Hybrid Learning and Student Engagement: A Bibliometric Analysis of Global Research Trends (2011–2025)

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ABSTRACT

Hybrid learning is reshaping education by integrating face-to-face and online modes to create flexible, student-centred learning environments. This bibliometric study examines publication trends, scholarly impact, leading authors, and landmark publications on hybrid learning and student engagement between 2011 and 2025, using Scopus-indexed journal articles published up to 26 December 2025. Following PRISMA-guided screening, 63 documents were retained for analysis. The bibliometric workflow was conducted using biblioMagika®, OpenRefine, and VOSviewer to compute key performance and impact indicators. Findings indicate accelerated growth in the literature from 2020 onwards, with citation patterns highlighting a core set of influential works shaping the discourse. Authorship patterns suggest a fragmented but expanding contributor landscape, with several small author clusters rather than a single dominant research group. Overall, the study provides an up-to-date overview of the field's development and highlights influential publications and leading authors that inform future research and practice in designing hybrid learning to foster student engagement.

Keywords
Hybrid learning; Student engagement; Teaching; Learning; Education; Bibliometrics

Introduction

Hybrid learning is often described as the intentional integration of face-to-face and online modes within a single course or program, frequently combining synchronous and asynchronous components (Gamage et al., 2022; Raes, 2022). Rather than merely mixing delivery channels, it involves a reconfiguration of time, space, and interaction, where students shift between campus-based, online, and simultaneous hybrid participation. However, recent research emphasizes that synchronous hybrid environments, where on-site and remote students participate simultaneously, present unique design, logistical, and equity challenges that earlier blended learning models do not fully address (Detyna & Koch, 2023; Raes, 2022). In this regard, hybrid learning is best understood as a deliberate organizational and pedagogical approach rather than just a technical setup. In this study, hybrid learning refers to the intentional combination of face-to-face and online participation within the same course, including both synchronous and asynchronous elements.

In this environment, student engagement has become a key factor in explaining why some hybrid courses succeed while others face challenges. Engagement is usually seen as a multi-faceted concept that includes behavioural participation, cognitive investment, emotional involvement, and social connectedness. In hybrid and blended environments, it is often regarded both as an outcome in itself and as a mediating factor that connects course design and technology use to learning success and satisfaction (De Bruijn-Smolders et al., 2024; Han, 2025). Reviews of technology-enhanced learning point out ongoing confusion about the concept, noting that many studies focus on behavioural indicators such as logins or attendance while undervaluing emotional and agentic forms of engagement, which limits the ability to compare findings and develop theories.

Empirical studies illustrate how specific hybrid configurations shape engagement. Heilporn et al. (2021) identify three meta-strategies through which lecturers in higher education foster engagement in blended courses: careful structuring of learning pathways, active learning activities, and relational teaching that cultivates presence, feedback, and support. Their work underlines the importance of aligning asynchronous online tasks with synchronous sessions rather than

treating digital work as optional extras. In synchronous hybrid classrooms, Raes (2022) reports that remote students often experience reduced social and teaching presence compared with their on-campus peers, while Detyna and Koch (2023) show that students value the flexibility of hyflex courses but frequently report fragmented attention, unequal participation and technology-related frustrations when design and support are inadequate.

Quantitative work complements these qualitative insights. In engineering education, Gamage et al. (2022) find that hybrid and online formats can support effective engagement and positive learning experiences when assessment, feedback, and learning activities are deliberately redesigned for digital environments, and caution that simply replicating face-to-face lectures can exacerbate disengagement. Drawing on large-scale survey data and structural equation modelling, Han (2023, 2025) shows that perceived effectiveness of blended learning positively predicts learning outcomes and that student engagement mediates this relationship, with academic motivation moderating its strength. Together, these studies suggest that engagement in hybrid learning depends less on modality itself than on context-sensitive pedagogical design, institutional support and learner characteristics.

Despite these contributions, significant gaps still exist. Many reviews emphasize effectiveness or learner experience but pay less attention to the structural features of the research field, such as where influential work is published, who the leading authors are, and which landmark publications shape the conversation. Hybrid learning is often categorized under broader terms like blended learning or technology-enhanced learning, which can obscure the specific benefits and challenges of synchronous hybrid and hyflex formats. How engagement is operationalized varies greatly across studies, making it hard to build a cumulative theory. These limitations highlight the importance of bibliometric methods that can systematically map publication growth, citation networks, leading authors, and landmark works within the field.

Literature Review

Hybrid learning is increasingly positioned as a deliberate pedagogical arrangement that integrates face-to-face and online participation through synchronous and asynchronous components (Gamage et al., 2022; Raes, 2022). Within this arrangement, student engagement is widely recognised as a key construct for explaining differences in learning experiences and outcomes across hybrid configurations. Engagement is commonly conceptualised as multidimensional, encompassing behavioural, cognitive, emotional, and social dimensions, yet the literature continues to show inconsistencies in how engagement is defined and measured, which limit comparability across studies and slow cumulative theory building (Balalle, 2024; De Bruijn Smolders et al., 2024).

Empirical research demonstrates that engagement in hybrid learning depends strongly on course design, sequencing and instructional presence. Heilporn et al. (2021) identify strategies such as structured learning pathways, active learning tasks, and relational teaching practices as central mechanisms for fostering engagement in blended contexts. In synchronous hybrid and hyflex settings, studies report that flexibility is valued but can be accompanied by unequal participation, reduced presence for remote students and technology-related disruptions when design and support are insufficient (Detyna & Koch, 2023; Raes, 2022). Quantitative evidence further suggests that engagement may mediate the relationship between the effectiveness of blended or hybrid learning and student outcomes, with motivation influencing these relationships (Han, 2023, 2025).

Although systematic reviews have synthesised benefits and challenges of hybrid learning, less attention has been given to mapping the structural characteristics of the research field itself, such as publication growth patterns, where influential work is published, who the leading authors are and which landmark publications shape the discourse (Gudonienė et al., 2025; Zhong & Rosli, 2025). These gaps support the need for bibliometric analysis to systematically chart publication and citation structures, identify influential works and clarify authorship patterns within the focused intersection of hybrid learning and student engagement.

Table 1

Previous Bibliometric Studies Related to Hybrid Learning and Student Engagement

Authors	Objective	Data source and years covered	TDE (total document entries)	Bibliometric attributes examined
Aparicio et. al. (2021). – A holistic bibliometric overview of the student engagement research field	To provide a comprehensive overview of student engagement in higher education and to build a research roadmap by compiling, organising and systematising relevant articles	Web of Science (Social Sciences Citation Index and related collections); student engagement articles in higher education from 1998–2018	755 articles	Descriptive performance analysis of main papers, journals and authors (publication and citation counts; most productive and most cited journals and authors); science-mapping through co-authorship networks and co-word analysis of keywords to identify primary research themes and structural relationships
Xiao & Zhang, (2024). – Knowledge mapping of blended learning classroom environment studies	To conduct a comprehensive bibliometric review of blended learning classroom environment research, identifying publication trends, key contributors, research hotspots and emerging trends	Web of Science (SSCI); topic search blended learning and classroom environment; publications from 1996–2023	283 publications	Performance indicators including annual publication output and distribution of journals, authors, institutions and countries; science-mapping with Cite Space (co-citation networks, top cited authors and references, top journals, countries and institutions); keyword co-occurrence and clustering to reveal research hotspots such as engagement, self-efficacy and classroom climate

Research Questions

This paper presents a bibliometric analysis of hybrid learning and student engagement in education by focusing on four main research questions:

1. What is the current state of research on hybrid learning and student engagement in education?
2. What emerging trends are observable in scholarly publications on hybrid learning and student engagement in education?
3. Who are the leading authors contributing to research on hybrid learning and student engagement?
4. Which highly cited or landmark publications have significantly shaped the discourse on hybrid learning and student engagement in education?
5. What are the main thematic clusters in hybrid learning and student engagement research based on author-keyword co-occurrence?

The comprehensive scope of this study enables a thorough understanding of research on hybrid learning and student engagement in education. Using bibliometric techniques, the study offers an overview of the scholarly landscape, including publication growth, citation patterns, leading authors, key outlets, and influential publications. These insights aim to guide future research and support the development and implementation of hybrid learning strategies that promote greater student engagement.

Methods

This study utilised data retrieved from the Scopus database as of 26 December 2025. Scopus was selected as the primary source because it is widely recognised as one of the most extensive abstract and citation databases for peer-reviewed publications, with broad coverage of disciplines relevant to hybrid learning and student engagement in education. Its journal selection policies and continuous curation support the reliability of bibliometric indicators generated in this study (Aghaei Chadegani et al., 2013). The search strategy was aligned with the research questions and combined terms related to hybrid learning and student engagement in educational contexts. Records were exported in comma-separated values (CSV) format and analysed in biblioMagika® to compute bibliometric indicators.

Search Strategy

The review adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines (Page et al., 2021). The literature search was conducted in Scopus using an advanced query to identify studies at the intersection of hybrid learning and student engagement in education. The following search string was used:

TITLE-ABS-KEY(("hybrid learning" OR "mixed-mode learning") AND ("student engagement" OR "learner engagement" OR "student participation" OR "classroom engagement") AND (educat* OR "school")) AND (LIMIT-TO(SUBJAREA,"SOCI") OR LIMIT-TO(SUBJAREA,"COMP") OR LIMIT-TO(SUBJAREA,"ARTS")) AND (LIMIT-TO(DOCTYPE,"ar")) AND (LIMIT-TO(LANGUAGE,"English"))

The search was limited to English-language journal articles indexed in Scopus that mentioned hybrid learning and student engagement in educational settings. Records were exported in CSV format for screening, cleaning, and bibliometric analysis.

The study selection followed PRISMA 2020 principles (Page et al., 2021) and was operationalised through Scopus search and refinement functions. The search strategy was structured to preserve conceptual specificity by restricting the corpus to Scopus-indexed journal articles within the Social Sciences domain, published in English, and aligned to the predefined query terms on hybrid learning and student engagement. The TITLE-ABS-KEY field restriction ensured that included records explicitly reflected the intended conceptual scope rather than only peripheral mentions.

The Scopus search initially yielded 162 records. No duplicates were identified (n = 0). Prior to screening, Scopus refinement filters were applied to remove records indexed outside the Social Sciences scope, resulting in 27 records excluded as ineligible (n = 27). This automated filtering step ensured that the dataset remained anchored within the intended disciplinary boundaries. After refinement, 135 records progressed to the screening stage. Using Scopus automation and document-type filtering, 72 records were excluded because they were not journal articles (n = 72). This step produced 63 reports for retrieval.

At the retrieval stage, all 63 reports were accessible and could be obtained in full text; no reports were excluded due to access restrictions (n = 0). These 63 reports were assessed for eligibility, and all met the inclusion criteria, resulting in a final dataset of 63 studies for the bibliometric analysis (n = 63). Overall, the PRISMA-guided selection process provides a systematic and transparent pathway from identification to inclusion. The combination of structured Scopus restrictions and automated refinement supports replicability while ensuring that the final dataset is both conceptually aligned with hybrid learning and student engagement and appropriate for subsequent bibliometric mapping.

Figure 1
Flow Diagram of the Search Strategy (Page et al., 2021)
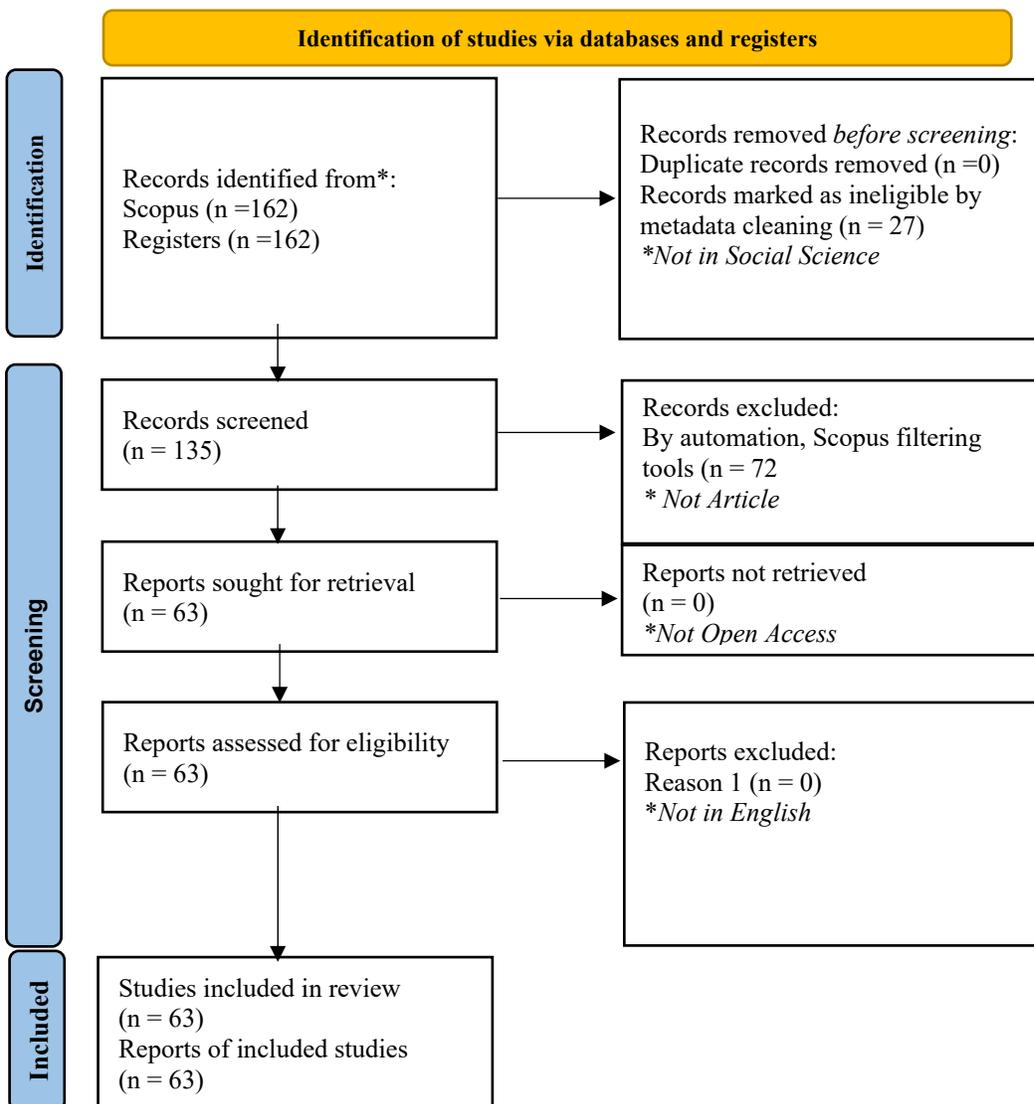
Data Cleaning and Harmonisation

Data cleaning and harmonisation are essential for ensuring accurate and reliable bibliometric analysis results. This study used OpenRefine, VOSviewer, and biblioMagika® (Ahmi, 2024) to refine, align, and analyse bibliographic data, including author names, affiliations, and keywords. After exporting the Scopus records in CSV format, OpenRefine was used to standardize key fields, especially author and keyword data, through clustering and reconciliation functions to minimize spelling variations and enhance consistency. VOSviewer was then used to construct and visualise bibliometric network maps, such as co-authorship and keyword co-occurrence networks, to identify relationships and thematic clusters within the dataset. biblioMagika® was subsequently used to calculate bibliometric indicators, including total publications, contributing authors, cited publications, total citations, citations per publication, citations per cited publication, citations per author, authors per publication, citations per year, and the h-, g-, and m-indices.

By utilizing these advanced tools, the researchers ensured the integrity of their analyses and the validity of their findings. The harmonization and cleaning processes improved the detail and clarity of the research dataset,

strengthening it as a solid foundation for exploring the complex field of hybrid learning and student engagement in education, as outlined in this study's research objectives and questions.

Data Analysis

The data analysis aimed to address the research questions. To answer RQ1, descriptive bibliometric indicators were calculated to summarize the field's overall development and scholarly impact, including total publications, cited publications, total citations, citations per publication, citations per cited publication, and the h-, g-, and m-indices. To answer RQ2, annual publication and citation trends were analysed to describe research growth over time. To answer RQ3, author productivity and citation-based indicators were examined to identify leading contributors. To answer RQ4, documents were ranked by total citations to identify highly cited and landmark publications shaping the discourse on hybrid learning and student engagement. To answer RQ5, an author-keyword co-occurrence analysis was conducted using VOSviewer to identify the main thematic clusters in the literature.

Tools

The study employed various tools to facilitate the bibliometric process. Microsoft Excel was used for initial review and organization of exported records. BiblioMagika® helped calculate and report bibliometric indicators and assisted in standardizing author-related metadata. OpenRefine was utilized to clean and harmonize the dataset by detecting duplicates and inconsistencies, normalizing variations in author names, keywords, and source fields, and standardizing formats to enhance data quality before analysis. VOSviewer was employed to build and visualize bibliometric networks, including author-keyword co-occurrence maps, enabling the identification of key thematic clusters, link strengths, and relationships among research topics in the hybrid learning literature.

Results

This results section explores the current research landscape of hybrid learning and student engagement in education. It answers the research questions by summarizing citation metrics, publication trends, highly cited documents, and author productivity patterns. This detailed analysis offers a comprehensive understanding of the field. Through this focused review, the authors aim to provide a thorough and insightful overview of hybrid learning and student engagement, offering valuable knowledge for scholars, practitioners, and decision-makers.

Current State of Research

To address the first research question (RQ1) regarding the field's development, productivity, and scholarly impact, citation metrics were analysed for publications from 2011 to 2025. The bibliometric summary generated with biblioMagika® (Ahmi, 2024) offers descriptive indicators of research output, collaboration patterns, and citation trends over the 15 years covered by the dataset (see Table 2).

As shown in Table 2, the dataset comprises 63 publications authored by 215 contributing researchers, reflecting ongoing activity and significant collaboration (an average of 3.41 authors per paper). Regarding visibility, 38 publications had received at least one citation. The total number of citations reached 525, for an average of 8.33 citations per paper; when considering only cited papers, the average rises to 13.82 citations per cited paper. The annualized rate of 37.50 citations per year further indicates continuous scholarly interest throughout the citation window. Citations also appear to be highly concentrated: biblioMagika reports 503 citations within the h-core, suggesting that a relatively small group of influential publications drives most of the citation impact.

Impact indices offer extra context. An h-index of 12 means that 12 publications each have at least 12 citations, indicating a solid foundational contribution. The g-index of 22 shows that the most cited papers attract a disproportionate number of citations, consistent with landmark studies in the collection. Meanwhile, the m-index of 0.800 reflects steady growth in influence over time rather than short-term citation spikes. Overall, these metrics highlight a field characterized by ongoing publication activity, strong collaboration, and a core of highly influential work, suggesting continued development within the broader educational research landscape.

Table 2
Citation metrics

| Main Information	Data
Publication Years	2011 - 2025
Total Publications	63
Citable Year	15
Number of Contributing Authors	215
Number of Cited Papers	38
Total Citations	525
Citation per Paper	8.33
Citation per Cited Paper	13.82
Citation per Year	37.50
Citation per Author	2.44
Author per Paper	3.41
Citation sum within h-Core	503
h-index	12
g-index	22
m-index	0.800

Publication Trends

To answer the second research question (RQ2), which explores the development over time and emerging trends in the field, the annual counts of publications and citations from 2011 to 2025 were analysed. The combined insights from Figure 2 and Table 3 offer a thorough overview of how research activity, scholarly engagement, and citation impact on hybrid learning and student engagement have changed over time. Overall, the data indicate a steady maturation of the field, transitioning from sporadic early contributions to a consistent and rapidly expanding body of work over 15 years.

In the early phase (2011–2018), publication activity was modest, with only 1-2 publications annually. Citation counts were generally low and inconsistent, with occasional spikes such as 56 citations in 2017 and 40 citations in 2018, indicating that a few early works attracted significant attention and served as important references for later studies. From 2020 to 2021, the field experienced a consolidation period, with output increasing in 2020 (3 publications) before a temporary decline in 2021 (1 publication). Despite the limited output, citation impact was notable, with 2020 reaching a peak of 142 citations and 2021 accumulating 24 citations, suggesting that several publications from these years quickly became influential within the hybrid-learning literature.

A pronounced acceleration is observed in the most recent period (2022–2025). Research activity expanded markedly, with 7 publications in 2022, 8 in 2023, 15 in 2024, and 25 in 2025. Citations also intensified, reaching 126 in 2022, before fluctuating to 59 in 2023, 42 in 2024, and 12 in 2025. The comparatively lower citation counts for the most recent year are consistent with normal citation delays, as newer articles have had limited time to accumulate references.

Figure 2

Total Publications and Citations by Year (Data is only Available Up to 26 December 2025)
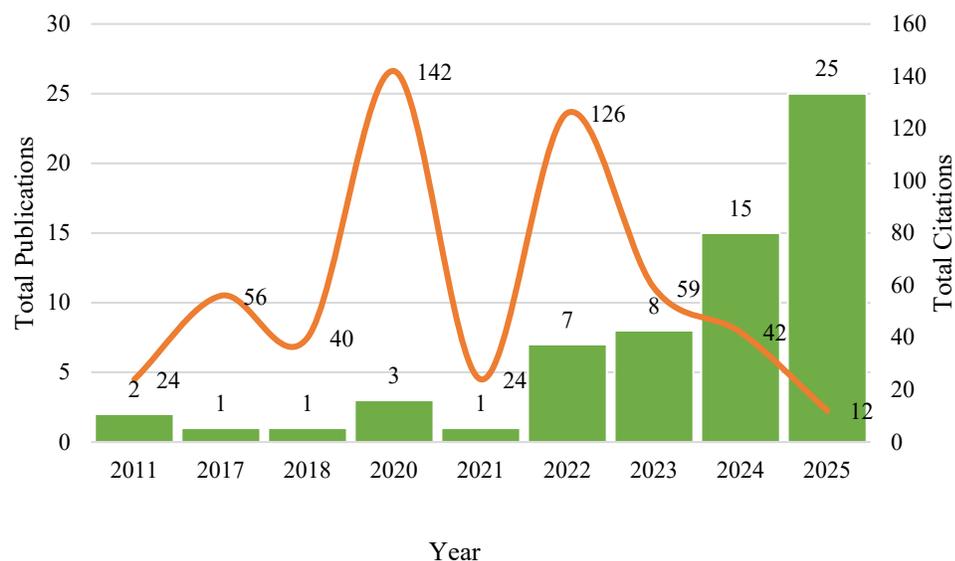
Impact indices from Table 3, such as total publications, cited publications, total citations, and h-type indices, show similar growth over time, especially since 2020. Overall, the annual trends in publications and citations indicate that this research area has developed from a few pioneering studies into a sizable, rapidly growing body of literature. The notable increase in publication output since 2022, along with consistent citation activity, confirms that hybrid learning and student engagement now hold a prominent and expanding role within the broader educational research landscape.

Table 3

Publication by Year

Year	TP	NCA	NCP	TC	C/P	C/CP	h	g	m
2011	2	4	2	24	12.00	12.00	2	2	0.133
2017	1	2	1	56	56.00	56.00	1	1	0.111
2018	1	2	1	40	40.00	40.00	1	1	0.125
2020	3	8	3	142	47.33	47.33	3	3	0.500
2021	1	3	1	24	24.00	24.00	1	1	0.200
2022	7	23	6	126	18.00	21.00	6	7	1.500
2023	8	19	7	59	7.38	8.43	6	7	2.000
2024	15	49	9	42	2.80	4.67	3	6	1.500
2025	25	105	8	12	0.48	1.50	2	2	2.000
Total	63	215	38	525	8.33	13.82	12	22	0.800

Notes: TP = total number of publications; NCP = number of cited publications; TC = total citations; C/P = average citations per publication; C/CP = average citations per cited publication; h = h-index; g = g-index; m = index.

Highly Cited Documents

To address the fourth research question (RQ4), which seeks to identify the most influential publications within the field, Table 4 presents the top 5 highly cited articles. These works represent key scholarly contributions that have shaped current understanding of hybrid, blended, and online learning, as well as student engagement in higher education. Their citation counts reflect substantial academic interest and sustained scholarly influence.

The most highly cited article in the dataset is by Code et al. (2020), published in Information and Learning Sciences. With 110 citations (18.33 per year), this study offers an in-depth exploration of technology education teachers' experiences and design practices during the COVID-19 pandemic. Its strong citation record indicates that it has become a central reference for discussions on how emergency remote teaching informed the future of technology-enhanced and hybrid learning.

Ranked second is the article by Gleason and Greenhow (2017), published in the Online Learning Journal, which has received 56 citations (6.22 per year). This paper highlights the pedagogical potential of robot-mediated communication within hybrid higher education settings, and its citation impact suggests it remains an important reference for technology-supported engagement and interaction in hybrid learning environments.

The third most cited contribution is by Gamage et al. (2022), which appeared in Education Sciences, with 48 citations (12.00 citations per year). This paper directly addresses strategies to improve student engagement and learning experiences in online and hybrid settings, offering practical recommendations and empirical evidence. Its influence highlights the importance of pedagogical design and student-centred approaches in technology-mediated learning environments.

Ranked fourth is the study by Cundell and Sheepy (2018), published in the Online Learning Journal, with 40 citations (5.00 citations per year). By foregrounding students' own evaluations of engaging online activities, this study offers valuable guidance for instructors seeking to design meaningful blended learning experiences at the graduate level.

The fifth most cited article is by De Santo et al. (2022), published in IEEE Transactions on Learning Technologies, with 32 citations (8.00 citations per year). This work demonstrates how gamified computational notebooks can foster computational thinking among non-computer-science students, reinforcing the relevance of motivational and game-based approaches in hybrid and technology-supported learning contexts.

Taken together, the articles in Table 4 (Top 5) form a strong intellectual foundation for research on hybrid, blended, and online learning and student engagement. Their high citation impact demonstrates the centrality of issues such as course design, learner experience, and technology-mediated engagement strategies in contemporary educational research. These contributions continue to guide theoretical development, methodological refinement, and practical implementation across a wide range of educational contexts.

Table 4
Top 5 Highly Cited Articles

No.	Author(s)	Title	Source Title	TC	C/Y
1	Code et al. (2020)	Pandemic designs for the future: perspectives of technology education teachers during COVID-19	Information and Learning Science	110	18.33
2	Gleason & Greenhow (2017)	Hybrid learning in higher education: The potential of teaching and learning with robot-mediated communication	Online Learning Journal	56	6.22
3	Gamage et. al. (2022)	Online and Hybrid Teaching and Learning: Enhance Effective Student Engagement and Experience	Education Sciences	48	12.00

| 4 | Cundell & Sheepy (2018) | Student perceptions of the most effective and engaging online learning activities in a blended graduate seminar | Online Learning Journal | 40 | 5.00 |
| 5 | De Santo et al. (2022) | Promoting Computational Thinking Skills in Non-Computer-Science Students: Gamifying Computational Notebooks to Increase Student Engagement | IEEE Transactions on Learning Technologies | 32 | 8.00 |

Notes: TC = Total Citations: C/Y = Average Citations by Year

Publications by Authors

Table 5 summarises the authors with the highest publication output in this dataset and reports their citation performance and author-level impact indicators. The metrics capture contributions through total publications (TP), number of cited publications (NCP), total citations (TC), average citations per publication (C/P) and per cited publication (C/CP), and impact indices (h-index, g-index, and m-index). Given that the maximum author output in this corpus is two publications, the table prioritises authors whose records demonstrate both output and observable citation visibility.

In terms of citation influence, Monk et al. (2020) shows the strongest impact. Although the publication volume is modest (TP = 2), both papers are cited (NCP = 2) and collectively receive the highest total citations (TC = 35). The identical C/P and C/CP values (17.50 each) indicate that both publications contribute substantively to the author's citation footprint in this dataset, consistent with h-index = 2 and g-index = 2, with an m-index of 0.286.

Black et al. (2025) shows a smaller but clearly detectable citation profile. With TP = 2 and NCP = 2, the author accumulates TC = 4, resulting in C/P = 2.00 and C/CP = 2.00, alongside h-index = 2 and g-index = 2. The relatively higher m-index (1.000) is plausibly attributable to recency effects, where early citations within a short time window can inflate the m indicator.

Overall, the author-level pattern indicates a literature in which productivity is distributed rather than dominated by highly prolific individuals. Citation impact is concentrated within a limited set of contributors, which is typical of a developing research domain where publication counts remain small at the author level and influence structures are still consolidating.

Table 5
The Most Productive Authors

Full Name	Current Affiliation	Country	TP	NCP	TC	C/P	C/CP	h	g	m
Black et al. (2025)	University of Colorado at Colorado Springs	United States	2	2	4	2.00	2.00	2	2	1.000
Monk et al. (2020)	University of Delaware	United States	2	2	35	17.50	17.50	2	2	0.286

Notes: TP = total number of publications; NCP = number of cited publications; TC = total citations; C/P = average citations per publication; C/CP = average citations per cited publication; h = h-index; g = g-index; m = m-index.

Co-occurrence Analysis

To address the final research question (RQ5), which investigates the key research themes supporting the development and growth of hybrid learning, a keyword co-occurrence analysis was performed using VOSviewer. Figure 3 displays the network of author-supplied keywords (minimum three occurrences), illustrating the field's conceptual structure

through node size (keyword prominence), link density (strength of association), and color-coded clusters (thematic groupings).

At the centre of the map, "hybrid learning" appears as the most prominent and structurally central node, indicating that the literature is strongly organized around hybrid learning as a key concept. Closely related high-impact terms such as "student engagement," "teaching," and "e-learning" suggest that the intersection of pedagogy, learner experience, and technology-based delivery drives the field. The dense connections around these core nodes indicate an active research area where instructional design choices, engagement outcomes, and digital platforms are frequently studied together rather than separately.

According to Figure 3, the red cluster emphasizes technology-driven delivery methods and the shift to post-pandemic learning. Keywords such as "e-learning," "online learning," "blended learning," "learning systems," "surveys," and "COVID-19" highlight a research focus fuelled by the rapid expansion of remote and blended instruction, often explored through survey research. This cluster demonstrates that hybrid learning research remains strongly influenced by the pandemic-era transition, with continued focus on platform use, learner perceptions, and large-scale implementation.

The green cluster highlights the integration of pedagogy and technology within hybrid learning ecosystems. Terms such as "teaching," "education," "educational technology," "personalized learning," "artificial intelligence," and "federated learning" reflect a growing emphasis on data-driven and intelligent learning strategies. The presence of AI-related keywords indicates an emerging trend in which hybrid learning is increasingly tied to adaptive support, analytics-based personalization, and privacy-conscious methods for managing learning data (as suggested by "federated learning").

The blue cluster emphasizes learner experience and instructional interaction. The prominence of "student engagement" alongside "computer-aided instruction," "learning environments," and "motivation" indicates that much research evaluates hybrid learning through engagement strategies, motivational outcomes, and the design of learning environments that sustain participation in both online and in-person settings. This cluster considers engagement not as a secondary outcome but as a central focus that connects to instructional tools and the design of the instructional environment.

The yellow cluster signifies institutional- and practitioner-focused settings, especially in higher education. Keywords such as "higher education," "teachers'," "education computing," and "higher education" (as indicated in the dataset) suggest that much of the evidence stems from higher education adoption, emphasizing teachers' roles and the computing or infrastructure conditions supporting hybrid delivery. The links from this cluster to the central "hybrid learning" node illustrate that institutional context and educator practice are closely connected to research on hybrid models.

Overall, the network shows that hybrid learning research is centred around multiple areas but closely connected, with hybrid learning acting as the main hub linking (i) online, blended, and pandemic-influenced implementation studies, (ii) development of pedagogical and educational technology, including AI-enabled personalization, and (iii) engagement-focused work on motivation and designing learning environments. The map indicates a field that has moved beyond simply describing hybrid formats to examining how hybrid learning functions, for whom, and under what instructional and technological conditions.

Figure 3
Co-occurrence Network of The Author's Keywords.

Discussions

This bibliometric review indicates that scholarship on hybrid learning and student engagement has shifted from intermittent early contributions to rapid expansion after 2020. The post-2020 inflection is commonly attributed to COVID-19, and the dataset supports this explanation, but it also suggests two overlapping dynamics that require clearer differentiation. On one hand, the pandemic created an immediate global disruption that legitimised hybrid and blended formats as urgent objects of inquiry, accelerating publication and citation activity (Gamage et al., 2022; Gudonienė et al., 2025; Zhong & Rosli, 2025). On the other hand, the continued growth beyond the peak disruption years signals that hybrid learning is increasingly treated as a durable organisational and pedagogical arrangement rather than a temporary emergency response.

Evidence for short-term, crisis-driven scholarship is visible in the concentration of early influence around COVID-19–anchored work. Citation patterns peak sharply in 2020, and the most cited study in the dataset (Code et al., 2020) functions as a landmark reference that consolidates much of the early pandemic discourse around hybrid practice, teacher experience, and rapid redesign. The clustering of "online learning," "blended learning," and "COVID-19" in the keyword co-occurrence network reinforces that a substantial part of the field's post-2020 momentum was shaped by implementation questions arising from crisis conditions. In this phase, research attention is often prioritised on feasibility, continuity of instruction, and immediate engagement challenges in technology-mediated environments, which is consistent with broader accounts of emergency-driven experimentation in hybrid and blended delivery (Gamage et al., 2022; Gudonienė et al., 2025).

At the same time, the publication trajectory after 2021 complicates a purely reactive interpretation. Output rises strongly from 2022 onwards and continues through 2025, which extends beyond the initial emergency teaching window. This pattern suggests structural consolidation, in which hybrid learning is embedded in institutional planning, course design, and long-term delivery models. The field-level indicators also align with this reading. Across 2011–2025, 63 publications accumulate 525 citations and produce an h-index of 12 and g-index of 22, indicating a recognisable, if still forming, core of influential studies. However, the distribution of impact remains uneven, with a subset of publications accounting for most citations, a pattern typical of domains that are expanding rapidly while still stabilising their theoretical and methodological centre.

The content of the most influential works further supports the argument that the field is not only reacting to crisis conditions but also developing durable research problems. Highly cited studies extend beyond pandemic logistics into themes that remain relevant regardless of crisis context, including learner experience, technology-mediated interaction,

engagement-focused instructional design, and gamified learning approaches (Gleason & Greenhow, 2017; Cundell & Sheepy, 2018; de Santo et al., 2022; Gamage et al., 2022). These emphases imply that lasting contributions are those that treat engagement as a designable outcome, shaped by instructional presence, interaction structures, and the alignment of synchronous and asynchronous learning activities, rather than those that focus only on modality labels.

The keyword structure also points to partial conceptual consolidation. "Hybrid learning" appears as the central hub, closely linked to "student engagement," "teaching," and "e-learning," which indicates that the literature increasingly organises itself around pedagogical practice and learner outcomes in technology-supported learning environments. Importantly, the appearance of terms such as "artificial intelligence" and "personalized learning" suggests a developing shift toward data-informed and adaptive approaches, which is more consistent with longer-term maturation than with short-lived crisis response. Still, the continued proximity of pandemic-era terms indicates that the crisis remains a shaping reference point rather than a closed chapter.

Authorship patterns provide a final, more cautious signal of the research domain's maturity. Productivity is distributed across many small clusters, with each author limited to two papers. This fragmentation implies broad participation but a still-developing intellectual structure, in which sustained research programmes and stable schools of thought have not yet fully crystallised. Therefore, the post-2020 growth should be interpreted as a combination of reactive scholarship and gradual consolidation. The evidence supports an initial pandemic-driven acceleration, followed by continued expansion increasingly tied to enduring questions of engagement-centred hybrid design. Future work should test the durability of this consolidation by examining whether post-2020 research converges on shared theoretical models of engagement, adopts more comparable operationalisations across studies, and produces denser cumulative linkages in co-citation and collaboration networks as the literature ages and accumulates citations.

Conclusion

The bibliometric analysis shows a research landscape that expanded sharply after 2020, consistent with pandemic-driven disruption and rapid institutional experimentation with hybrid and blended formats (Gamage et al., 2022; Gudonienė et al., 2025; Zhong & Rosli, 2025). Publication trends indicate a transition from sporadic early work to sustained growth, with outputs and citations rising markedly in the post-2020 period. However, the surge is best interpreted through two overlapping dynamics. First, the pandemic period produced highly visible scholarship shaped by crisis conditions and emergency transitions. Second, the continued rise in publications beyond the initial crisis window suggests progressive consolidation of hybrid learning as a longer-term organisational and pedagogical arrangement, rather than a temporary workaround.

At the field level, citation indicators point to a developing but consolidating knowledge base. From 2011 to 2025, the dataset comprises 63 publications across 15 years, with at least one publication involving 215 contributing authors. The corpus has accumulated 525 total citations, averaging 8.33 citations per paper and 37.50 citations per year, with 38 papers receiving citations. The h-index (12), g-index (22), and m-index (0.800) indicate a recognisable core of influential studies, although impact remains concentrated among a subset of publications.

Influence is particularly visible in a small set of highly cited works. The leading article by Code et al. (2020) has accumulated 110 citations, underscoring its central role during the COVID-19 phase of the literature. Other highly cited contributions, including Gleason and Greenhow (2017), Cundell and Sheepy (2018), and de Santo et al. (2022), highlight recurring emphases on learner experience, technology-mediated interaction, engagement-focused instructional design, and gamified approaches. Taken together, these patterns suggest that the most impactful studies tend to address design and implementation questions that directly connect hybrid learning arrangements to student engagement.

At the author level, productivity and influence remain distributed across small clusters rather than dominated by a single research group. The most productive authors contribute two publications each, and citation impact is uneven, with some productive authors receiving limited or no citations, plausibly due to recency and citation time lag. Overall, evidence from publication trends, citation performance, influential papers, and author profiles suggests an area that is expanding rapidly while consolidating around shared priorities and an emerging core literature. Future bibliometric work that maps thematic structures and collaboration networks would further test whether post-2020 growth reflects enduring theoretical maturation or remains primarily reactive to crisis-era conditions.

Limitations and Future Studies

This study has several limitations. The dataset was obtained solely from Scopus records retrieved on 26 December 2025, which may exclude relevant studies indexed in other databases or published in non-journal outlets and non-English contexts. In addition, the bibliometric indicators employed, particularly citation-based measures, capture scholarly visibility rather than direct educational effectiveness and are influenced by disciplinary citation norms and citation time lag, which can disadvantage more recent publications. Although data cleaning was conducted systematically, bibliographic metadata may still contain inconsistencies, such as author name variants, changes in affiliation, and keyword ambiguity, which could affect estimates of author productivity and thematic patterns.

Future research should broaden evidence coverage by integrating multiple databases and, where appropriate, expanding publication types and languages to enhance representativeness. Further, combining bibliometric mapping with content-focused synthesis, such as a systematic review or meta-analysis, would strengthen interpretation by clarifying how student engagement is defined and measured and by identifying which hybrid learning configurations are most consistently associated with engagement outcomes across educational settings.

Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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