



Mapping Research Trends on Communication Skills in Digital Learning in Higher Education: A Bibliometric Analysis

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ABSTRACT

Objective: The present research aims to map the development and intellectual structure of research on communication skills in digital learning in higher education. The Scopus database was the primary source of data, with 277 publications analyzed using the Biblioshiny interface of the Bibliometrix package in R and VOSviewer to visualize bibliometric networks. **Method:** The analysis covered publication productivity, the most relevant and influential sources, documents with the highest global citations, keyword frequency, topic trends, and cluster mapping through network and overlay visualization. **Results:** The results show a significant increase in publications since 2020, with contributions predominantly from the fields of education and health education. Keywords such as online learning, communication skills, and higher education emerged as the main nodes in the research network structure. Cluster visualization indicates a close relationship between interpersonal communication, digital learning technologies, and interactive pedagogical approaches. Temporal analysis reveals a shift in focus from emergency learning responses to strengthening the quality and efficacy of communication within the digital learning ecosystem. **Novelty:** These findings emphasize the importance of developing more systematic conceptual models and evaluation instruments for communication skills in digital higher education.

INTRODUCTION

A thorough analysis of communication skills in digital learning in higher education is crucial in the context of the ongoing digital transformation and the increasing reliance on technology-mediated teaching (Alenezi, 2023; Goulart et al., 2022; Røe et al., 2022). Online platforms like Google Classroom and Zoom significantly enhance students' communicative competence by facilitating interaction, collaboration, as well as engagement in virtual learning environments that are highly relevant to the global digital economy (Baimakhan et al., 2024; Shetelia et al., 2024).

The rapid digital transformation in higher education has been significantly accelerated by the COVID-19 pandemic, which forced universities worldwide to shift from traditional face-to-face instruction to online and hybrid learning environments. This sudden transition has increased the importance of communication skills in digital learning contexts, as effective interaction between instructors and students, as well as among peers, has become a critical factor in maintaining learning engagement and collaboration in virtual settings. Despite the growing body of research on digital learning and communication competencies, the existing literature remains fragmented across different disciplines and research contexts. Consequently, there is still a lack of systematic analysis that maps the development, trends, and intellectual structure of research on communication skills within digital learning in higher education.

Empirical evidence indicates improvements in digital communication quality among pupils and educators after the pandemic (Aziz et al., 2026; Urbanek et al., 2023). Furthermore, analyzing communication skills in a digital context is crucial for addressing

issues of digital inclusion and equity. While digital tools expand access to learning resources and collaboration opportunities, disparities in ICT competencies, infrastructure, and access to technology continue to pose significant challenges (Budić et al., 2025; Maqbool et al., 2025).

Without systematic analysis, these structural inequalities may hinder the development of equitable communication competencies among students (Viswanath et al., 2020; Yoo et al., 2023). Communication skills in digital learning are also closely associated with broader soft skills such as teamwork, critical thinking, and problem solving (Kocak et al., 2021; Mészáros & Csiszárík-Kocsir, 2024; Van Laar et al., 2020), which are increasingly valued in higher education and the labor market (Fifani et al., 2025; Pérez-Del-vallín, 2022). From a teaching perspective, educators' digital teaching skills directly influence teaching quality, student engagement, and overall learning effectiveness, making continuous professional development in digital competencies essential (Arregui-Valdivieso et al., 2024; Zhang & Wu, 2025). Additionally, faculty satisfaction and institutional support systems make a strategic contribution to sustaining the development of digital communication competency within e-learning systems (Shindina et al., 2024).

However, effective digital communication requires a balanced pedagogical approach (Engeness, 2021; Hafner, 2020; Väättäjä & Ruokamo, 2021) that integrates technological innovation with sound instructional design while considering the pedagogical, technical, and psychological dimensions of learning (Aziz et al., 2026; Baimakhan et al., 2024). Therefore, systematically analyzing communication skills in digital learning is not only an academic endeavor but also a strategic necessity to enhance teaching effectiveness, promote inclusive education, strengthen essential soft skills, and prepare graduates to thrive in an increasingly connected and digitally mediated world.

Systematic literature mapping is essential for understanding how communication skills in digital learning are conceptualized, practiced, and assessed within higher education. Although the literature on communication skills in digital learning continues to evolve, no comprehensive bibliometric analysis has yet been conducted to systematically map how this topic is addressed within the field. A bibliometric approach is important because it allows researchers to examine publication patterns, scientific collaboration, and key themes, as well as identify research gaps (Donthu et al., 2021). Using this method, this article aims to evaluate research trends in communication skills in digital learning in higher education over the past decade, identify dominant geographical regions and institutions, and highlight under-explored topics.

In this context, bibliometric methods provide a strong methodological framework for objectively and quantitatively examining the evolution of communication skills research in digital learning in higher education. Unlike traditional narrative reviews, bibliometric analysis enables researchers to identify publication trends, collaborative linkage among researchers, and the thematic evolution of the field over time (Azizan, 2024; Rahimi et al., 2024; Sahabuddin et al., 2023). Thus, bibliometric techniques offer a meticulous overview of the intellectual structure of this field while revealing underexplored domains.

By mapping existing research trends and areas of focus, the present study aims to contribute, both theoretically and practically, to the development of more inclusive communication skill frameworks. Theoretically, the findings enrich the discourse on communication skills in digital learning in higher education. Practically, the bibliometric results may serve as a basis for educators, learning designers, and policymakers to

develop communication skills strategies that are more responsive to the needs of diverse learner groups. Accordingly, this investigation conducts a bibliometric approach of communication skills in digital learning in higher learning institutions over the past ten years and addresses various research questions as follows:

1. **RQ1:** How has research on communication skills in digital learning in higher education evolved over time?
2. **RQ2:** Which are the most productive and influential authors, institutions, and countries in this field?
3. **RQ3:** Which studies are considered landmark contributions to the literature on communication skills in digital learning in higher education?
4. **RQ4:** What are the main thematic areas and emerging topics in communication skills in digital learning in higher education?
5. **RQ5:** What gaps remain in existing literature, and what future research directions should be pursued?

RESEARCH METHOD

Research Design

The present study employs a quantitative descriptive analysis using a bibliometric approach. Bibliometrics is an approach that employs quantitative techniques to examine scientific literature systematically with the objective of determining publication data (Donthu et al., 2021). It enables the mapping of publication trends, citation networks, author collaborations, and the thematic evolution of research over a specific period. In this research, the bibliometric method was utilized to map the development of studies on communication skills in digital learning, with a focus on higher education.

Data Sources and Search Strategy

The authors sourced the research data from Scopus database, which uses a rigorous content selection process and ensures that the study includes high-quality peer-reviewed publications, an essential aspect for establishing the credibility of bibliometric analysis (Baas et al., 2020). In addition, Scopus offers comprehensive bibliometric information, including citation data, authors' affiliations, and advanced filtering options, which enable accurate segmentation and large-scale dataset analysis (Pranckutė, 2021).

The authors conducted the database search on February 2, 2026, focusing on publications released between 2015 and 2025 to obtain a detailed overview of studies on communication skills in digital learning in higher education over the past ten years. The search strategy was formulated using a selected mix of article titles, abstracts, and keywords. The keyword combinations used in the Scopus database are presented in Table 1.

Table 1. Keyword search combinations

Database	Search Combination
Scopus	"Communication skill*" OR "communication competence" OR "interpersonal communication" AND "digital learning" OR "online learning" OR "hybrid learning" OR "virtual learning" OR "digital technolog*" OR "digital platforms" AND "higher education" OR "university" OR "tertiary education" OR "undergraduate*" OR "undergraduate student*"

Article Selection Criteria and Procedures

To ensure the quality and relevance of the dataset, the authors applied a series of selection criteria. The collected data consisted exclusively of peer-reviewed journal articles that were final publications, published between 2015 and 2025, and written in English. Publications that did not meet these criteria, such as conference proceedings, editorials, book reviews, and other non-academic documents, were excluded. In addition, articles classified as bibliometric studies, meta-analyses, scientometric, or systematic literature reviews were also excluded. This bibliometric study followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to guarantee transparency during the selection of articles (Agrawal et al., 2024).

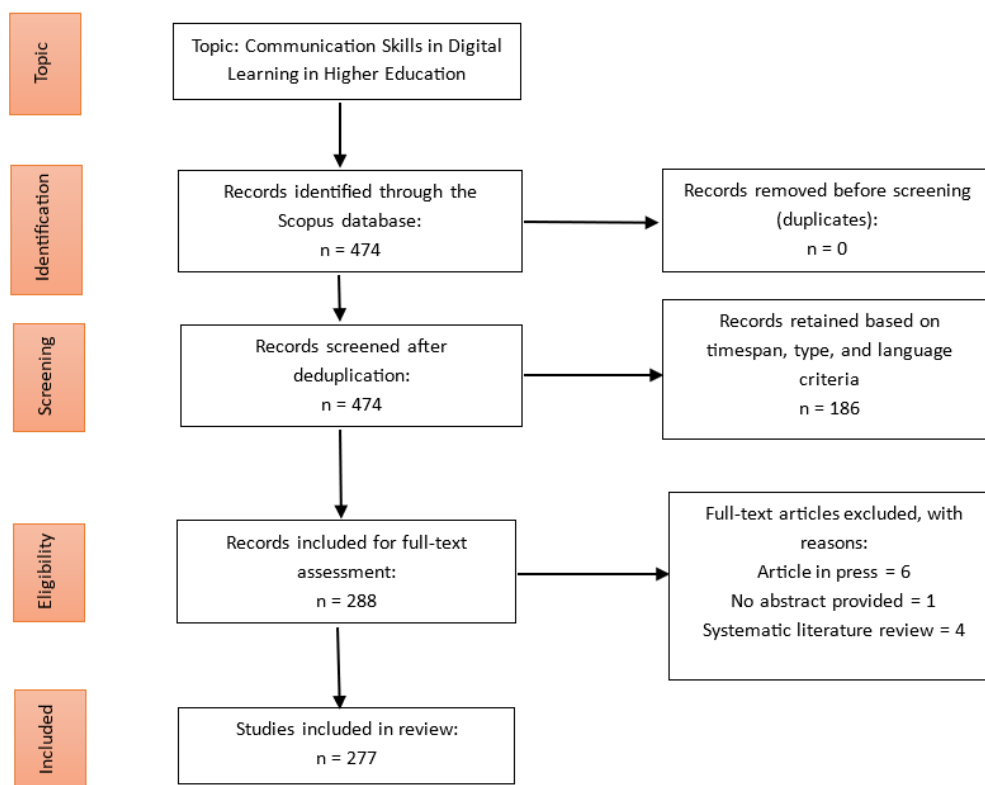


Figure 1. PRISMA flow chart for article inclusion

The article selection process using the PRISMA framework consisted of four stages: (1) identifying articles, (2) screening articles, (3) assessing article eligibility, and (4) including articles (Page et al., 2021). During the identification process, 474 documents were retrieved from Scopus using the keywords presented in Table 1. A duplicate check revealed no duplicate records; therefore, all articles were eligible to proceed to the screening phase. Initial selection was based on publication year (2015–2025), publication type (article), and language (English), yielding 288 documents eligible for further assessment. During the eligibility evaluation stage, several documents were excluded for the following reasons: articles in the process of publication ($n = 6$), articles without abstracts ($n = 1$), and publications classified as systematic literature reviews ($n = 4$). As a result, 277 final publications were selected for the bibliometric analysis.

The final dataset was analyzed using Bibliometrix Biblioshiny, developed in the R programming language. These tools were used to examine annual publication trends, identify the most productive sources and journals, and map leading authors, institutions,

and countries in the field (Abafe et al., 2022; Mondal, 2025). Additionally, document citation analysis and keyword co-occurrence were conducted to detect dominant themes and emerging research topics related to communication skills in digital learning in higher education. The authors also used VOSviewer to enhance the visualization of bibliometric element networks, including relationships among keywords, authors, and institutions. Data were exported in CSV format and visualized in VOSviewer based on frequency and link strength. Bibliometrix and VOSviewer integration enabled a meticulous and structured examination of research trends and scientific relationships in communication skills in digital learning in higher education.

RESULTS AND DISCUSSION

Results

Main Information

This R program feature presents preliminary overview statistics derived from bibliometric data, including the number of documents, authors, citations, publication trends, and the most productive sources and affiliations. This analysis enables researchers to comprehend the general landscape of studies on communication skills in digital learning in higher education and serves as a foundation for exploring emerging themes.

Table 2. Main information

Indicator	Value
Sources (journals, books, etc.)	196
Documents	277
Annual growth rate %	22.32
Average document age	3.71
Average citations per document	10.45
References	2471
Keywords Plus (ID)	1420
Author keywords (DE)	1004
Authors	1088
Authors of single-authored documents	22
Single-authored documents	22
Co-authors per document	4.01
International co-authorships %	20.2
Articles	277

Bibliometric analysis results show that studies on communication skills in digital learning in higher education experienced significant development during the 2015–2025 period. A total of 277 scientific documents were published across 196 journal sources. This indicates that the topic has received considerable attention.

The annual publication growth rate of 22.32% shows a strong and consistent upward trend. This indicates that communication skills are increasingly seen as a crucial element of digital transformation in higher education. The average document age of 3.71 years suggests that most of the publications are relatively recent, making them relevant to the latest developments in digital learning practices. This finding is reinforced by an average of 10.45 citations per document, which indicates a fairly strong level of visibility and academic impact.

In terms of content, the dataset included 1,420 Keywords Plus and 1,004 author-provided keywords, reflecting diversity in terminology and conceptual approaches. The high number of keywords suggests that research on communication skills in digital learning is multidisciplinary and involves perspectives from education, technology, communication, as well as digital pedagogy.

From a writing perspective, 1,088 authors contributed to the 277 documents, with an average of 4.01 authors per article. This pattern shows that research in this field is generally conducted collaboratively, reflecting the complexity of issues that require cross-disciplinary expertise. The relatively small proportion of single-author documents (22 documents) further confirms that research on communication skills in digital learning tends to be collective and interdisciplinary. International collaboration accounts for 20.22% of the publications, indicating that a global network has emerged, with potential for further improvement.

Research Growth

Publication trends were examined to investigate annual growth in research intensity. This process provides an overview of the increasing scientific interest and attention to communication skills within the field.

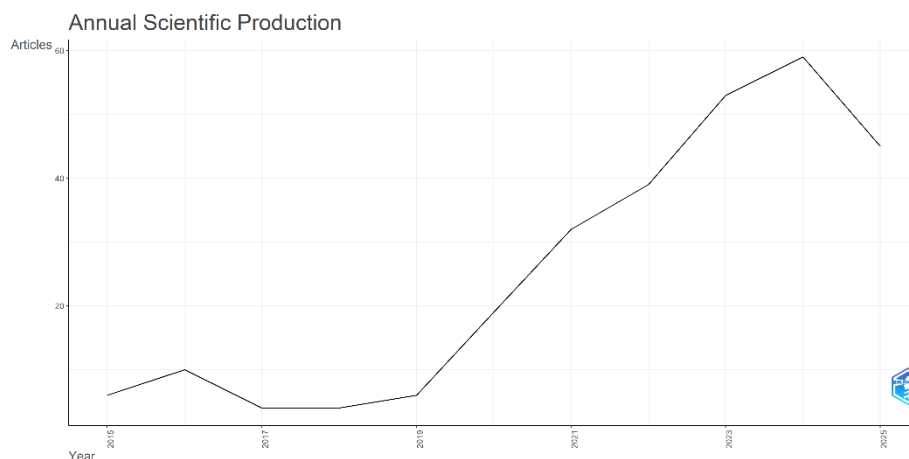


Figure 2. Annual scientific production

Figure 2 demonstrates the dynamics of research articles on communication skills in digital learning in higher education from 2015 to 2025. In general, the publication trend shows a non-linear growth pattern, with a sharp increase in the second half of the observation period.

During the early phase (2015–2019), the publication count was relatively low, fluctuating below 10 per year. Article production during this period was limited, indicating that communication skills in digital learning were in the early stages of conceptual exploration and had not yet become a central focus in higher education research. At that time, communication-related issues in digital learning were typically positioned as supporting variables rather than as the main focus of study.

A significant increase began in 2020, with 19 articles published, followed by a sharp surge during the period 2021–2024, exceeding 30 articles per year. This trend indicates a shift in the research paradigm, in which communication skills are increasingly recognized as an essential competency in the digital learning ecosystem. The substantial growth in publications after 2020 can be understood in the perspective of global education system disruption due to the COVID-19 pandemic, which prompted

universities to adopt online and hybrid learning on a massive scale. As a result, communication skills in a digital environment became an increasingly crucial pedagogical and interactional concern.

Scientific production peaked in 2024, with 59 published articles, marking a phase of intensification and early maturation of the research field. At this stage, research was no longer limited to describing phenomena, but began to focus on testing models, developing competency frameworks, and evaluating communication-based digital learning practices.

The apparent decline in the number of publications in 2025 should be interpreted with caution, as the indexing process in the Scopus database may still be incomplete at the time of data collection. Therefore, the lower number of publications in this year does not necessarily indicate a real decrease in research activity but rather reflects the ongoing indexing process.

Figure 2 also presents the average citations per year, illustrating changes in the scientific impact of research on communication skills in digital learning in higher education over the 2015–2025 publication. In general, citation trends show a gradual increase until reaching a peak, followed by a decline in the most recent years.

In the early phase (2015–2017), average citations per article were relatively low and declined, suggesting that publications during this period had not yet attracted widespread academic attention. This condition reflects the field of study's position, which was still in its early stages of development, with limited visibility and citation networks.

From 2018 to 2023, average annual citations increased steadily, with citations peaking in 2023. This pattern indicates that publications from this period began to serve as important references in digital learning studies, particularly in studies focusing on communication and interaction. The rise in citations is in line with the surge in publications after 2020, indicating not only quantitative growth but also an increase in the relevance and scientific impact of the research.

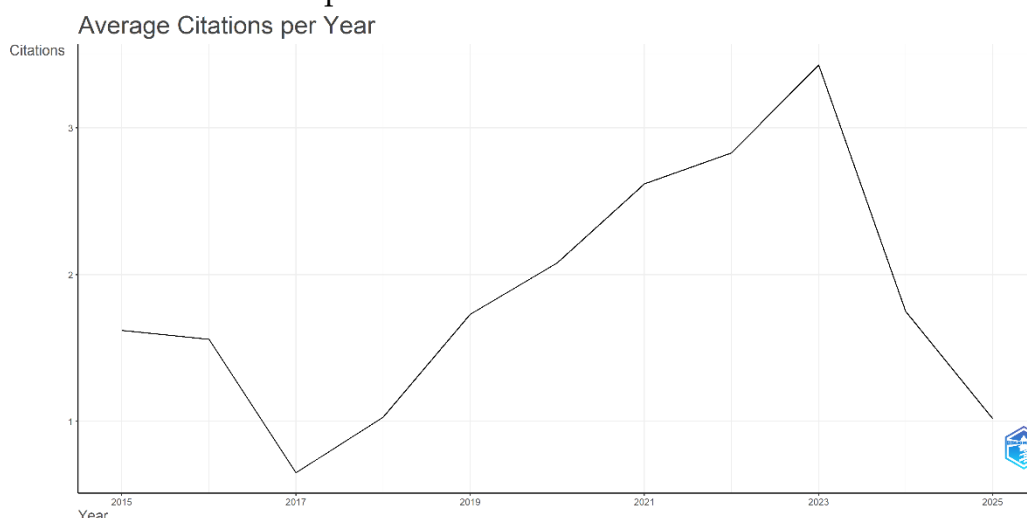


Figure 3. Average citations per year

Key Players in Communication Skills in Digital Learning at Higher Education Research.

The visualization of the most relevant authors in Figure 3 shows that there is no strong dominance by certain individuals or researcher groups in the study of communication skills in digital learning in higher education. All authors identified as the most relevant

produced only two documents during the observation period. The relatively low number of publications per author, with the most productive authors contributing only two publications, suggests that research on communication skills in digital learning within higher education is still a relatively emerging field. Unlike more established research domains where a few leading scholars dominate the publication landscape, this topic appears to be explored by a diverse group of researchers from different disciplines. This pattern indicates that the field has not yet developed clearly established thought leaders and may still be in an early stage of intellectual consolidation. This also suggests opportunities for future scholars to contribute to the development of a more coherent research agenda in this area. The first three authors in the figure are Abdigapbarova Ulzharkyn, Adelina Asmawi, and Johannes Bauer.

Abdigapbarova Ulzharkyn is affiliated with the Department of Pedagogy and Psychology at Abai Kazakh National Pedagogical University in Kazakhstan. Her main research focuses on digital literacy in education and technology-enhanced learning. Adelina Asmawi is a lecturer in the Department of Language and Literacy Education, Faculty of Education, University of Malaya in Malaysia. Her research centers on communication skills in online language learning. Johannes Bauer is a professor of educational research and methodology at the University of Erfurt, Germany. His research addresses communication and science acceptance across various contexts, including teacher education, doctor-patient communication, and the digitization of higher education.

The bibliometric findings on the most relevant affiliations in Figure 4 show that contributions to publications related to communication skills in digital learning in higher education are concentrated in several institutions with relatively specific disciplinary backgrounds. The Royal College of Surgeons in Ireland (RCSI) ranks first with 11 articles, followed by Imam Abdulrahman bin Faisal University with eight articles. In addition, Abai Kazakh National Pedagogical University and Thai Binh University of Medicine and Pharmacy each contributed six articles each, while other institutions such as the University of Florida, Acharya Shri Chander College of Medical Sciences, and Universitätsklinikum Tübingen contributed approximately five articles each.

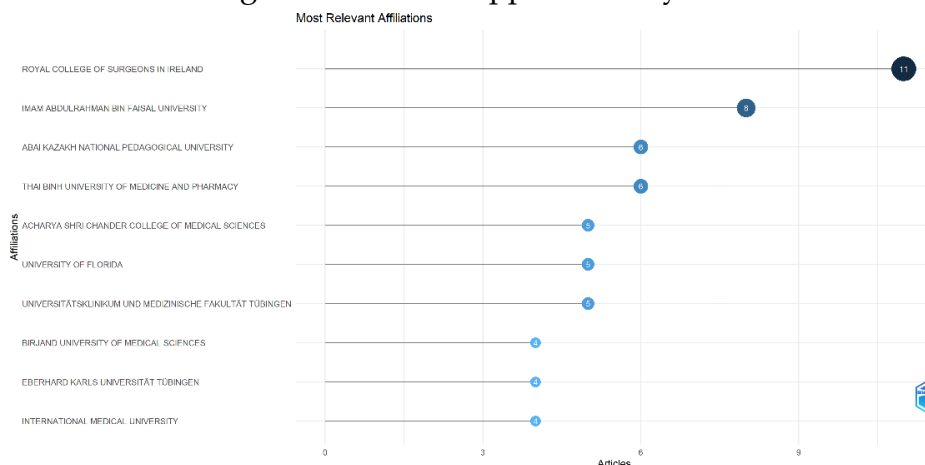


Figure 4. Most relevant affiliations

The visualization of country production over time in Figure 5 shows the dynamics of the contribution of scientific publications across countries in the study of communication skills in digital learning in higher education during the 2015–2025 period. In general, all

analyzed countries exhibit an upward trend in article production, with varying growth rates, especially after 2020.

The United States (U.S.) stands out as the most dominant contributor and shows a consistently increasing publication output. Since 2019, the number of articles from the U.S. has risen sharply, from approximately 10 articles to more than 100 articles by 2025. This surge reflects the strength of the research ecosystem, funding support, and rapid adoption of digital learning in higher education, especially pre- and post-COVID-19 pandemic. This dominance confirms the U.S.'s position as a global hub of knowledge production in research on digital learning and communication skills.

European countries, particularly the United Kingdom (U.K.) and Germany, show relatively stable and progressive growth patterns. The U.K. shows gradual growth from 2015 onward and is projected to reach more than 30 articles by 2025, while Germany exhibits more significant acceleration after 2020.

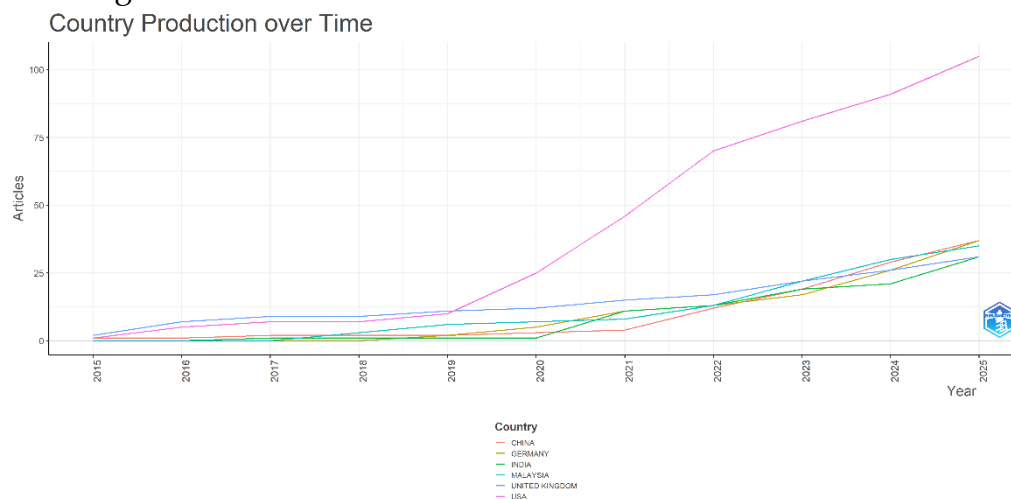


Figure 5. Country production over time

The visualization of the most cited countries in Figure 6 illustrates the distribution of scientific influence of countries in research on communication skills in digital learning in higher education, as measured by the number of citations. The findings show that citation impact does not always correspond to publication volume but rather reflects the quality, relevance, and referential power of the scientific work.

Hong Kong ranks highest with 327 citations, surpassing the U.S., which recorded 311 citations. Although the U.S. leads in publication quantity, Hong Kong's high citation counts indicate a strong and substantial scientific impact, particularly in the development of pedagogical models, communication competencies, and digital learning innovations that are widely referenced internationally. Australia and Singapore follow, each with 155 citations, while China records 150 citations. Malaysia and Romania record relatively balanced numbers of citations, with 127 and 126 citations respectively, reflecting the significant contribution of developing countries and Eastern European countries to this research domain.

The analysis of the most relevant sources in Figure 7 identifies the main journals that serve as the dominant references and publication outlets in the study of communication skills in digital learning in higher education. The distribution of publication sources indicates a strong tendency for this theme to develop across disciplines, with a notable dominance of the fields of health education and applied sciences.

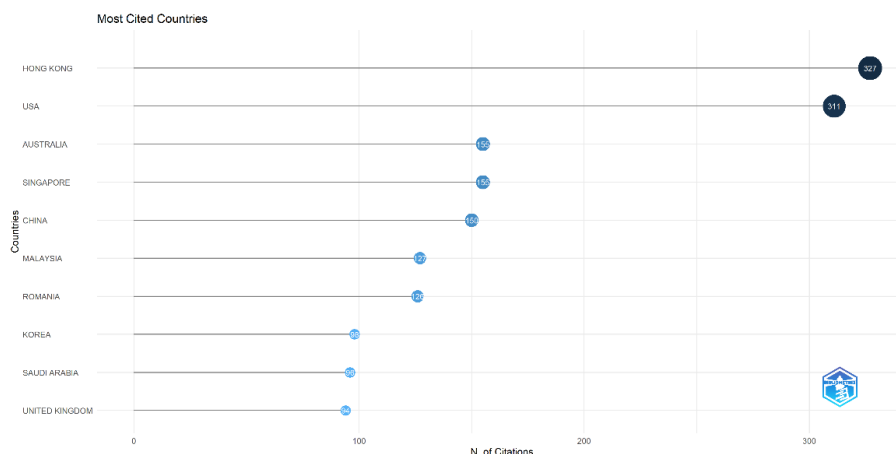


Figure 6. Most cited countries

BMC Medical Education and *PLOS ONE* rank highest, with 11 documents each, confirming the central role of reputable open-access journals in disseminating research related to communication skills and digital learning innovation. The dominance of these two journals indicates that communication skills are widely studied in professional education contexts and, through empirical research approaches, are highly relevant to higher education practices.

At the next level, *Frontiers in Medicine* and the *International Journal of Environmental Research and Public Health* each published six documents. The presence of these journals further reinforces that studies of communication skills in digital learning are often associated with issues of health, well-being, and interdisciplinary education, especially in the context of online learning and post-pandemic.

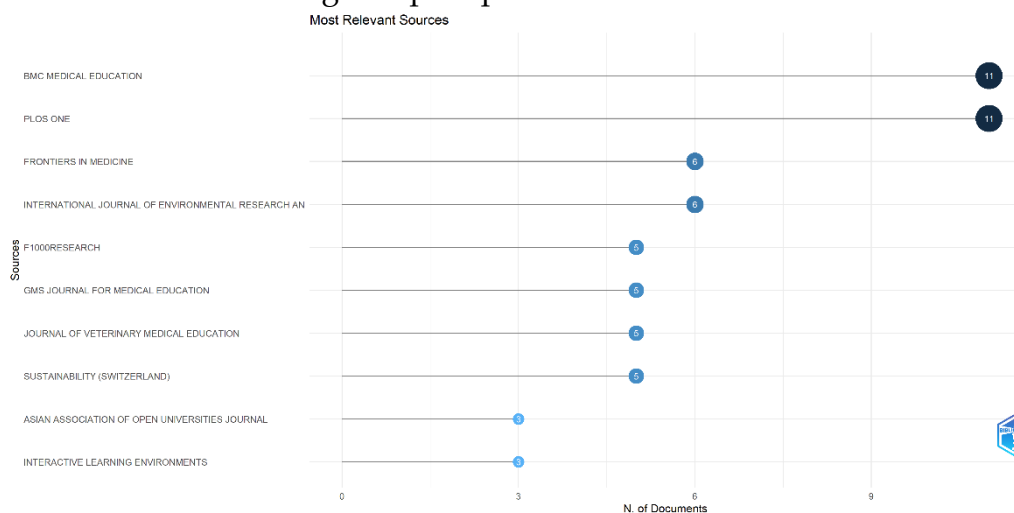


Figure 7. Most relevant sources

The analysis of sources' local impact based on total citations (TC) aims to identify journals that exert the strongest influence within the research corpus, as reviewed from the accumulation of citations received by articles related to communication skills in digital learning in higher education. Based on the results presented in Figure 8, the *International Journal of Environmental Research and Public Health* (IJERPH) ranks highest, with a total of 192 local citations. The dominance of IJERPH indicates that this journal serves as the primary reference source for the study of digital communication skills, particularly at the intersection of education, public health, and professional competence.

The *Journal of Computing in Higher Education* ranks second with 178 citations, followed by *Nurse Education Today* with 177 citations. *BMC Medical Education* recorded 154 citations, reinforcing the substantial contribution of the medical education sector to the development of digital communication literature. At an intermediate level of influence, the *Journal of Surgical Education* (124 citations) and *Sustainability* (Switzerland) (95 citations) demonstrate significant but more focused role. Furthermore, the *International Journal of Educational Technology in Higher Education* (75 citations) and *JMIR Research Protocols* (73 citations) reflect relatively moderate contributions.

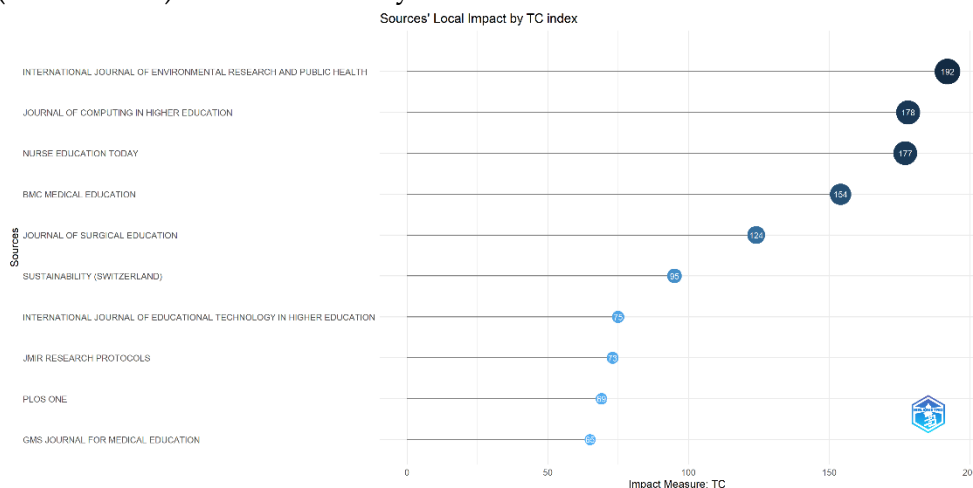


Figure 8. Sources' local impact by TC Index

Most Influential Documents

The visualization of the most globally cited documents shown in Figure 9 indicates that scientific influence in research on communication skills in digital learning is highly concentrated in a limited number of key articles, most of which were published within a relatively short period, especially since 2020. Thematically, the top five articles with the highest citation counts focus on technology-based learning, digital interaction, and communication skill development in online learning environments. The first-ranked article discusses the use of chatbots to enhance learner engagement in fully online learning and addresses crucial issues in post-pandemic higher education (Hew et al., 2023). The second-ranked article develops and evaluates artificial intelligence-based virtual reality simulations designed to train interprofessional communication skills among nursing students (Lee et al., 2022).

The subsequent article discusses the perceptions of online learning quality among students amid the COVID-19 pandemic through a quantitative survey conducted at a university in Romania (Radu et al., 2020). Its main focus includes infrastructure, lecturer-student communication, learning motivation, and online learning evaluation. Another influential study compares in-person (on-campus) and online learning, with a focus on self-regulated learning (SRL) and cognitive transfer skills in undergraduate students (Barak et al., 2016). The final article explores the establishment and testing of a metaverse-based social skills training program (Lee et al., 2022).



The representation of the most frequently used terms in Figure 10 shows that the landscape of communication skills research in digital learning in higher education is dominated by the terms "interpersonal communication," "human(s)," and "article," which occupy the most central and prominent positions. The dominance of these terms indicates that human interaction remains the main focus of research, positioning communication as the core component of digital learning rather than viewing technology as a technical instrument.

The emergence of the terms "online learning," "e-learning," and "digital technology" consistently reinforces that the digital context is the primary framework in the development and analysis of communication skills. However, the strong correlation between the term's communication and online learning shows that research in this field emphasizes the dynamics of interpersonal communication in virtual environments rather than mastery of the technology itself. This confirms a paradigm shift from technology-centered learning to communication centered digital learning.



The visualization of trending topics in Figure 11 illustrates the gradual and context-driven evolution of research themes on communication skills in digital learning in higher education. During the early period (2015–2018), dominant topics were largely technological and systemic, such as “online systems,” “computer-aided instruction,” and “medical research.” During the transition period (2019–2020), there was a shift in themes

toward a more empirical and applied approaches, marked by the emergence of terms such as "pilot study," "pilot projects," and "attitude to health." The most significant change occurred from 2020 to 2023, marked by the emergence and increased prominence of the terms "COVID-19," "communication," "interpersonal communication," and "human(s)."

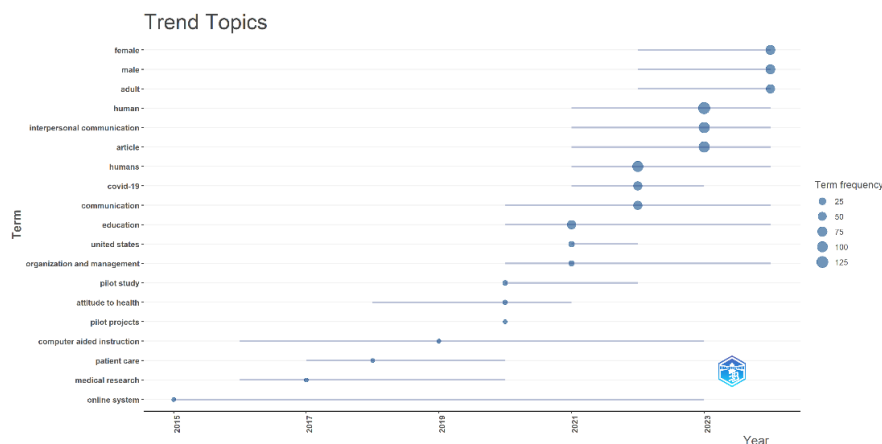


Figure 11. Trend topics

The network visualization generated through VOSviewer in Figure 12 shows the conceptual structure and thematic connections in research on communication skills in digital learning in higher education. This network map displays several interconnected main clusters, with "online learning" acting as the core node with the highest level of connectivity.

The dominance of online learning as the center of the network indicates that it serves as the main conceptual framework in the research discourse. This node is strongly connected to the terms "communication," "e-learning," "blended learning," and "communication skills," which confirms that communication is positioned as a key element in the successful implementation of digital learning.

Another prominent cluster centers on higher education and health education, characterized by the terms "higher education" and "medical education." The close relationship between this cluster and those related to online learning and communication skills indicates that health and medical education are the dominant contexts in research on digital communication skills.

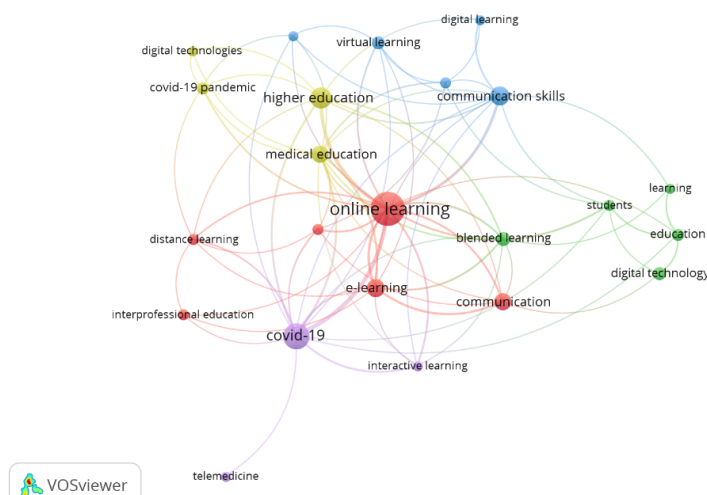


Figure 12. Network visualization

Unexplored Areas for Future Research

The visualization presented in Figure 13 represents a bibliometric mapping based on keyword co-occurrence using VOSviewer software. This analysis uses an overlay visualization scheme to distinguish the urgency and novelty of research topics. The results show that the topics "interprofessional education" and "interactive learning" have relatively small node sizes and are located on the periphery. Academically, this pattern represents a valuable opportunity for future research. To date, there is a scarcity of studies that thoroughly explore how interprofessional collaboration and high-level interactivity strategies are integrated into established digital learning ecosystems.

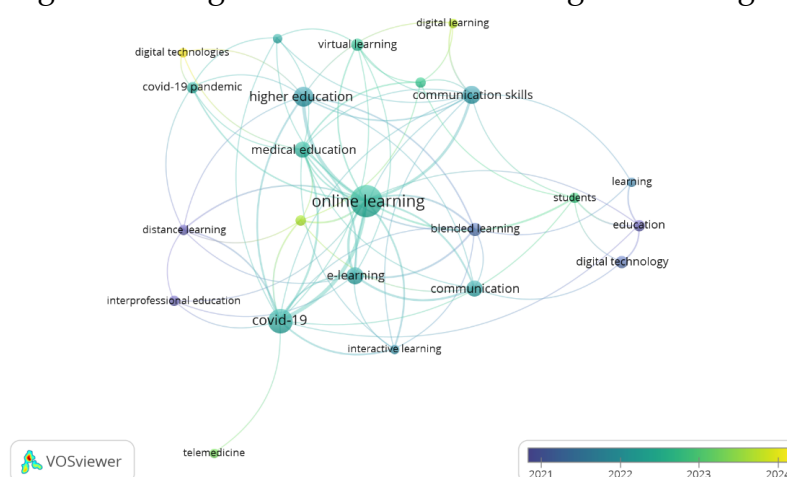


Figure 13. Overlay visualization

Discussion

This study presents a detailed mapping of the study landscape on communication skills in digital learning in higher education. The bibliometric analysis reveals that studies on communication skills in digital learning in higher education have experienced substantial growth, especially since 2020. The publication number increase during this period indicates an acceleration of academic attention closely linked to the disruption of the global education system due to the COVID-19 pandemic. The transition from in-person to online learning has driven the urgency to develop adaptive communication skills (Eklund & Isotalus, 2024; Katz & Kedem-Yemini, 2021; Neuwirth et al., 2021), both at the lecturer and student levels, making this topic a major focus in various disciplines, especially higher education and health education.

The prominence of reputable international journals, such as *PLOS ONE*, *BMC Medical Education*, and the *International Journal of Environmental Research and Public Health*, in terms of both local impact and total citations, confirms that the discourse on communication in digital learning is multidisciplinary and cross-contextual. These journals not only serve as a medium for publication but also as drivers of research direction through highly cited articles. This pattern suggests that communication in digital learning is no longer considered as a purely pedagogical issue but increasingly as a strategic concern related to learning quality, mental health, and the effectiveness of academic interactions (Karakolias et al., 2025; Skarbalienė et al., 2019; Stamer et al., 2023).

The analysis of documents with the highest global citations shows that key articles generally focus on evaluating the efficacy of online learning, student learning experiences, and the pedagogical implications of using digital technology (Barak et al.,

2016; Chao et al., 2021; Hew et al., 2023; Lee et al., 2022; Liaw et al., 2023; Radu et al., 2020). Articles published during the early stages of the pandemic tend to receive high citations, underscoring their role as foundational references during the global education crisis. However, the high number of citations also highlights a strong reliance on pandemic-related contexts, which may limit the exploration of communication skills within the post-pandemic context and sustainable digital learning environments.

Findings from the analysis of frequently used terms and trending topics reveal that terms such as “interpersonal communication,” “online learning,” “communication skills,” and “higher education” are the central focus of research. In addition, the strong emergence of the term “medical education” indicates that the health sector is a particularly intensive context for examining communication skills in digital learning environments, likely due to the high demands for professional communication competencies in medical practice (Gross et al., 2025; Janssen et al., 2025).

Network visualization results show a relatively clear but interconnected cluster structure. Clusters centered on online learning and e-learning serve as the main axis connecting the digital technology, communication, and higher education clusters. The communication cluster, which includes communication skills and interpersonal communication, appears to be closely integrated with digital pedagogy clusters such as blended learning and interactive learning. This configuration indicates that communication skills are not positioned as stand-alone competencies but rather as integral components of digital learning design as well as implementation (González-Salamanca et al., 2020; Kyaw et al., 2019; Thoma et al., 2019).

Overlay visualization further reveals important temporal dynamics. Early research topics, such as distance learning and online systems (Nasrullah et al., 2023), dominated the initial phase, before shifting to more specific issues, such as communication skills, interactive learning, and digital learning in the more recent period. The shift in color toward a newer spectrum indicates a transition in research focus from emergency responses to the pandemic toward strengthening the quality of digital learning and developing 21st-century competencies. Nevertheless, limitations remain apparent in the conceptual exploration of communication skills measurement models and their integration into digital curricula.

Critically, these findings indicate that despite the growing volume and impact of publications, research on communication skills in digital learning in higher education remains largely descriptive and context-driven. Studies that develop theoretical frameworks, valid evaluation instruments, and sustainable pedagogical models are relatively limited. Therefore, further research should be directed toward strengthening conceptual and methodological aspects, particularly in formulating communication skills models that are relevant to post-pandemic digital learning ecosystems.

CONCLUSION

This study provides a detailed overview of the development of communication skills research in digital learning in higher education. The results show that this topic has received significant academic attention, especially since 2020, which correlates strongly with changes in the learning system due to the COVID-19 pandemic. Online and digital learning not only pose technical challenges but also elevate communication skills as a key competency for maintaining effective pedagogical interactions in higher education.

From an academic perspective, this study shows that the discourse on communication skills in digital learning is multidisciplinary, with contributions predominantly from the fields of education, health education, and learning technology. Internationally reputable journals are critical in shaping research direction, as evidenced by the high citation impact of certain sources and documents. Keyword analysis, trend topics, and network visualization confirm that online learning, communication skills, and higher education are the main nodes connecting various thematic clusters, ranging from digital technology to interactive pedagogy.

This research features several limitations. First, data collection was constrained to a single database, Scopus. As a result, studies indexed exclusively in other databases, such as Web of Science, ERIC, Google Scholar, or DOAJ, were not included, potentially excluding relevant literature, especially from local or regional journals. Second, the analysis was limited to English-language publications. Critical discourse on communication culture, communication skills training, and interpersonal communication also exists in non-English literature, including works published in Russian, Spanish, and French, which often reflect different educational policies and pedagogical practices.

Future research should also focus on developing and validating specific measurement tools for assessing communication skills in digital learning environments. These may include digital communication rubrics, interaction analysis frameworks, and learning analytics approaches that capture the quality of student engagement in online discussions, collaborative projects, and virtual presentations. Developing reliable and standardized assessment instruments will be essential for ensuring that communication competencies are effectively integrated and evaluated within digital higher education curricula.

More importantly, the findings highlight the evolving role of communication skills in the transition from emergency remote teaching during the COVID-19 pandemic toward the development of sustainable and high-quality digital pedagogy. As digital learning continues to expand in higher education, strengthening communication competencies will be essential to support meaningful interaction, collaboration, and student engagement in increasingly technology-mediated learning environments.

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