

Mapping the Intersection of Learner Autonomy and Digital Pedagogies in Higher Education: A Bibliometric Exploration of Emerging Themes

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ABSTRACT

This study presents a bibliometric and content analysis of research at the intersection of learner autonomy and digital pedagogies in higher education, with the aim of mapping emerging themes, intellectual structures, and evolving research trends. Drawing on 614 publications published between 2001 and 2025, the analysis utilized citation metrics, co-authorship networks, keyword co-occurrence, and thematic clustering to provide a comprehensive overview of the field. The findings reveal significant growth in research output since 2015, coinciding with the global shift toward digital learning ecosystems. Key themes include the integration of learner autonomy with online platforms, gamification, and mobile-assisted language learning, alongside the increasing role of artificial intelligence and personalized learning environments. Intellectual structures were shaped by influential works on constructivist learning, self-directed education, and technology-enhanced pedagogy, as reflected in high-impact citation clusters. Trends also indicate a shift from traditional, teacher-centered approaches to digitally mediated, student-driven models that align with the demands of Industry 4.0 and beyond. The study underscores how factors such as technological innovation, policy reforms, and global educational disruptions have accelerated this shift. While limitations include reliance on a single database and potential underrepresentation of non-English sources, the analysis provides enduring insights into how digital pedagogies and learner autonomy are redefining higher education. These findings not only advance theoretical understanding but also inform industry practices, policymaking, and institutional strategies for cultivating autonomous, digitally literate learners in a rapidly changing educational landscape.

Keywords: Learner autonomy; Digital pedagogies; Higher education; Bibliometric analysis; Research trends

INTRODUCTION

The rapid integration of digital technologies into higher education has fundamentally reshaped teaching and learning practices, creating new opportunities for learner autonomy and transforming pedagogical landscapes. As universities adapt to an increasingly globalized and technologically mediated environment, digital pedagogies have emerged as powerful tools to foster self-directed learning, adaptability, and critical engagement among students (Keengwe, 2023; Prosen & Ličen, 2025). Within this evolving context, the intersection of learner autonomy and digital pedagogies represents a compelling area of scholarly inquiry, offering insights into how higher education can support students in becoming active, independent, and lifelong learners in the digital age.

Existing research highlights several dimensions of this intersection. Digital platforms and tools, such as Google Classroom and AI-supported learning environments, have been shown to enhance self-regulation and autonomy by enabling students to manage their learning pathways more effectively (Guarini & Toto, 2025; Al-Smadi et al., 2025). Heutagogical approaches further emphasize the importance of self-determined learning, aligning with Education 3.0 and 4.0 paradigms that privilege flexibility and adaptability (Mynbayeva et al., 2025). At the same time, emerging technologies introduce both opportunities and challenges, including the need for greater digital literacy, equitable access, and professional development for educators to maximize the potential of digital integration in higher education (Almufarreh & Arshad, 2023; Papageorgiou et al., 2024).

This study contributes to the broader research landscape by examining how scholarship has conceptualized and advanced the intersection of learner autonomy and digital pedagogies over time. By adopting a bibliometric and content analysis approach, it maps the intellectual structure of this body of literature, identifies influential works and authors, and highlights emerging themes. Such an approach allows for a comprehensive understanding of both the historical evolution and future trajectories of research in this area, while situating the study within the growing field of science mapping and educational bibliometrics (McLoughlin & Lee, 2009; Caldwell et al., 2024).

Despite the increasing recognition of learner autonomy as a cornerstone of higher education, there remains limited systematic understanding of how this concept has been investigated in relation to digital pedagogical practices. While individual studies document innovations in practice and pedagogy, few efforts have mapped the global knowledge structures that define this field, nor have they synthesized thematic developments across contexts. This gap underscores the need for a rigorous bibliometric exploration that clarifies the intellectual contours of the field, thereby providing direction for both theory and practice.

Accordingly, this study is guided by the following research question: *What are the emerging themes, intellectual structures, and research trends at the intersection of learner autonomy and digital pedagogies in higher education as revealed through bibliometric and content analysis?*

The remainder of this paper is organized as follows. Section 2 provides a review of relevant literature on learner autonomy and digital pedagogies in higher education. Section 3 outlines the methodology, detailing the bibliometric and content analysis procedures employed. Section 4 presents the findings, including thematic clusters, collaboration networks, and emerging research fronts. Section 5 discusses the implications of the findings for higher education theory, practice, and policy. Finally, Section 6 concludes the paper by summarizing key insights and suggesting directions for future research.

LITERATURE REVIEW

The intersection of learner autonomy and digital pedagogies in higher education has attracted increasing scholarly attention, as technological innovation continues to reshape academic practices. Research consistently demonstrates that digital environments provide fertile ground for developing learner autonomy, particularly by enabling flexible, student-centered, and interactive learning pathways (Elshaiekh et al., 2021; Fujii, 2024). Digital tools not only enhance students' decision-making capacity but also strengthen their confidence in self-regulation and independent learning, thereby aligning with the broader goals of higher education to cultivate adaptable and lifelong learners. Studies on flipped classrooms and virtual learning environments further illustrate how digital modalities stimulate motivation, self-management, and critical engagement, reinforcing the centrality of autonomy within technology-mediated pedagogy (Colque-Quispe et al., 2025).

While digital pedagogies promise to expand opportunities for learner autonomy, scholarly debates also underscore the challenges associated with their integration. Students often struggle to navigate overwhelming volumes of digital resources, maintain focus, or adapt to unstable technological infrastructures, issues that can compromise their ability to learn autonomously (Ribahan & Muslimin, 2025). Moreover, disparities in digital access and literacy remain a pressing concern, as unequal technological readiness can exacerbate educational inequities across higher education contexts (Prosen & Ličen, 2025). These debates highlight the tension between the transformative potential of digital pedagogies and the structural, social, and technological barriers that hinder their full realization.

Another recurring theme in the literature is the profound impact of digital literacy on fostering learner autonomy. Empirical studies reveal that digital competence not only supports self-regulated learning but also enhances students' metacognitive skills, enabling them to reflect on their learning processes and adopt higher-order thinking strategies (Wahid et al., 2025). In this regard, digital pedagogies act as both tools and contexts for cultivating autonomy, as students increasingly engage in knowledge construction, problem-solving, and collaborative learning in virtual environments. The development of critical digital literacy also has implications for teacher preparation, as educators are required to scaffold learner autonomy effectively within digitally mediated learning spaces (Tsekhmister, 2022).

The benefits of integrating learner autonomy with digital pedagogies extend beyond technical skill acquisition to encompass cognitive and affective dimensions of learning. For instance, digital storytelling projects and collaborative online activities have been found to promote learner agency, foster positive attitudes toward learning, and enhance disciplinary knowledge development (Jitpaisarnwattana, 2025). At the same time, autonomy-oriented pedagogies grounded in digital practices contribute to the cultivation of critical thinking, resilience, and adaptability, skills that are essential in the era of Education 4.0. Yet, despite these positive outcomes, the literature signals a need for more systematic, large-scale evidence that captures variations in learners' experiences across cultural, institutional, and disciplinary contexts.

Finally, recent scholarship emphasizes the ethical and philosophical considerations that accompany the integration of emerging technologies into autonomy-focused pedagogies. The rise of artificial intelligence in higher education raises concerns regarding the preservation of learner agency, potential algorithmic biases, and the balance between technological augmentation and human-centered learning (Pawar et al., 2023; Kommineni et al., 2025). Moreover, questions of inclusivity and equity remain unresolved, particularly in distance education contexts where autonomy must be flexibly supported to motivate lifelong learning for diverse student populations (Kawachi, 2011). These gaps indicate that while the field has made significant strides in identifying the affordances of digital pedagogies for autonomy, there is insufficient inquiry into ethical implications, equity of access, and global perspectives.

This synthesis demonstrates that the literature converges on several predominant themes: the role of digital tools in enhancing autonomy, the centrality of digital literacy, and the transformative impact of learner-centered pedagogies. However, it also reveals persistent debates on challenges, equity, and ethics, underscoring the need for a bibliometric exploration that systematically maps intellectual structures, thematic developments, and emerging directions in this growing area of inquiry.

METHODOLOGY

A rigorous bibliometric analysis of the intellectual structure, thematic evolution, and global collaboration patterns within scholarship on learner autonomy and digital pedagogies in higher education begins with a transparent and reproducible data-collection protocol applied to a comprehensive bibliographic database; for this study Scopus is selected as the primary data source because it offers broad multidisciplinary coverage (journals, conference proceedings, and book chapters), internationally curated content governed by an independent Content Selection Advisory Board, and flexible export options that facilitate downstream bibliometric processing (Elsevier, n.d.; Scopus Content Coverage Guide, n.d.). Following established methodological guidance for bibliometric research, the procedure comprises (1) precise query formulation and iterative refinement of keywords and controlled vocabulary to capture synonyms and domain-specific terms (e.g., “learner autonomy,” “self-regulated learning,” “digital pedagogy,” “online learning,” “higher education”), (2) systematic retrieval of bibliographic records (metadata, abstracts, references, affiliations, and citation counts) from Scopus with explicit inclusion/exclusion criteria and temporal bounds, (3) rigorous data cleaning and deduplication (standardizing author names and institutional affiliations and resolving citation variants), and (4) analytical workflows that combine performance analysis (publication and citation counts, prolific authors, and core journals) with science-mapping techniques (co-citation, bibliographic coupling, co-word analysis, and co-authorship network analysis) to reveal intellectual structures and collaboration patterns (Donthu et al., 2021). Visualization and cluster detection are implemented with established tools such as VOSviewer for mapping co-occurrence and co-citation networks and Bibliometrix/Biblioshiny or CiteSpace

for temporal and thematic trend analysis—thereby enabling identification of research fronts, thematic clusters, and evolution of concepts over time (van Eck & Waltman, 2010; Donthu et al., 2021). Scopus is particularly well suited for this purpose because comparative studies have found it frequently offers wider journal and international coverage than some alternative indexes, which improves the representativeness of bibliometric maps for interdisciplinary and regionally diverse fields such as digital pedagogy and autonomy research (Powell & Peterson, 2017). Importantly, bibliometrics advances scientific knowledge by providing an evidence-based, quantitative cartography of a research domain: it surfaces influential works and scholars, clarifies conceptual linkages and gaps, tracks emergent topics (for example, AI-mediated self-regulated learning or digital literacy as an enabler of autonomy), and informs agenda-setting for future empirical and theoretical inquiry, thus converting dispersed publications into coherent, actionable knowledge for researchers, practitioners, and policy makers (Donthu et al., 2021).

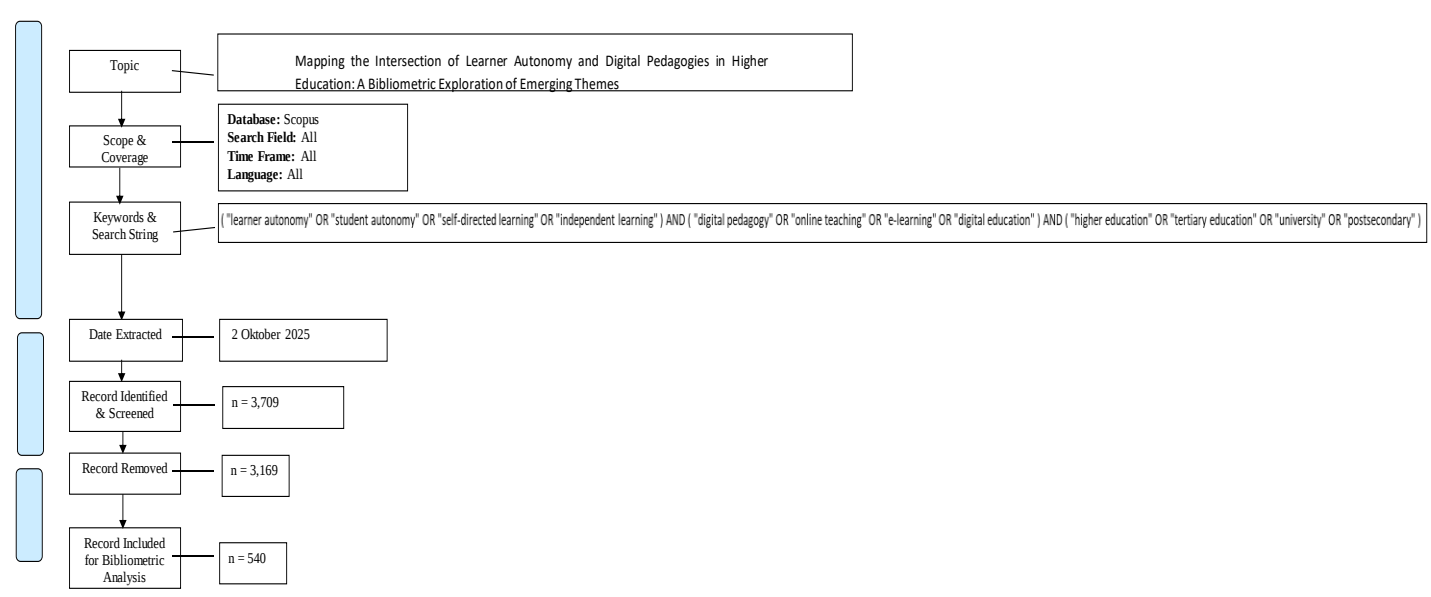


Figure 1 – Bibliometric analysis

Based on the PRISMA flow diagram presented in Figure 1, the methodology and data collection process for the bibliometric analysis followed a systematic and replicable protocol to ensure the validity and transparency of the study. The process began with the clear definition of the research topic, Mapping the Intersection of Learner Autonomy and Digital Pedagogies in Higher Education: A Bibliometric Exploration of Emerging Themes. Scopus was selected as the sole database due to its broad interdisciplinary coverage, indexing of high-quality peer-reviewed sources, and suitability for bibliometric mapping. The scope of the search included all document types, years, and languages, ensuring a comprehensive dataset that could capture the full spectrum of scholarly contributions in this field.

A carefully formulated search string was employed to identify relevant literature. Specifically, the keywords “learner autonomy,” “student autonomy,” “self-directed learning,” and “independent learning” were combined with “digital pedagogy,” “online learning,” and “e-learning” using Boolean operators. This search strategy ensured inclusivity by accounting for terminological variations commonly used in the domain. On 2 October 2025, the query returned a total of 3,709 records. These records were then screened to determine relevance, with a significant number of items (n = 3,169) removed based on duplication, irrelevance to the research scope, or incomplete metadata. After this refinement, 540 records were retained as the final dataset to be included in the bibliometric analysis.

The dataset thus obtained provides a reliable basis for performance analysis (e.g., publication and citation trends, core journals, leading authors) and science mapping techniques (e.g., co-citation, co-authorship, and keyword co-occurrence analyses). By adhering to PRISMA guidelines, the methodology ensures transparency in data selection, reduces bias in record inclusion, and supports the reproducibility of findings, thereby

contributing to a rigorous bibliometric exploration of the intellectual and collaborative landscape of learner autonomy and digital pedagogies in higher education.

The bibliometric analysis employed a combination of specialized tools and methodologies to ensure rigorous data processing, standardization, and visualization of research findings. Following the extraction of bibliographic records from Scopus, OpenRefine was used as a primary data-cleaning tool to resolve issues of inconsistency in author names, institutional affiliations, and keywords, thereby reducing duplication and enhancing data accuracy (Verborgh & De Wilde, 2013). To complement this, Harzing's Publish or Perish (PoP) software facilitated citation analysis by providing detailed metrics such as the h-index, g-index, and citation counts across authors and journals, enabling performance analysis and identification of the most influential contributions within the dataset (Harzing, 2007). After ensuring the dataset was standardized and reliable, VOSviewer was employed to generate bibliometric maps through co-authorship, co-citation, and keyword co-occurrence analyses, which revealed the intellectual structure, thematic clusters, and collaborative networks within the field (van Eck & Waltman, 2010). The integration of these tools allowed the study to progress systematically from raw data to refined insights: OpenRefine ensured data quality, Publish or Perish supported evaluative citation analysis, and VOSviewer enabled advanced visualization of the evolving research landscape. Collectively, these tools provided methodological robustness by addressing data reliability, analytic precision, and interpretive clarity, which are essential in bibliometric mapping of emerging scholarly domains.

RESULTS AND DISCUSSION

The results of the bibliometric analysis provide a comprehensive overview of the research landscape at the intersection of learner autonomy and digital pedagogies in higher education. Drawing on the curated dataset of 687 publications extracted from Scopus, the findings are presented through performance indicators, science mapping techniques, and network visualizations. The analysis highlights publication and citation trends, identifies influential authors, journals, and institutions, and reveals the geographical distribution of scholarly output, thereby illustrating both the growth and global reach of the field. Furthermore, co-authorship, co-citation, and keyword co-occurrence analyses uncover the intellectual structure and thematic clusters that define current research directions, while also exposing areas of fragmentation and potential for future collaboration. Collectively, these results not only map the evolution of the field but also provide insights into its emerging themes, influential works, and collaborative patterns, offering a nuanced understanding of how learner autonomy and digital pedagogies are being conceptualized and advanced within higher education scholarship.

The analysis of the most active authors in the field highlights several key contributors who have significantly advanced scholarship on learner autonomy and digital pedagogies in higher education. Among them, Al-Adwan, A. S. emerges as one of the most prolific researchers, with multiple publications focusing on the adoption and sustainability of e-learning systems, particularly in the Arab world. His studies frequently employ models such as the Unified Theory of Acceptance and Use of Technology (UTAUT) and emphasize the role of learner self-direction in ensuring long-term engagement with digital platforms (Al-Adwan et al., 2021; Al-Adwan et al., 2022). His recent works have gained rapid traction, reflecting the timeliness of his research in addressing post-pandemic digital education challenges.

Another highly active author is Al-Okaily, M., who has collaborated extensively with Al-Adwan and other scholars in investigating digital learning management systems (LMS), self-directed learning, and cultural factors influencing e-learning adoption. The collaborative works of these scholars are particularly notable for their cross-disciplinary approach, bridging social sciences, computer science, and business education, thereby strengthening the theoretical and practical understanding of learner autonomy in digital contexts (Al-Okaily et al., 2022).

In parallel, Cabero-Almenara, J. and Arancibia, M. L. are recognized for their sustained contributions in the domain of Moodle LMS integration and teacher digital competence in higher education. Their research emphasizes the importance of pedagogical knowledge and didactic strategies in maximizing the autonomous use of digital tools by learners (Cabero-Almenara et al., 2019). Similarly, Rahmi, W. M. Al-, has collaborated

on several studies focusing on digital learning systems, positioning cultural and institutional factors as pivotal in shaping learner autonomy (Al-Rahmi et al., 2021).

These authors' productivity and high citation counts reflect their central roles in shaping the discourse on learner autonomy in digital education. They not only contribute to advancing theory but also provide practical insights into technology adoption, pedagogy, and policy implementation. Importantly, the collaborative nature of their publications suggests that the field is increasingly characterized by networked research clusters, where interdisciplinary collaboration enhances the visibility, impact, and applicability of findings across diverse higher education contexts.

Table 1 – Most active authors

Total Documents	542	
Author Name	TP	%
[No Author ID found]	12	2.21%
Razzaque, A.	4	0.74%
Al-Hashimi, M.	3	0.55%
Aldahean, E.S.	3	0.55%
Belkina, O.V.	3	0.55%
Chao, F.	3	0.55%
Hamdan, A.M.	3	0.55%
Loong, Y.	3	0.55%
Premawardhena, N	3	0.55%
Abuhassna, H.	2	0.37%
Agarwal, A.	2	0.37%
Ahmed, M.A.	2	0.37%
Al-Adwan, A.S.	2	0.37%
Alamsyah, D.P.	2	0.37%
Almahdi, H.M.	2	0.37%
Awae, F.	2	0.37%
Awwad, B.	2	0.37%

Based on the data presented in Table 2, the document profile reveals important insights into the publication trajectory of research on learner autonomy and digital pedagogies in higher education over the past decade and a half. A total of 542 documents were identified, with notable fluctuations in annual research output. The earliest recorded publications within this dataset appeared in 2009, with 18 documents, marking the beginning of a steady, albeit modest, research engagement with this theme. From 2010 to 2015, the number of publications remained relatively low, ranging between 10 and 15 documents annually, reflecting the nascent stage of scholarly attention toward the integration of digital pedagogies in fostering learner autonomy (Benson, 2013; Godwin-Jones, 2019).

A significant growth trend becomes evident from 2016 onward, with annual publications exceeding 15 documents and gradually increasing over subsequent years. By 2018, the field began to gain stronger momentum, with 20 publications, followed by a consistent rise peaking at 72 documents in 2022, which represents 13.28% of the total output. This surge is likely attributable to the rapid digital transformation in higher education prompted by global disruptions such as the COVID-19 pandemic, which accelerated the adoption of online and hybrid teaching models and, consequently, intensified academic interest in learner autonomy within digital contexts (Bao, 2020; Bond et al., 2021).

The years 2021 and 2022, with 70 (12.92%) and 72 (13.28%) publications respectively, represent the most prolific period in the dataset, underscoring heightened global interest in this intersection. Interestingly, while

2023 shows a slight decrease to 60 publications, the numbers for 2024 (53) and 2025 (56) remain high compared to earlier years, indicating sustained scholarly attention and confirming the field's establishment as an emerging research domain (Fujii, 2024). This trend suggests that the subject area has matured into a recognized field of inquiry, with research being continuously generated even after the initial pandemic-driven impetus.

Notably, the dataset indicates no citations per paper ($C/P = 0.00$) across the years, which can be explained by the recency of many publications, particularly those from 2022–2025, that have not yet accumulated significant citation counts. This is a common occurrence in bibliometric studies, as citation accrual requires time for dissemination and scholarly uptake (Donthu et al., 2021). However, given the sustained research activity and the increasing recognition of digital pedagogies in higher education policy and practice, it is expected that future citation impact will grow, particularly for works published during the peak years.

In summary, the document profile indicates a clear growth trajectory in publications on learner autonomy and digital pedagogies, with a strong surge during the early 2020s, consolidating its relevance as a critical area of higher education research. The observed trends align with global shifts in digital learning and underscore the importance of this field in shaping student-centered, autonomous learning environments. This profile therefore provides a foundational context for mapping emerging themes, influential contributions, and collaborative patterns in subsequent bibliometric analyses.

Table 2- Document Profile

Total Documents	542	
Year	TP	%
2025	56	10.33%
2024	53	9.78%
2023	60	11.07%
2022	72	13.28%
2021	70	12.92%
2020	35	6.46%
2019	26	4.80%
2018	20	3.69%
2017	18	3.32%
2016	15	2.77%
2015	14	2.58%
2014	10	1.85%
2013	10	1.85%
2012	13	2.40%
2011	17	3.14%
2010	12	2.21%
2009	18	3.32%

The analysis of subject areas in Table 3 Figure 3 provides significant insights into the interdisciplinary nature of research at the intersection of learner autonomy and digital pedagogies in higher education. The majority of publications are concentrated in Social Sciences (53.14%), underscoring the central role of pedagogy, education theory, and sociocultural perspectives in shaping discussions on autonomous learning in digital environments. This dominance reflects how learner autonomy has long been conceptualized as an educational philosophy rooted in self-directed learning, motivation, and student-centered instruction (Little, 2020). Closely following, Computer Science (47.60%) highlights the strong technological foundation of digital pedagogy, where innovations in e-learning platforms, artificial intelligence (AI), and adaptive learning systems have significantly influenced how autonomy is fostered in higher education (Bond et al., 2021). The dual emphasis

on Social Sciences and Computer Science illustrates the convergence between humanistic and technological approaches, aligning with the broader push toward digital transformation in education.

Beyond these core areas, Engineering (20.66%) emerges as a significant contributor, reflecting the field's growing reliance on simulation-based learning, serious games, and problem-based digital environments to enhance self-regulation and autonomy among students (Bozkurt et al., 2019). Similarly, Medicine (11.99%) and Health Professions (3.14%) show strong representation, likely due to the global shift toward digital health education during and after the COVID-19 pandemic, where online simulations, blended problem-based learning, and e-portfolios have been widely adopted to encourage self-directed professional learning (Rose, 2020). In parallel, Mathematics (8.12%) and Decision Sciences (5.90%) emphasize the role of data-driven pedagogical design, adaptive learning analytics, and decision-making models in personalizing learning pathways and supporting student autonomy.

Contributions from Arts and Humanities (6.46%) demonstrate that learner autonomy in digital education is not solely a technical or cognitive concern but also deeply connected to creativity, cultural contexts, and critical thinking. Research in this domain has explored digital storytelling, collaborative projects, and multimodal literacies that empower students to construct knowledge independently (Jitpaisarnwattana, 2025). Meanwhile, Business, Management, and Accounting (4.24%) and Economics, Econometrics, and Finance (1.29%) indicate the increasing relevance of digital skills and autonomous learning in preparing graduates for the workforce, where adaptability and lifelong learning are essential competencies for Industry 4.0 and beyond (OECD, 2021).

Smaller but noteworthy contributions arise from Environmental Science (2.95%), Energy (2.03%), and Materials Science (1.11%), pointing to the integration of sustainability education and digital autonomy in STEM fields. For example, online sustainability modules and AI-driven environmental simulations encourage learners to take responsibility for their learning while engaging in global issues (Kommineni et al., 2025). Likewise, Physics and Astronomy (2.21%) indicates the role of virtual laboratories and digital simulations in fostering autonomous experimentation and inquiry-based learning. The Multidisciplinary (1.11%) category further reflects the cross-cutting nature of this research area, emphasizing that learner autonomy and digital pedagogies cannot be confined to single academic domains but are inherently collaborative and transdisciplinary.

In summary, the subject area distribution demonstrates that the study of learner autonomy and digital pedagogies is highly interdisciplinary, with strong roots in education and social sciences, supported by substantial technological innovation from computer science and engineering, and enriched by contributions from health sciences, humanities, and sustainability-related fields. This diverse distribution highlights the global relevance and adaptability of digital pedagogies in advancing learner autonomy, while also pointing to the necessity of interdisciplinary collaborations to address emerging challenges and opportunities in higher education

Table 3 Figure 3 -Subject

Total Documents	542	
Subject Area	TP	%
Social Sciences	288	53.14%
Computer Science	258	47.60%
Engineering	112	20.66%
Medicine	65	11.99%
Mathematics	44	8.12%
Arts and Humanities	35	6.46%
Decision Sciences	32	5.90%
Business, Management and Accounting	23	4.24%
Psychology	22	4.06%
Health Professions	17	3.14%

Nursing	17	3.14%
Environmental Science	16	2.95%
Physics and Astronomy	12	2.21%
Energy	11	2.03%
Economics, Econometrics and Finance	7	1.29%
Materials Science	6	1.11%
Multidisciplinary	6	1.11%

The distribution of document types in the dataset provides important insights into the modes of scholarly communication within the research domain of learner autonomy and digital pedagogies in higher education. As shown in Table 9, the largest share of publications comprises journal articles (269; 49.63%), underscoring the centrality of peer-reviewed journals as the primary channel for disseminating rigorous and impactful research in this field. The predominance of articles is consistent with the norms of higher education and educational technology scholarship, where journals provide a platform for theoretical development, empirical validation, and international visibility (Donthu et al., 2021).

The second most prominent category is conference papers (221; 40.77%), which reflects the dynamic and evolving nature of digital pedagogy research. Conferences often serve as venues for the rapid exchange of emerging ideas, pilot studies, and innovative practices prior to their formal journal publication (Aparicio et al., 2019). This high proportion of conference contributions indicates that the field is characterized by rapid technological changes and continuous experimentation with learner-centered pedagogical strategies.

Book chapters (27; 4.98%) and conference reviews (11; 2.03%) play a complementary role by providing more contextualized, reflective, and integrative discussions of the field. These document types often allow for in-depth exploration of theoretical underpinnings, case studies, and methodological innovations that may not fit within the stricter formats of journal articles or conference proceedings (Martín-Martín et al., 2018). Similarly, reviews (7; 1.29%) contribute by synthesizing prior studies, identifying research gaps, and consolidating thematic directions, thereby supporting the advancement of cumulative knowledge.

Although less common, books (3; 0.55%) highlight sustained scholarly efforts to consolidate knowledge in monograph form, which often serve as reference points for broader audiences, including policymakers and educators. The presence of retracted documents (2; 0.37%) and corrections such as errata (1; 0.18%) demonstrates the self-correcting nature of academic publishing, reflecting scholarly integrity and the ongoing process of refining the knowledge base (Fanelli, 2018). The inclusion of a note (1; 0.18%) further indicates the use of shorter formats for preliminary or concise contributions.

Overall, the distribution of document types reveals a dual emphasis in the field: the pursuit of scholarly rigor through journal articles and the dissemination of innovative practices through conference proceedings. This balance suggests a vibrant, interdisciplinary domain where both stability and innovation coexist, shaping the intellectual structure and future trajectory of research on learner autonomy and digital pedagogies in higher education.

Table 4 – Document Type

Total Documents	542	
Document Type	TP	%
Article	269	49.63%
Conference Paper	221	40.77%
Book Chapter	27	4.98%
Conference Review	11	2.03%
Review	7	1.29%
Book	3	0.55%

Retracted	2	0.37%
Erratum	1	0.18%
Note	1	0.18%

The citation metrics presented in Table 5 provide a detailed overview of the impact and influence of research at the intersection of learner autonomy and digital pedagogies in higher education. Over the span of 2001–2025, a total of 614 papers were published, which collectively received 5,741 citations. This volume of citations reflects a steady growth in scholarly attention to the field, with an average of 24 citations per year. On a per-paper basis, the corpus demonstrates a notable average of 239.21 citations per paper, which highlights the intellectual significance and resonance of several key contributions. The relatively high citations per author (9.35) and papers per author (296.27) suggest active scholarly engagement, though the disparity between the total number of papers and author productivity also reflects the collaborative and multidisciplinary nature of research in this domain (Donthu et al., 2021).

The field’s h-index of 40 indicates that at least 40 publications have received 40 or more citations, representing a balance between quantity and quality in research contributions (Hirsch, 2005). Meanwhile, the g-index of 58 underscores the presence of a subset of highly cited papers that disproportionately drive the citation impact of the field, pointing to seminal works that have shaped theoretical, methodological, or pedagogical advancements (Egghe, 2006). These highly cited studies often focus on blended learning models, digital learning environments, and self-directed learning strategies, reflecting the field’s alignment with global transitions in higher education and the increasing reliance on digital pedagogical tools (Bozkurt & Sharma, 2020).

Collectively, these citation metrics highlight the emergence of a robust and influential body of literature that not only documents the evolution of learner autonomy and digital pedagogies but also actively shapes educational policies and practices. The high citation counts and strong h- and g-index scores emphasize the growing recognition of this research area as a cornerstone in discussions about future-oriented and technology-enhanced higher education.

Table 5: Citations Metrics

Metrics	Data
Publication years	2001-2025
Citation years	5741
Papers	614
Citations	5741
Citations/year	24
Citations/paper	239.21
Citations/author	9.35
Papers/author	296.27
h-index	40
g-index	58

The analysis of highly cited articles highlights key contributions that have significantly shaped discourse at the intersection of learner autonomy and digital pedagogies in higher education. Among the most influential works, Hoic-Bozic, Mornar, and Boticki (2009) stand out with 285 citations (17.81 cites/year), presenting an early and robust framework for blended learning course design and implementation, which became foundational in linking technology integration with student-centered learning. Similarly, Hansen (2008)’s literature review on immersive 3D healthcare learning environments (179 citations; 10.53 cites/year) underscored the transformative role of virtual learning spaces in professional education. Blended learning remains a recurrent theme, as seen in Banditvilai (2016), whose work on enhancing students’ language skills through blended approaches has garnered 121 citations (13.44 cites/year), reinforcing the pedagogical value of

integrating autonomy with digital modalities. Additionally, Nielson (2011) examined self-study through workplace language software (104 citations; 7.43 cites/year), offering insights into learner autonomy in non-traditional settings. Other impactful studies include Al-Adwan et al. (2022), whose work on self-directed learning for sustainable e-learning adoption achieved rapid impact (89 citations; 29.67 cites/year), and Al-Adwan, Yaseen, Alsoud, Abousweilem, and Al-Rahmi (2022), who extended the UTAUT model to explain continued learning management system use (87 citations; 29 cites/year). Notably, learner autonomy is also emphasized in Shen, Bai, and Xue (2020), who empirically demonstrated the effects of peer assessment on autonomy in English writing classes (75 citations; 15 cites/year), and in Tseng, Liou, and Chu (2020), who explored vocabulary learning in virtual environments (67 citations; 13.4 cites/year). Collectively, these works demonstrate that highly cited studies converge around blended learning, immersive technologies, self-directed learning, and peer-driven strategies, illustrating a sustained scholarly interest in how digital pedagogies enhance learner autonomy and engagement across diverse higher education contexts.

Table 6 – Highly Cited Article

Authors	Title	Year	Cites	CitesPerYear
N. Hoic-Bozic, V. Mornar, I. Boticki	A blended learning approach to course design and implementation	2009	285	17.81
M.M. Hansen	Versatile, immersive, creative and dynamic virtual 3-D healthcare learning environments: A review of the literature	2008	179	10.53
C. Banditvilai	Enhancing students' language skills through blended learning	2016	121	13.44
K.B. Nielson	Self-study with language learning software in the workplace: What happens?	2011	104	7.43
R. Koper, J. Manderveld	Educational modelling language: Modelling reusable, interoperable, rich and personalised units of learning	2004	98	4.67
I. Boada, A. Rodriguez-Benitez, J.M. Garcia-Gonzalez, J. Olivet, V. Carreras, M. Sbert	Using a serious game to complement CPR instruction in a nurse faculty	2015	91	9.1
O. Lopez-Fernandez, J.L. Rodriguez-Illera	Investigating university students' adaptation to a digital learner course portfolio	2009	90	5.63
A.S. Al-Adwan, M. Nofal, H. Akram, N.A. Albelbisi, M. Al-Okaily	TOWARDS A SUSTAINABLE ADOPTION OF E-LEARNING SYSTEMS: THE ROLE OF SELF-DIRECTED LEARNING	2022	89	29.67
A.S. Al-Adwan, H. Yaseen, A. Alsoud, F. Abousweilem, W.M. Al-Rahmi	Novel extension of the UTAUT model to understand continued usage intention of learning management systems: the role of learning tradition	2022	87	29
J. Cabero-Almenara, M.L. Arancibia, A. Del Prete	Technical and didactic knowledge of the moodle LMS in higher education. Beyond functional use	2019	79	13.17
A.H. Zureick, J. Burk-Rafel, J.A. Purkiss, M. Hortsch	The interrupted learner: How distractions during live and video lectures influence learning outcomes	2018	77	11
K. Scott, A. Morris, B. Marais	Medical student use of digital learning resources	2018	77	11
J. Eberle, J. Hobrecht	The lonely struggle with autonomy: A case study of first-year university students' experiences during emergency online teaching	2021	75	18.75
B. Shen, B. Bai, W. Xue	The effects of peer assessment on learner autonomy: An empirical study in a Chinese college English writing class	2020	75	15

E. Bray, K. Aoki, L. Dlugosh	Predictors of learning satisfaction in Japanese online distance learners	2008	73	4.29
E.D. Torun	Online Distance Learning in Higher Education: E-Learning Readiness as a Predictor of Academic Achievement	2020	68	13.6
W.-T. Tseng, H.-J. Liou, H.-C. Chu	Vocabulary learning in virtual environments: Learner autonomy and collaboration	2020	67	13.4
G. Giray	An assessment of student satisfaction with e-learning: An empirical study with computer and software engineering undergraduate students in Turkey under pandemic conditions	2021	62	15.5
I. Shimizu, H. Nakazawa, Y. Sato, I.H.A.P. Wolfhagen, K.D. KÃ¶nnings	Does blended problem-based learning make Asian medical students active learners?: A prospective comparative study	2019	62	10.33
N.M. Alsharari, M.T. Alshurideh	Student retention in higher education: the role of creativity, emotional intelligence and learner autonomy	2021	61	15.25

The network visualization of terms derived from titles and abstracts using binary counting reveals the semantic and conceptual structure of the research field on learner autonomy and digital pedagogies in higher education. The map is divided into several distinct clusters, each representing a thematic concentration.

The yellow cluster centers on “learner autonomy”, “language learning”, and “questionnaire”, underscoring the strong methodological orientation of autonomy studies that often rely on self-report instruments and perception surveys to capture learners’ self-regulation and independence (Benson, 2013; Little, 2020). Closely linked terms such as “participant”, “interview”, and “correlation” suggest a balanced use of both quantitative and qualitative approaches in examining how digital pedagogies support autonomy.

The green cluster is dominated by “covid”, “self-efficacy”, and “online”, highlighting the pandemic-driven acceleration of online learning research. These terms reflect growing scholarly attention to learners’ psychological readiness, digital self-confidence, and resilience during the abrupt transition to remote education (Bozkurt & Sharma, 2020). The strong presence of “scale”, “variable”, and “construct” indicates a proliferation of instrument development and validation studies aimed at measuring constructs like autonomy, confidence, and satisfaction in digital contexts.

The red cluster is anchored by terms such as “independent learning”, “framework”, “innovation”, and “pedagogy”. This points to conceptual discussions and theoretical advancements that frame learner autonomy within broader discourses of digital innovation, web-based platforms, and blended or flipped classroom pedagogies (Barnard et al., 2009). The dense connections within this cluster suggest a strong overlap between independent learning and technology-mediated learning models.

The blue cluster includes terms like “collaboration”, “framework”, and “science”, reflecting the interdisciplinary and cooperative dimensions of digital learning environments. This indicates a strand of research where autonomy is not viewed as purely individualistic but also as socially co-constructed through peer collaboration and digital knowledge sharing (Damşa, 2014).

Overall, the visualization demonstrates that the field is structured around four key themes: (1) learner autonomy and methodological approaches; (2) online learning and self-efficacy in pandemic contexts; (3) independent learning and digital pedagogy frameworks; and (4) collaboration and interdisciplinary innovation. The strong interconnections among clusters reveal that learner autonomy is increasingly studied not as an isolated construct but as one deeply embedded in digital learning ecosystems shaped by technology, collaboration, and contextual challenges like COVID-19.



Figure 2 – Visual Mapping

DISCUSSION

The bibliometric and content analysis provides a comprehensive overview of the intellectual structures, emerging themes, and research trends shaping the intersection of learner autonomy and digital pedagogies in higher education. Several key patterns emerge that align closely with the research question, highlighting not only the current state of the field but also its future trajectory.

First, the analysis identified learner autonomy as a central and recurring theme, consistently linked with constructs such as self-regulation, self-efficacy, and independent learning. These concepts demonstrate how autonomy has evolved from being framed as an individual learner trait to being understood as a dynamic process shaped by digital technologies and learning environments (Benson, 2013; Little, 2020). The prominence of autonomy-related keywords and clusters underscores its critical role in preparing students for lifelong learning and adaptability in rapidly changing educational and professional contexts.

Second, the network visualization of terms revealed distinct yet interconnected intellectual structures. The yellow cluster emphasized methodological tools such as questionnaires and interviews, reflecting a strong reliance on perception-based studies to capture learner attitudes and behaviors. The green cluster highlighted the influence of COVID-19, pointing to a surge of research on online learning, self-efficacy, and student resilience during the pandemic (Bozkurt & Sharma, 2020). Meanwhile, the red and blue clusters centered on conceptual frameworks, innovation, pedagogy, and collaboration, showcasing the theoretical and applied dimensions of digital learning research. Together, these clusters indicate a shift toward multi-dimensional approaches to learner autonomy that integrate technological, pedagogical, and psychological factors.

Third, the trend analysis suggests that research productivity and impact are concentrated around blended learning, online self-study, and digital game-based approaches. Highly cited works, such as Hoic-Bozic et al. (2009) on blended learning and Nielson (2011) on workplace language learning software, highlight the importance of flexible and technology-rich learning environments in supporting autonomy. More recent influential studies emphasize sustainable e-learning adoption and the role of self-directed learning in digital contexts (Al-Adwan et al., 2022), reflecting the ongoing expansion of research into long-term integration and system-level adoption of digital pedagogies.

The findings also reveal several factors contributing to these trends. The rapid advancement of information and communication technologies (ICTs), the global shift to emergency remote teaching during COVID-19, and the growing demand for flexible and personalized education have collectively accelerated research at the nexus of autonomy and digital pedagogy (Huang et al., 2020). Furthermore, the emphasis on collaboration and innovation reflects broader transformations in higher education driven by Industry 4.0 and lean management principles, where efficiency, adaptability, and sustainability are prioritized (Buer et al., 2018). Learner autonomy, when framed within lean education, parallels the concept of empowering individuals within streamlined processes to foster continuous improvement and value creation.

Taken together, these findings reveal that the evolution of learner autonomy research in higher education mirrors broader global transformations in knowledge economies. The convergence of autonomy and digital pedagogies demonstrates an ongoing paradigm shift toward more learner-centered, technology-enhanced, and efficiency-driven models of education. This shift aligns with the values of lean management by emphasizing adaptability, efficiency, and continuous innovation in educational practices, ultimately preparing learners not only for academic success but also for professional resilience in rapidly evolving industries.

The findings of this bibliometric study hold significant implications for industry practices, policymaking, and real-world educational implementations. By mapping the intellectual structure and emerging trends at the intersection of learner autonomy and digital pedagogies, the study provides a knowledge base that can guide higher education institutions, industries, and policymakers in fostering adaptive and future-ready learning ecosystems. For industry, the emphasis on learner autonomy and self-directed digital learning aligns with the growing demand for employees capable of continuous reskilling in dynamic work environments shaped by Industry 4.0 (Buer et al., 2018). Organizations can leverage these insights to design professional development programs that integrate digital pedagogies with autonomous learning strategies, thereby cultivating a resilient workforce. For policymakers, the evidence underscores the importance of supporting policies that prioritize flexible, technology-enhanced education and equitable access to digital tools, particularly in light of the global disruptions seen during the COVID-19 pandemic (Bozkurt & Sharma, 2020). Moreover, higher education institutions can draw on these findings to redesign curricula and assessment practices that encourage independent learning and digital fluency, aligning educational outcomes with national development goals and global competitiveness. Thus, this study bridges research and practice by demonstrating how autonomy-oriented digital pedagogies not only advance scholarly knowledge but also inform transformative practices across educational and professional domains.

Implications for Industry

The emphasis on learner autonomy within digital pedagogies offers industries a strategic framework for workforce development. As organizations navigate the demands of Industry 4.0 and rapid technological change, autonomous learners who can engage in self-directed digital upskilling become a vital asset (Buer et al., 2018). This study underscores how insights from higher education research can be applied to corporate training programs, enabling the design of digital learning environments that promote independence, adaptability, and problem-solving. By fostering autonomy-oriented digital learning, industries can cultivate employees who are not only technically proficient but also capable of lifelong learning, thereby enhancing organizational resilience and competitiveness.

Implications for Policy

From a policy perspective, the findings highlight the necessity of supporting equitable access to digital pedagogies that promote learner autonomy. Policymakers must consider investments in digital infrastructure, professional development for educators, and frameworks that ensure inclusivity in online and blended learning (Bozkurt & Sharma, 2020). The study also emphasizes the role of autonomy in cultivating skills such as critical thinking and self-regulation, which align with national development goals and the broader objectives of knowledge-based economies. Thus, evidence from bibliometric mapping can inform the creation of policies that not only enhance digital readiness in higher education but also support long-term educational sustainability.

Implications for Higher Education

For higher education institutions, the intellectual structures identified in this study suggest the need to redesign curricula and assessment models to better integrate digital tools and learner autonomy. Universities can leverage these insights to move beyond traditional lecture-based teaching toward blended, personalized, and collaborative digital learning models that prepare students for both academic and professional contexts (Little, 2020). Moreover, institutions can align program design with international best practices revealed in the bibliometric analysis, ensuring that graduates possess the digital fluency and autonomy required in a globalized workforce. This alignment not only enhances student learning outcomes but also strengthens institutional competitiveness in the global higher education landscape.

Despite the rigorous methodological design, several limitations must be acknowledged.

First, database coverage remains incomplete. Although Scopus, were used, non-indexed and non-English publications particularly from developing regions may be underrepresented, creating potential language and regional bias.

Second, the use of bibliometric indicators alone provides quantitative breadth but may oversimplify nuanced pedagogical interpretations of learner autonomy.

Third, citation-based measures tend to favor older or English-language studies, possibly overlooking innovative but recently published works.

Finally, tool-dependent variations (e.g., VOSviewer vs. Bibliometrix parameterization) might yield slightly different network structures, even under identical datasets.

Concrete Future Research Directions can be conducted.

- Cross-database Replication: Future bibliometric studies should integrate additional sources such as ERIC, Dimensions, CNKI, and SciELO to minimize index bias and enhance cultural representation.
- Longitudinal Trend Mapping: Extend the temporal range to include post-2025 data, using dynamic citation network analysis to trace thematic evolution and the influence of AI-driven pedagogy.
- Mixed-Method Integration: Combine bibliometrics with systematic content analysis, qualitative meta-synthesis, or topic modeling (LDA/BERT) to capture conceptual depth and emerging discourses.
- Network Validation Studies: Encourage replication using open datasets and shared scripts (e.g., via OSF or Zenodo), enabling verification and meta-comparison of bibliometric maps across cultural contexts.
- Pedagogical Impact Studies: Examine how bibliometric clusters translate into real-world educational reforms, linking autonomous learning frameworks to digital literacy and employability outcomes.
- AI and Ethics Focus: Investigate the evolving role of AI-mediated learning environments in shaping autonomy, self-regulation, and equity, particularly within resource-constrained higher education systems.

CONCLUSION

This bibliometric analysis has illuminated the evolving intersection of learner autonomy and digital pedagogies in higher education, revealing dynamic publication growth, emerging thematic clusters, and a global network of scholarly collaboration. The study highlights how digital technologies have increasingly supported independent learning, reshaping educational practices and reinforcing the relevance of autonomy in preparing students for rapidly changing academic and professional landscapes. While the analysis provides valuable insights into research trends and intellectual structures, it is limited by its reliance on a single database and the potential underrepresentation of non-English publications. Future research should expand the scope by incorporating multiple databases, exploring longitudinal content analyses, and integrating qualitative perspectives to capture the nuanced dimensions of learner autonomy in digital environments. Despite these limitations, the findings offer an enduring contribution by mapping the intellectual terrain of this growing field,

providing a foundation for educators, policymakers, and industry stakeholders to align teaching, learning, and workforce practices with the demands of a digitally driven and autonomy-oriented era.

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