevent overfitting to bibliometric artifacts (Taamneh *et al.*, 2023; Kelder *et al.*, 2025; Pham *et al.*, 2023). Temporal stability: Co-word structures were compared across early (2016–2019), transition (2020–2022), and consolidation (2023–2026) sub-periods to ensure that cluster cores persisted and evolved plausibly with the pandemic/GenAI inflection. External plausibility: We compared co-word signals for SNA-mediated teaching with outcome-focused studies to verify that topic salience in the maps aligns with reported effects on performance and adoption (Sobaih *et al.*, 2022; Taamneh *et al.*, 2023).

3.7 Ethical considerations and limitations

We analyzed secondary, publicly available metadata and did not process personal data beyond the author and affiliation strings available in Scopus exports. Findings are

limited by Scopus's coverage and indexing practices; however, the corpus is large and diverse enough to support reliable science-mapping, and the AI-assisted normalization reduces common noise in author and keyword variants (Aria & Cuccurullo, 2017).

Figure 1

Main Information



Source: AI Bibliometrix 5.0

Figure 1 shows that, based on a sensitivity analysis of the Main Information for 2016–2026 retrieved from Scopus, the digital skills of university lecturers in this evidence base include 751 documents published across 524 sources. This provides a solid starting point for exploring strategic university management of capability development. The field remains active and influential, with a 6.49% annual growth rate, an average document age of 3.34 years, and an average of 16.81 citations per document. This indicates a young but visible body of literature that could inform policy. Collaboration is common: 2,176 authors contribute, with an average of 3.19 authors per document. About 22.24% (378) of the documents involve international collaboration, and only 110 are single-authored works (approximately 14.65%). This shows that knowledge creation is mainly a cross-border, team-based activity, better suited to institutional partnerships. The results are mostly journal-based, with 584 articles (approximately 77.76%), followed by conference papers (111; approximately 14.78%), book chapters (47; approximately 6.26%), and books (9; approximately 1.20%). This pattern reflects a preference for peer-reviewed venues where managerial insights circulate quickly. There are many concepts:

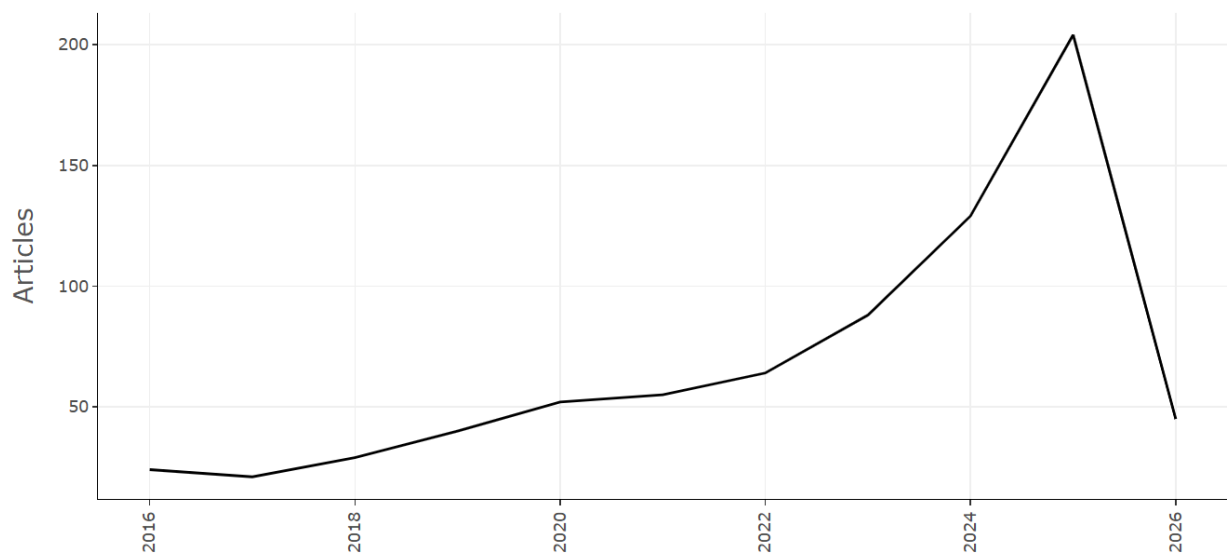
2,010 Keywords Plus and 2,297 author keywords, offering strong potential for AI-enabled co-word mapping and thematic analysis to identify emerging priorities such as digital pedagogy, AI literacy, and assessment analytics. Strategically, these trends suggest that universities should expand structured faculty development, invest in international collaborations, focus on core journals while monitoring emerging subfields through conferences, and use real-time bibliometric dashboards to guide digital skills training and evidence-based, adaptable governance (Aria & Cuccurullo, 2017).

4 RESULTS

4.1 Annual scientific production

Figure 2

Annual Scientific Production



Source: AI Bibliometrix 5.0.

Figure 2 displays the annual production of scientific publications on digital skills among university lecturers, showing a sharp and steady increase. It has grown from 24 documents in 2016 to a projected maximum of 204 in 2025, with a compound annual growth rate of about 26.8% and a linear growth of roughly 16.6 items per year. The trend appears to be driven by momentum after 2020, with notable rises in 2023 (88), 2024 (129), and 2025 (204). It is also notable that the years 2023–2025 already represent 59.6%

of the total from 2016 to 2025, highlighting a rapid concentration of research interest in the social sciences. Yearly growth serves as a key indicator, culminating in a 58.1% increase from 2024 to 2025, following strong growth in 2023 (around 37.5%) and 2024 (about 46.6%). Past fluctuations, such as in 2017, may be short-term noise within an overall upward trend. The count of 45 documents for 2026 reflects data available at the time of analysis and should be interpreted cautiously. Managing this growth strategically suggests a maturing yet expanding agenda: universities need to coordinate faculty development, targeted seed funding, and incentive mechanisms with ongoing waves of research; align conference pipelines and special issues with phases of accelerated adoption; and use AI-powered bibliometric dashboards to monitor turning points, identify high-velocity subtopics, and reallocate resources dynamically, thereby scaling digital skills capacity in line with the rising production.

4.2 Countries' scientific production

Figure 3

Countries' Scientific Production

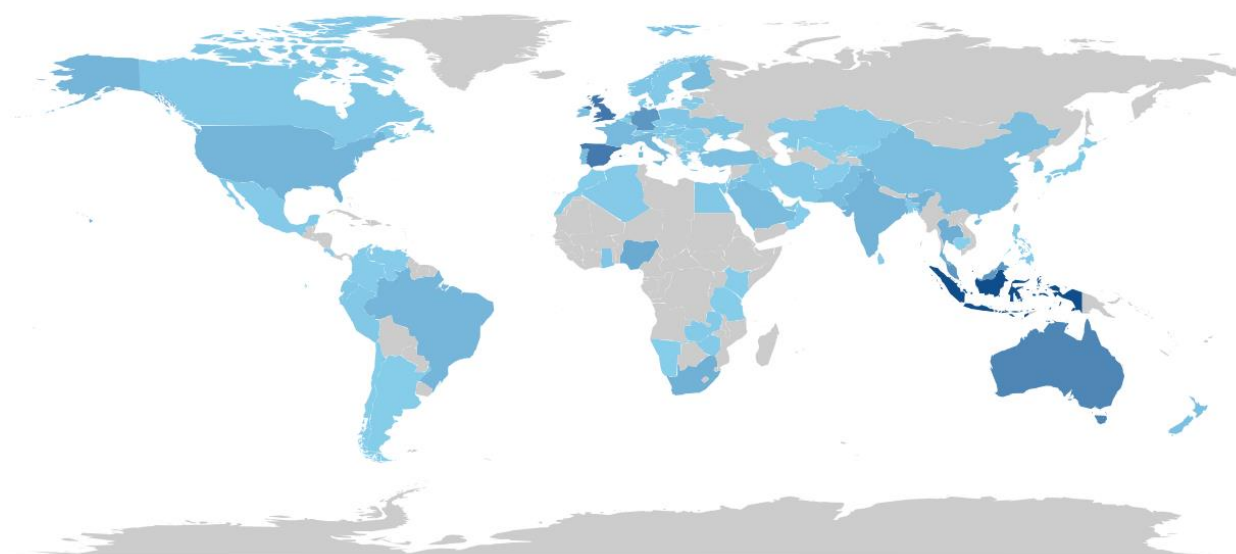


Table 1*Countries' Scientific Production*

Country	Freq	Country	Freq
INDONESIA	239	GERMANY	96
UK	157	NIGERIA	63
SPAIN	152	THAILAND	55
AUSTRALIA	130	SOUTH AFRICA	52
MALAYSIA	97	INDIA	46

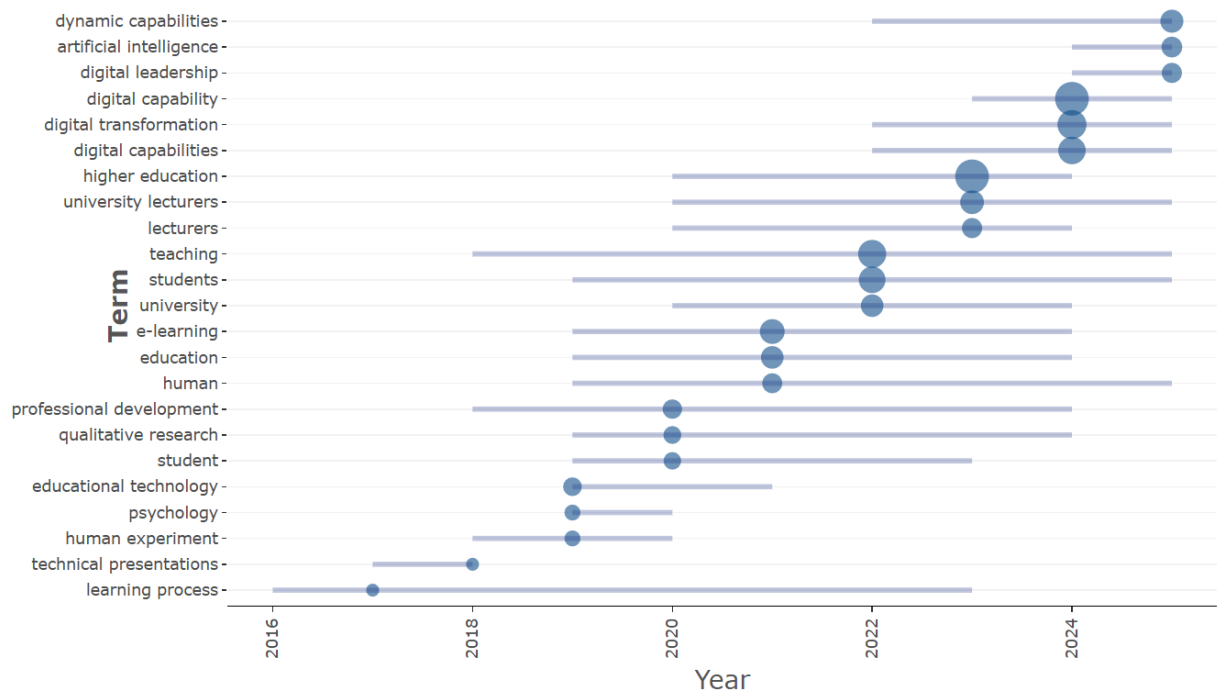
Source: AI Bibliometrix 5.0.

At the country level, the scientific output on digital skills for higher education is heavily concentrated in a few nations: Indonesia ranks first with 239 documents, followed by the UK (157), Spain (152), and Australia (130), with Malaysia (97) and Germany (96) completing the leading group. This pattern of ASEAN and Anglophone countries reflects a certain dynamic in developing strategic agendas for lecturer upskilling, balancing emerging and established research systems. Major contributors like Nigeria (63) and Thailand (55) are just beginning a long tail of countries with low single-digit outputs, such as Algeria, the Philippines, and Mexico (each with 6). There are also contributions below ten from Afghanistan, Bahrain, Costa Rica, Kenya, Kuwait, Oman, Qatar, Slovakia, and Venezuela (2 each), and one contribution each from Cambodia, Croatia, Kyrgyzstan, Namibia, North Macedonia, and Uzbekistan, indicating varied capacity and diffusion. From a bibliometric perspective, these disparities highlight three strategic approaches for managing the development of digital skills among university lecturers: (i) fostering strategic South–South and North–South co-authorships that connect leading producers with emerging nodes; (ii) investing in AI-enabled bibliometric literacy within research offices to accelerate evidence-based programming; and (iii) creating incentives for cross-country studies that translate findings into scalable professional learning models. The prominence of Indonesia, Malaysia, and Thailand suggests that middle-income countries have potential for scaling through regional consortia and open-science infrastructures to support platform adoption and reforms in digital pedagogy. Meanwhile, contributions from countries with low output point to opportunities for capacity-building funds to transform bibliometric peripheries into strategic partners, as shown in Table 1 and Figure 3.

4.3 Trend topics

Figure 4

Trend Topics



Source: AI Bibliometrix 5.0.

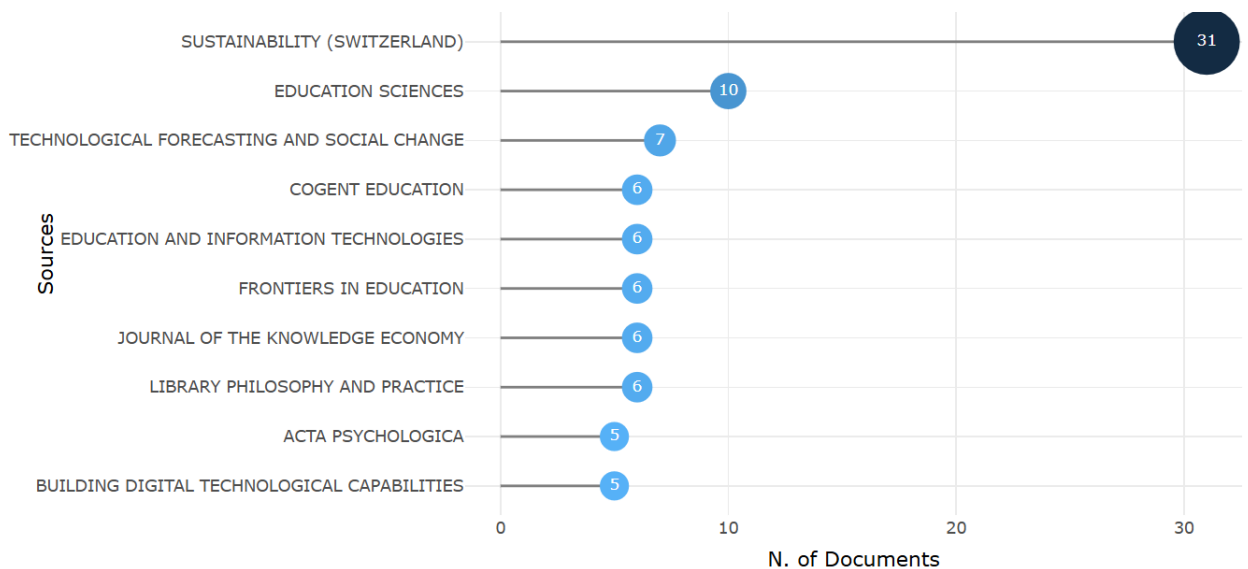
A bibliometric analysis of trending topics in the academic literature further underscores a phased progression in policy emphasis on lecturer development, transitioning from method-centric pedagogical approaches to capability-focused governance. Early justifications of existing professional practices are somewhat limited and predominantly encompass two themes: “learning process” (Q1 2016) and “technical presentations” (Q1 2017), signifying initial engagement with instructional rather than organizational capacity enhancement. By 2019, the emphasis expanded to include adoption strategies, with terms such as “educational technology” (frequency 16) and “e-learning” (frequency 52; median 2021; Q3 2024), illustrating a shift toward the platformization of educational delivery. From 2020 onwards, discourse becomes increasingly institutional and role-specific, featuring keywords such as “higher education” (frequency 151; Q1 2020; median 2023), “university lecturers” (frequency 44; median 2023), “students” (frequency 68; median 2022), and “teaching” (frequency 82;

median 2022–Q3 2025), highlighting the university as the principal locus for digital skills development. Between 2022 and 2025, the scope further broadens to incorporate strategic terms including “digital transformation” (frequency 92; Q1 2022; median 2024; Q3 2025), “digital capability/capabilities” (frequency 151/76; Q1 2023/2022; medians 2024), and “dynamic capabilities” (frequency 39; median/Q3 2025), signifying a shift from mere tools to scalable capacity-building initiatives. Emerging frontier governance themes in 2024–2025, such as “artificial intelligence” (frequency 26; Q1 2024; median 2025) and “digital leadership” (frequency 23; Q1 2024; median 2025), indicate a move towards AI-enabled decision systems and stewardship. These trends establish a foundation for strategic management, with the objective of transforming incentives for leaders through outcome-based measures and AI-driven bibliometric dashboards that continuously align faculty competencies with evolving institutional priorities (Figure 4).

4.4 Most relevant sources

Figure 5

Most Relevant Sources



Source: AI Bibliometrix 5.0.

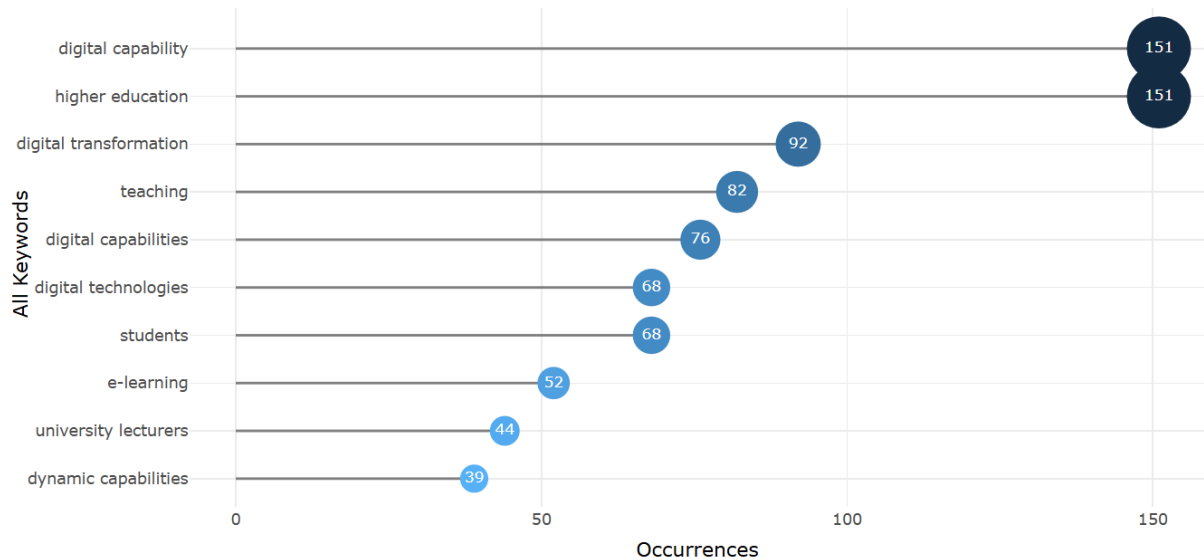
Figure 5 displays a focused yet interdisciplinary primary source: Sustainability (Switzerland) leads with 31 articles in this profile, followed by Education Sciences (10) and Technological Forecasting and Social Change (7), as digital skills agendas for

lecturers are viewed as both institutional change and societal transition efforts. A second group, comprising six articles, includes sources like Cogent Education, Education and Information Technologies, Frontiers in Education, Journal of the Knowledge Economy, and Library Philosophy and Practice, concentrating on pedagogical innovation from knowledge-economy and information-literacy perspectives. Praxis in higher education is also prominently featured by the Journal of Further and Higher Education (4), Studies in Higher Education (3), Teachers and Teaching (3), and Higher Education Research & Development (3), highlighting the university as the main setting for broad capability development. Digital skills are discussed within debates on organizational performance and governance in outlets such as Business Strategy and the Environment (4), Management Decision (4), Business Process Management Journal (4), Information & Management (3), IEEE Transactions on Engineering Management (3), and Technology Analysis & Strategic Management (2), as well as more generally within strategy and organization (and increasingly in the IS literature). Knowledge sharing is accelerated through proceedings like ASCILITE 2017 (4), EDUCON (2), FIE (2), and ECEL/PACIS (2 each), while meta-evaluation is prominent in Scientometrics (2). For strategic management, this environment suggests a dual approach: publish in education-technology journals to expand pedagogy, and in management/IS outlets to build institutionalized dynamic capabilities; additionally, use conferences for quick pilots and AI-enhanced bibliometric dashboards to track outlet shifts and co-host special issues connecting lecturer training with transformation metrics (see Figure 5).

4.5 Keyword data visualisation

Figure 6

Most Frequent Words



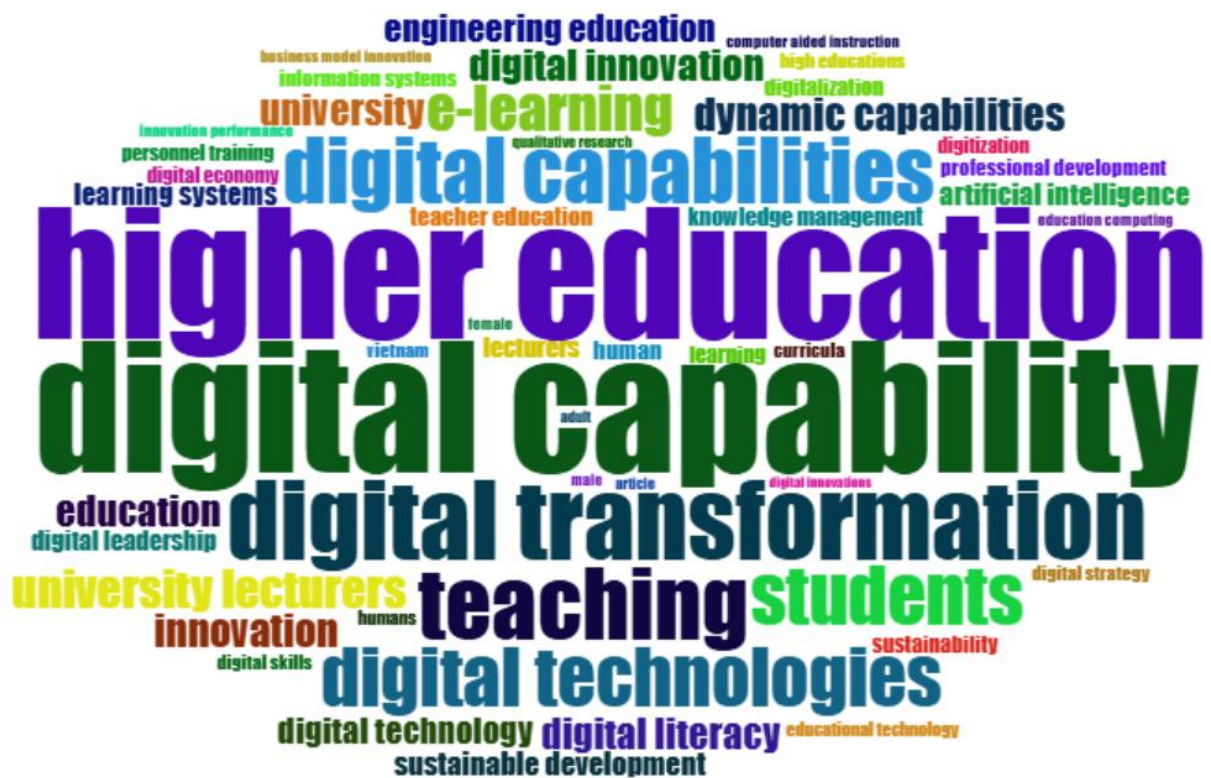
Source: AI Bibliometrix 5.0.

The AI-assisted bibliometric analysis of the Scopus corpus identifies "digital capability" and "higher education" as two main conceptual hubs, each with 151 occurrences. This clarifies a clear agenda for strategically managing lecturers' digital skill development. Around these key concepts, the field revolves around digital transformation (92), teaching (82), and the pluralized digital capabilities (76), reflecting a capability-building approach that links daily pedagogy to broader institutional transformation. Practice clusters focusing on digital technologies and students (68 each), e-learning (52), and the actor label university lecturers (44) suggest that design efforts are most effective when grounded in teaching–learning contexts rather than isolated training events. The capability perspective extends to dynamic capabilities (39), innovation (38), digital innovation (37), and digital literacy, education, and university (36 each), indicating that upskilling is most successful when institutions intentionally connect micro-skills with meso-level innovation processes. Governance-related terms such as digital leadership (23), knowledge management (21), digitalization and professional development (20 and 19), and efforts to strengthen digital strategy (17) show that leadership, incentives, and curriculum cohesion are crucial to translating skills into

tangible outcomes. Artificial intelligence (26) acts as a cross-cutting accelerator in this context. A regional focus emerges with mentions of Vietnam (17) and sustainable development (27), highlighting impact models and context sensitivity. Overall, with a total of 1,663 references across 50 different keywords, the data strongly suggest a strategic management focus: developing lecturers' digital capabilities as dynamic, AI-enabled resources, coordinated through leadership and knowledge systems, and integrated into teaching practices for institutional transformation (Figure 6).

Figure 7

WordCloud



Source: AI Bibliometrix 5.0.

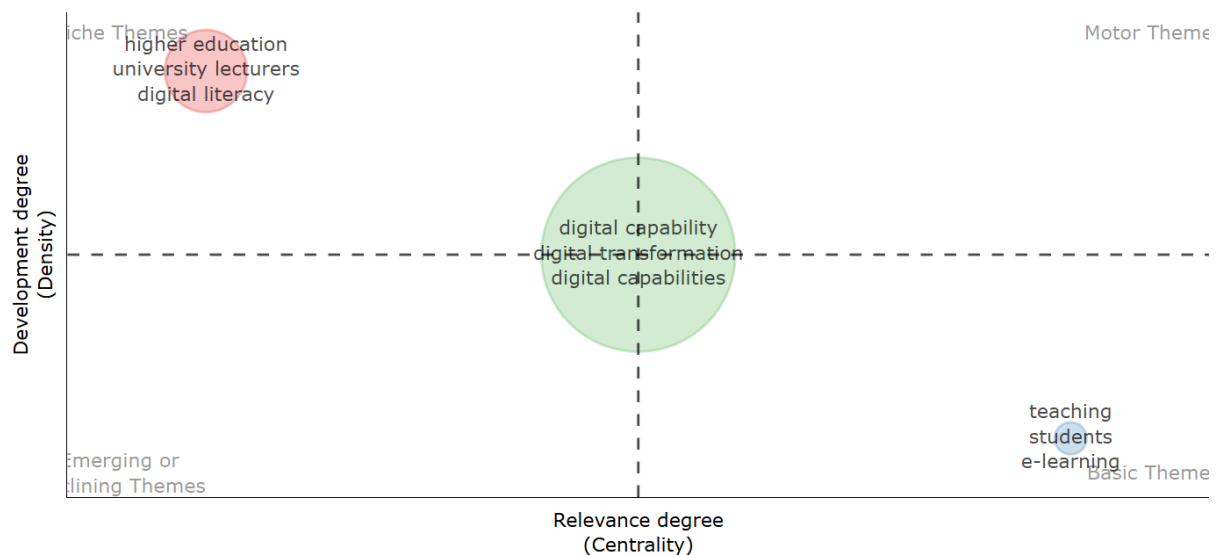
The word cloud visually consolidates the conceptual framework of digital skills in higher education, with “digital capability” and “higher education” occupying the most prominent space, demonstrating that they are key in shaping strategic actions to upskill lecturers. These core ideas are supported by related clusters such as “digital transformation,” “teaching,” and “digital capabilities,” which emphasize the mutually reinforcing nature of pedagogical and institutional renewal. Terms like “digital

Figure 8 depicts the co- word network extracted from the Scopus corpus, which segments into four clusters that collectively illustrate how conversations about lecturers' digital skills are organized across areas like transformation, pedagogy, contextual descriptors, and literacy/skills, providing a concise map for managerial action. Cluster 1 centers on the transformation–governance core, where digital transformation is the main connector (betweenness = 232. 232.830; closeness = 0. 016; PageRank = 0. 062), surrounded by digital capability (83. 125; 0. 014; 0. 055), digital technologies (57. 410; 0. 014; 0. 034), and an institutional surrounding of digital strategy, digitalization, and knowledge management (low PageRank nodes that still sit within the same governance framework). Cluster 3 anchors the pedagogy–practice core: teaching has high influence (114. 114.869; 0. 015; 0. 056) alongside higher education (133. 133.101; 0. 015; 0. 041), with e- learning (49. 611; 0. 014; 0. 034), students (19. 583; 0. 013; 0. 039), and artificial intelligence (26. 852; 0. 013; 0. 016) connecting classroom practice to emerging tools; notably, the term university lecturers appears but with modest centrality (0. 267; 0. 011; 0. 009), indicating dispersed author- keyword usage. Cluster 2 groups education and demographic descriptors such as education (27. 702; 0. 013; 0. 025), human/humans, female/male, and adult, which connect peripherally to practice and transformation nodes and often focus on studying populations rather than capability development. Cluster 4 includes literacy/skills terms, with digital literacy holding moderate centrality (8. 649; 0. 012; 0. 012), while digital skills are underrepresented (0. 217; 0. 011; 0. 006), reflecting terminological fragmentation that managers can address through vocabulary guidance in calls and training. Overall, the network indicates a sequencing logic for strategy: use Cluster 1 to guide institutional transformation, Cluster 3 to implement pedagogy and AI in classrooms, Cluster 2 to profile contexts, and Cluster 4 to standardize capability language. This approach helps to align governance, practice, and clear development pathways.

4.6 Theme map

Figure 9

Thematic Map



Source: AI Bibliometrix 5.0.

Based on Figure 9, the thematic map derived from the Bibliometrix analysis resolves the discourse into three dominant clusters that together articulate a pathway from institutional context to classroom practice to capability governance, with each cluster characterized by distinct frequency and centrality profiles that guide strategic decisions. At the contextual pole, the higher education cluster is anchored by higher education with 151 occurrences and substantive broker values, accompanied by university lecturers with 44, digital literacy with 36, education with 36, university with 36, digital technology with 31, learning with 20, and a regional node for Vietnam with 17, indicating an evidence base that is simultaneously global and sensitive to country conditions and sector specific governance signals such as leadership and teacher education that register non trivial betweenness values. The practice cluster centers on teaching with 82 occurrences and strong connective metrics, with students at 68, e learning at 52, engineering education at 32, artificial intelligence at 26, learning systems at 26, professional development at 19, personnel training at 18, and digital skills at 17, a profile that positions this cluster as a basic and transversal theme where capability is enacted in curricula, assessment, and day

at 21, along with strategy indicators like digitalization at 20 and digital strategy at 17, suggesting a coordinated institutional direction toward change. On the opposite side of this axis, the practice cluster emphasizes teaching at 82 with strong connections, students at 68, e-learning at 52, learning systems at 26, engineering education at 32, and artificial intelligence at 26, indicating that pedagogical implementation and assessment routines function as an applied theme focused on enacting skills. The second axis separates the sectoral and contextual background anchored by higher education at 151, alongside university lecturers at 44, digital literacy at 36, education at 36, university at 36, and a prominent regional node, Vietnam at 17. These elements help explain variance across systems in capability pathways and highlight where policy and demographic factors influence adoption. The quadrant structure thus provides a clear roadmap for management: align investments with the capability core to build institutional readiness; translate these gains into classroom practice, where the teaching cluster prevails; and adjust strategies in response to contextual signals from the higher education landscape. This ensures that capability development progresses from strategic planning to tangible learning outcomes (Figure 10).

5 DISCUSSION

The AI-powered bibliometric analysis maps the field across three interconnected areas that managers can use to inform policy. The core capability is driven by digital skills, with 151 mentions and high centrality, along with digital transformation at 92 and digital technologies at 68. The practice area focuses on teaching, with 82 mentions, students at 68, and e-learning at 52, with artificial intelligence emerging as a quickly growing area with 26 mentions. The contextual setting is defined by higher education with 151 mentions, university lecturers at 44, digital literacy at 36, and a country indicator for Vietnam at 17. This framework shows how classroom practices, governance measures, and systemic conditions co-evolve rather than change independently.

Compared to earlier research in the Excel corpus, the practice cluster confirms and expands on evidence of platform adoption collected during the pandemic. Studies on lecturers' acceptance of learning management systems show that performance expectancy and facilitating conditions influence both intention and actual use, while time pressure

and learning demands further impact LMS reliance. These mechanisms match the clustering of teaching, e-learning, and students in the same dense area of the map, which suggests that capability is most clearly demonstrated through assessment, interaction, and feedback cycles (Taamneh *et al.*, 2023). In environments with limited formal platforms, structured social network applications were associated with better academic performance. Our map interprets this as practice-driven capability development within resource constraints (Sobaih *et al.*, 2022).

The core of capability positions leadership and knowledge routines near the transformation lexicon, helping to unify disparate organizational studies into a clear pathway. Authentic leadership has been shown to enhance digital capability and preparedness among university staff, aligning with the presence of digital leadership in 23 instances within the capability cluster, along with knowledge management at 21 and digitalization at 20 (Kelder *et al.*, 2025). In Vietnam, enablers of knowledge management, such as rewards, culture, and knowledge self-efficacy, influence processes that mediate university performance. This finding aligns with Vietnam being a contextual node and the governance vocabulary surrounding the capability core (Pham *et al.*, 2023). The literature on integrating AI into curricula reports that prior AI education and personal use shape attitudes and self-efficacy among lecturers, which our map interprets as a human factors layer linking the artificial intelligence node in practice to the governance side, where leadership and knowledge processes are located (Nowiński *et al.*, 2025).

Readiness gaps remain prominent, and the Excel corpus documents them clearly. Evidence from Malaysian universities shows low preparedness to teach Industry 4.0 content even in engineering and computer science departments. The thematic map shows digital skills at 17 instances and professional development at 19 in the practice cluster, indicating that universities should view pedagogy-led reskilling as essential infrastructure rather than occasional training (Chew *et al.*, 2024). The Excel *set also* indicates that AI adoption by lecturers contributes to broader sustainability goals, such as campus energy management, when institutions invest in technological readiness and highlight tangible benefits. The presence of artificial intelligence in the practice cluster and sustainable development in the capability cluster suggests a clear path from classroom experimentation to institutional value when governance explicitly addresses use cases and measurement (Ayyash & Salah, 2025).

Taken together, the discussion reshapes scattered findings into a layered capability system. At the classroom level, lecturers implement platforms and AI within their courses. At the organizational level, leadership and knowledge management convert individual skills into institutional capacity. At the strategic level, transformation programs connect capability indicators to performance and sustainability. The bibliometric evidence suggests a practical order: invest where the teaching cluster has the greatest impact. Institutionalize gains through leadership development and knowledge processes that the capability core links to lasting change. Align these investments with system conditions reflected by the higher education context and country indicators. This sequence maintains the human aspect of academic work while fulfilling the governance requirement to monitor capability growth with clear evidence.

6 CONCLUSION

This study demonstrates that effectively managing lecturers' digital skills requires a layered capability system that connects classroom practices, organizational enablers, and whole-institution transformation. AI-powered bibliometrics provided a clear map of this system, illustrating how pedagogy, leadership, knowledge routines, and technology adoption come together into logical pathways. By analyzing sources, topics, and collaboration patterns, the study moved beyond isolated success stories to offer an evidence-based view of where investments will yield the greatest learning impact.

For universities, the implications are practical and immediate. Capability building should begin where teaching and students concentrate value, then be institutionalized through leadership development and knowledge management, and finally be governed with data-driven dashboards that keep incentives and resources aligned. The patterns surfaced here suggest that systems with diverse readiness levels can still progress if they combine pedagogy-led reskilling with explicit transformation programs and consistent vocabulary for skills, outcomes, and accountability. In doing so, institutions can convert dispersed digital efforts into durable capacity, ensuring that lecturers are supported to innovate responsibly while advancing the broader mission of higher education.

6.1 Limitations

The analysis is descriptive and relational rather than causal. Co-word structures, thematic maps, and networks show proximity and prominence but do not determine the effect of specific interventions on lecturers' capabilities, pedagogy, or student outcomes. Parameter choices in science-mapping and AI-assisted disambiguation can influence community detection and factor solutions, and visual interpretation remains partly judgment-based. Finally, generalizability is limited by time and context. The corpus captures a period of rapid digitalization, including the post-pandemic and early generative-AI phases, and the managerial implications should be considered alongside institutional factors such as governance models, resource constraints, and national policy environments.

6.2 Future directions for Vietnam

Vietnam's next phase of strategic management for lecturers' digital skills should focus on transforming fragmented efforts into a coordinated capability framework that connects classroom practices, organizational routines, and system governance into a single, measurable pathway for improvement. A practical starting point is to embed competency-based professional learning as a central part of academic development, rather than relying on an occasional workshop culture, with clear progression paths that incorporate digital pedagogy, assessment literacy, and responsible use of emerging technologies. These paths should align with workload models and promotion criteria so that time, recognition, and advancement reflect the behaviors universities aim to foster. At the program level, universities could establish design studios where interdisciplinary teams of lecturers, learning designers, and data specialists collaborate to create courseware, improve assessments, and document scalable patterns for large-enrollment courses; by treating design as a team effort, institutions can reduce variability and accelerate the transfer of best practices. At the organizational level, leadership development should go beyond inspiring seminars to a structured curriculum that nurtures genuine leadership, change management skills, and data-informed decision-making, reinforcing habits that turn local innovations into institution-wide routines. To sustain

momentum, knowledge management should be made visible through curated playbooks, shared repositories of learning activities, and peer-reviewed micro-credentials that validate practical mastery rather than passive attendance. Nationally, ministries and quality agencies can support coherence by standardizing a simple vocabulary for digital capability outcomes, aligning funding with competency goals, and fostering cross-institutional collaborations that pool limited expertise, especially in regions outside major urban centers. Data infrastructure is crucial: universities should adopt lightweight bibliometric dashboards and course analytics to monitor where capabilities are expanding, which interventions are effective across disciplines, and where additional support is needed, all while safeguarding privacy and academic freedom. Equity must stay a priority, with targeted grants to assist under-resourced institutions in upgrading connectivity, devices, and local support, along with flexible professional development options for lecturers juggling research, teaching, and family commitments. Ultimately, Vietnam can position itself as a regional leader by commissioning comparative studies, hosting open repositories of teaching exemplars, and aligning doctoral training and postdoctoral fellowships with the digital capability agenda—building a pipeline of academic leaders who see pedagogy, technology, and governance as interconnected. Collectively, these steps can help universities shift from episodic training to ongoing capacity building, promote responsible innovation among lecturers, and convert digital investments into tangible learning improvements and institutional resilience.

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Authors' Contribution

Bui Huy Khoi and Tran Van Thanh drafted the main manuscript, while Bui Huy Khoi developed the Methods and Data Mining sections. Tran Van Thanh wrote the remaining parts. All authors contributed to the review and approval of the final manuscript.

Data availability

All datasets relevant to this study's findings are fully available within the article.

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