

Global Knowledge Structure and Evolution of Collaborative Online International Learning (COIL): A Bibliometric and Science-Mapping Analysis, 2016–2025

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Abstract: Collaborative Online International Learning (COIL) has emerged as an important approach to internationalization at home, enabling higher education institutions to provide digitally mediated international and intercultural learning opportunities without requiring physical mobility. Despite the rapid growth of COIL scholarship, the field remains conceptually and geographically fragmented, limiting a comprehensive understanding of its intellectual structure, research collaboration patterns, and thematic development. This study maps the global knowledge structure and evolution of COIL research from 2016 to 2025 using bibliometric and science-mapping approaches. Following the PRISMA 2020 framework, 1,083 Scopus-indexed publications were identified and analyzed using Bibliometrix/Biblioshiny and VOSviewer through performance analysis, co-authorship analysis, keyword co-occurrence, thematic mapping, and thematic evolution analysis. The findings show that COIL is a rapidly expanding and increasingly collaborative field, with an annual publication growth rate of 18.13% and international co-authorship of 38.87%. Research productivity and collaboration are concentrated among countries such as the United States, Spain, China, and the United Kingdom, revealing a core-periphery structure in global knowledge production. The thematic structure is anchored in virtual exchange, telecollaboration, intercultural competence, collaborative learning, educational technology, and internationalization. Thematic evolution further indicates a shift from communication- and language-oriented telecollaboration toward more interdisciplinary and learner-centered approaches emphasizing intercultural awareness, global competence, sustainability, and internationalization at home. The absence of dominant motor themes suggests that COIL remains in a phase of conceptual consolidation. These findings position COIL as an increasingly interdisciplinary framework for digitally mediated



internationalization while highlighting the need for stronger theoretical development, broader participation of Global South institutions, and more inclusive international research collaboration.

Keywords: Collaborative Online International Learning (COIL), Bibliometric Analysis, Internationalization at Home, Intercultural Competence, Virtual Exchange, Global Mindset

1. INTRODUCTION

The impact of digital evolution and the phenomenon of the globalization of higher education have caused major changes in international education (Altbach & de Wit, 2020; Knight, 2015). Higher education institutions understand the importance of global competence as a prerequisite for the incorporation of intercultural learning in the curriculum (De Wit et al., 2015). Nevertheless, the traditional means of internationalization, such as study abroad and academic mobility programs are still out of reach for students as a result of financial, geographical, and institutional constraints (Beelen & Jones, 2015). As a result of these challenges, many institutions of higher learning have embraced internationalization-at-home (IaH) policies and frameworks that seek to address the need for global and intercultural learning in the context of the home country. The strong focus on the equitable and inclusive internationalization of education has encouraged higher learning institutions to use digital technologies to implement global learning frameworks (or models) that are flexible and capable of providing international learning opportunities in the context of international education.

In this context, Collaborative Online International Learning (COIL) has been described as a groundbreaking innovation that incorporates the idea of internationalization at home (O'Dowd, 2021; Rubin, 2016), by using structured virtual interactions between students and staff across different countries. COIL allows learners to engage in various types of interactions, for instance, different types of dialogues or cooperative interactions, as well as reflective interactions, in synchronous or asynchronous learning environments, through various technologies, and without the need for physical travel (Rubin, 2017). Through virtual exchange, students are able to develop their skills in interacting across cultures and in collaborative learning, as well as develop a wider global outlook, and in turn, prepare and equip them for engagement in a multicultural academic or professional setting (O'Dowd, 2021). Consequently, COIL is increasingly seen as a scalable, inclusive approach to opening access to international learning opportunities in higher education.

COIL is gaining more prominence as a result of the changing trends in higher education that are characterized by increased globalization, digitalization, and a greater need for internationalization that is inclusive (Knight, 2012). The rapid shift to online learning, accelerated by the COVID-19 pandemic, has led to a greater prevalence of virtual exchange and telecollaboration among universities, substantiating the importance of digitally mediated international learning (O'Dowd, 2021). This is in close alignment with Sustainable Development Goal 4 (UNESCO, 2020), which emphasizes the importance of inclusive and equitable quality education and lifelong learning opportunities and is oriented toward the promotion of global competence and intercultural understanding. As a result, COIL has moved beyond being an additional teaching and learning strategy to being the first approach to digitally integrated internationalization and global learning within higher education.

Although scholarship on COIL is on the rise, it remains highly fragmented as a result of its interdisciplinary nature, in combination with and collaboration among a number of already existing fields such as Internationalization, Virtual Exchange, Telecollaboration, E-learning, Intercultural Communication, and Educational Technology. The field's lack of theory is due to the variety of perspectives and methods, along with the presence of similar terms and concepts and the distribution of boundaries (O'Dowd & Lewis, 2016). The available literature shows that, in addition to other topics, there is much interest in Intercultural and Collaborative Learning, Virtual Mobility, and Digital Pedagogy. Little is known, however, about how these topics intertwine with each other and how they progress in the bigger picture in the COIL framework. For this reason, in order to know where the framework is headed, it is important to enhance the clarity of the thinking around digitally mediated Internationalization (Altbach & de Wit, 2020).

Analyzing the existing literature shows the current interest in the COIL framework and offers the opportunity to study the existing frameworks and the state-of-the-art as well as the big picture in COIL, in a structured manner (Aria & Cuccurullo, 2017; Donthu et al., 2021). Traditional methods of measuring the impact of COIL, such as studying the number of publications and citations, provide a description of the frameworks and the state-of-the-art in COIL and show its importance. These methods, along with keyword analysis and mapping of topics and authors' networks, identify the important and emerging themes, frameworks, and theories in COIL (Cobo et al., 2011; Zupic & Čater, 2015). The existing literature in the COIL framework leads to a better understanding of the state-of-the-art as well as the existing frameworks in the COIL field.

Research on Collaborative Online International Learning (COIL) has expanded; yet a considerable amount of this research has been conducted at Western institutions, where internationalization is prevalent, with limited studies on Global South institutions (De Wit et al., 2015). As a result, the operationalization of intercultural competence, virtual exchange, global mind, and the internationalization of domestic education has received little attention in the context of the Global South and under-resourced educational settings. The limited studies on COIL conducted in the Global South show that virtual intercultural collaboration has a positive impact on the development of intercultural competence, cultural intelligence, collaborative learning, and a global mindset within the context of global learning enabled by digital technology. The findings suggest that COIL, in this context, is a technology and a transformative framework that is pedagogically focused on internationalization and the provision of a global learning opportunity.

To this end, this study aims to conduct a bibliometric and science mapping analysis of COIL research between the years of 2016 and 2025. In particular, it aims to assess the scope of COIL research, the degree of collaboration, the intellectual framework, and the shift in focus in COIL research. It aims to integrate bibliometric mapping and empirical research in under-resourced COIL contexts in the Global South to synthesize and extend the research to further understand the role that COIL research plays in the internationalization of higher education.

2. METHODS

Research Design

This study applied a bibliometric research design to identify the patterns and the trends of COIL research from 2016 to 2025 in published documents. It established the global collaboration of COIL research based on the intellectual structure and the evolution of themes. Bibliometric analysis is the quantitative study of the research output through the analysis of metadata (i.e. authors, citations, keywords, research funding, publisher, etc.) that helps identify the patterns of research volume, ideas, and collaboration (Donthu et al., 2021). The study used a mixed methods approach and integrated the three methods of performance analysis, science mapping, and thematic analysis to understand the contributions of authors and institutions in COIL research as well as the changes in the structure of themes in COIL research.

Performance analysis studied the patterns of research volume and the most influential authors, journals, and institutions. It also analyzed the citations and the most influential countries and the most prominent journals. The science mapping method defines the intellectual, conceptual, and social structures of the field through co-authorship networks and keyword co-occurrence analysis, and through thematic mapping and analysis of thematic evolution (Cobo et al., 2011; Zupic & Čater, 2015). The method, together with the other bibliometric techniques, analyzed the evolution of COIL research in the context of the integration of digitalization in the field of internationalization (internationalization at home) research.

To maintain replicability, transparency, and rigor, the study adhered to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) 2020 guidelines for the systematic search, screening, and selection of published materials (Page et al., 2021). The PRISMA guidelines provided a framework for search and screening, assessment for eligibility, removal of duplicates, and inclusion of relevant studies for bibliometric analysis. The combination of systematic review and bibliometric mapping enhanced the reliability and replicability of the study.

Data Source

Data for this study's bibliography was collected from the Scopus database exclusively, as it is the largest comprehensive database of peer-reviewed literature's abstracts and citations. Scopus's comprehensive inter-discipline classification and presence of educational, internationalization, and technology-enhanced learning research publications informed its selection. Scopus is appropriate for research like the COIL research as it comprises journals, conference literature, and books across all disciplines and interdisciplinary bibliometric research.

The use of a particular database aids in methodological precision as merging databases incurs variable metadata, structures, indexing, and citation formats. Scopus, unlike other databases, offers authors, institutions, and cited works along with abstracts, keywords, and citations as bibliographic data for the analyses of research performance and collaboration, and for the analysis of the structures of research themes (Aria & Cuccurullo, 2017). Its reliability and extensive coverage makes it a favorable database for bibliometric studies and research science mapping and aid integration with bibliometric softwares (Donthu et al., 2021).

Search Strategy and Data Extraction

To obtain COIL-related publications and publications related to the concept of COIL in the field of education, the Scopus Advanced Search interface was used to implement a systematic and structured search strategy. The search query included multiple synonymous terms of COIL in order to better capture the breadth of the term and to mitigate bias in the terminology. These synonymous terms included virtual exchange, telecollaboration, online intercultural exchange, globally networked learning, and international virtual collaboration.

The search query that was used is as follows:

TITLE-ABS-KEY (("Collaborative Online International Learning" OR "COIL" OR "virtual exchange" OR "telecollaboration" OR "online intercultural exchange" OR "globally networked learning" OR "international virtual collaboration")) AND TITLE-ABS-KEY ((education OR "higher education" OR "teacher education" OR "tertiary education" OR "university" OR "college" OR "curriculum" OR "teaching" OR "learning")) AND PUBYEAR > 2015 AND PUBYEAR < 2026 AND (LIMIT-TO (SUBJAREA,"SOCI") OR LIMIT-TO (SUBJAREA,"COMP"))

The purpose of the search strategy was to include multiple terminologies and conceptual variations related to COIL in the publications related to education that were obtained. In order to incorporate the dimensions of COIL within the field of education and within the field of technology, Social Sciences (SOCI) and Computer Science (COMP) were used as subject area constraints. The search was conducted in March 2026 and an initial result of 1,908 publications was obtained for the period of 2016-2025.

Inclusion and Exclusion Criteria

The selection of literature observed the PRISMA 2020 guidelines as a framework for systematic and transparent selection of relevant publications (Page et al., 2021). The defined inclusion and exclusion criteria identified digital mediated intercultural approaches in the field of higher education and related fields, including publications on COIL, virtual exchange, and telecollaboration found in publications listed in the Scopus database for the period of 2016 to 2025.

Publications on COIL that fell outside the designated period for the review, publications that lacked sufficient bibliographic data (title, author, abstract, keywords), and scholarly work in the field of digital-mediated intercultural collaboration that fell outside the education domain were not considered. Redundant and duplicate entries were removed in the screening and eligibility phases. After applying the defined inclusion and exclusion criteria, a total of 1,083 entries were selected for bibliometric and science mapping analyses.

Data Cleaning and Normalization

Before bibliometric analysis, the data cleaning and normalization processes were manually conducted. As part of these processes, duplicate records were eliminated, metadata errors were rectified, indexing artifacts were removed,

and keyword synonyms were manually addressed through a synonym text file. During keyword normalization, the focus was on the keyword form (singular vs. plural), the removal of generic keywords, and the merging of keywords that, from the authors' perspective, were similar and interchangeable.

The data cleaning and normalization procedures increased the reliability of the analyses' co-occurrence, mapping of themes, and overlay visualization. This was achieved through the normalization of the data set. The same practices of data normalization are recommended in bibliometric studies for greater accuracy in science mapping and the interpretation of themes (Aria & Cuccurullo, 2017).

Data Analysis

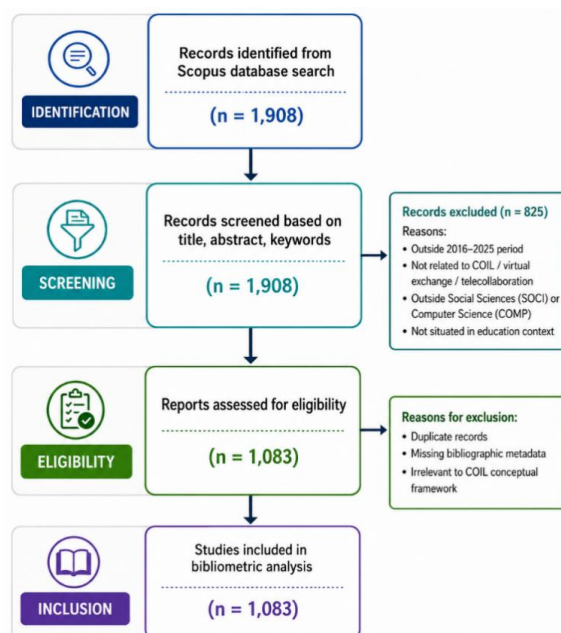
This study applied science mapping and performance analysis and used Bibliometrix/Biblioshiny and VOSviewer. Bibliometrix is an R-package that enables the implementation of bibliometric analyses, and Biblioshiny provides a web-based platform for users to perform data processing and visualization (Aria and Cuccurullo, 2017). VOSviewer was used for the analyses of co-authorship, keyword co-occurrence, and the mapping of relation (thematic) structures of scientific (knowledge) domains (van Eck and Waltman, 2010).

Performance analysis included the evaluation of the volume of annual publications, citations, the most influential journals, the most productive countries, pertinent institutions, and the most cited articles. Co-authorship was used to analyze the international and institutional research collaboration networks in COIL. Keyword co-occurrence was used to determine the dominant research field structures and the active and developing research domains in the data. Overlay visualizations were used to analyze the shifting and changing research domains in the COIL field.

Thematic mapping was used to identify “basic,” “niche,” “emerging,” and “motor” themes in COIL research (Cobo et al., 2011). The analysis of the evolution of the themes was used to study the changes of the COIL research themes within the selected time intervals of the study. The focus of the cited methods was to establish the research trends and the intellectual structures in the COIL research documents published globally between 2016 and 2025.

Figure 1

PRISMA flowchart diagram of the study



3. RESULTS

3.1 Descriptive Characteristics of the Dataset

The bibliometric analysis of COIL research for the period of 2016 to 2025 shows that documents were published in varying interdisciplinary collaborative fields by 2,310 researchers, showing a total of 1,083 documents published in 528 sources. The dataset shows an emerging research field with an increasing focus among researchers, indicated by the average of 3.92 years per document and 8.78 citations per document. The dataset of COIL research reveals a collaborative field of research, shown by the average of 2.75 co-authors per document and an international co-authorship of 38.87%.

The average document published shows an annual growth rate of 18.13% demonstrating the increased research focus in digitally mediated Internationalization, virtual exchange, and intercultural learning. Over half of the total documents published ($n = 658$) are articles, showing a preference for journal publications, with a total of 248 book chapters and 101 conference documents published, showing interest in publication avenues supported by research conferences. The field of COIL research is collaborative and interdisciplinary in nature, shown by the total of 2,357 author keywords and 1,747 Keywords Plus entries, with a focus on education technology, virtual exchange, intercultural communication, and Internationalization.

Table 1

Descriptive Characteristics of the COIL Bibliometric Dataset (2016–2025)

Category	Indicator	Value
Main Information	Timespan	2016–2025
	Sources (journals, books, proceedings)	528
	Documents	1,083
	Annual growth rate	18.13%
	Average document age (years)	3.92
	Average citations per document	8.78
Document Contents	Keywords Plus (ID)	1,747
	Author keywords (DE)	2,357
Authorship	Total authors	2,310
	Authors of single-authored documents	195
Collaboration	Single-authored documents	251
	Co-authors per document	2.75
	International co-authorship	38.87%
Document Types	Articles	658
	Book chapters	248
	Conference papers	101
	Reviews	31
	Books	25
	Conference reviews	7

	Editorials	5
	Notes	3
	Errata	3
	Data papers	2

3.2 Research Trends and Temporal Dynamics

From 2016 to 2025, the first dataset indicates the annual scientific production of COIL research. Publications for this dataset ranged from 47 in 2016 to 215 in 2025. Year-to-year changes displayed minor fluctuations, particularly for the years 2017, 2020, and 2024; however, the focus and growth of research related to COIL and virtual exchanges has been both continuous and accelerating.

The most pronounced growth rate was observed in the span following 2020. This reflects the likely positive relationship between the COVID-19 pandemic and the growth of research in digitally mediated internationalization and online intercultural collaboration. As institutions shifted from one type of virtual learning to another during the pandemic, COIL's application as a flexible, internationalization-at-home approach that allows for sustained interactivity during periods of travel restriction was seen as an advantageous pedagogical approach. This research indicates that COIL has moved beyond being an innovative approach to teaching and learning to being a mainstream scholarship focus within higher education and digital internationalization.

Figure 2

Annual Scientific Production of COIL Research (2016–2025)

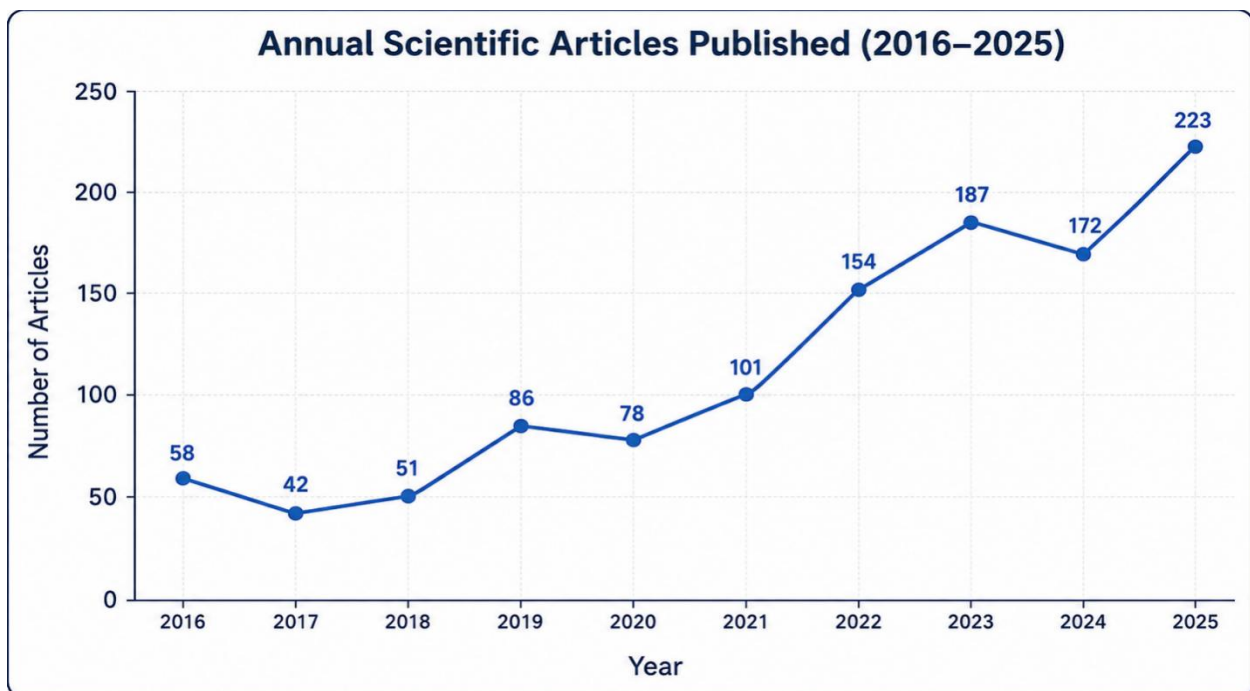


Figure 3 shows the average number of annual citations for COIL publications. In the earlier years of the dataset, most years had an average of COIL publications that received a relatively high number of citations. 2016, 2018, and 2020 are notable years, with 2020 being the year with the highest average number of citations. Publications from this year received a considerable amount of attention from scholars, likely impacting the direction of research in this area. Bibliometric studies have little concern for declining citation averages following the publication of new works. This decline is most visible in the years immediately preceding the publication of this report. In the field of bibliometrics,

the citation trends described here show that the earliest COIL studies provided a significant foundation for the field with their citations. The COIL studies published more recently showcase the field's growing productivity, and the extent to which these studies will be cited continues to evolve.

Figure 3

Average Citations per Year of COIL Research

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Average Citations per Year of COIL Research

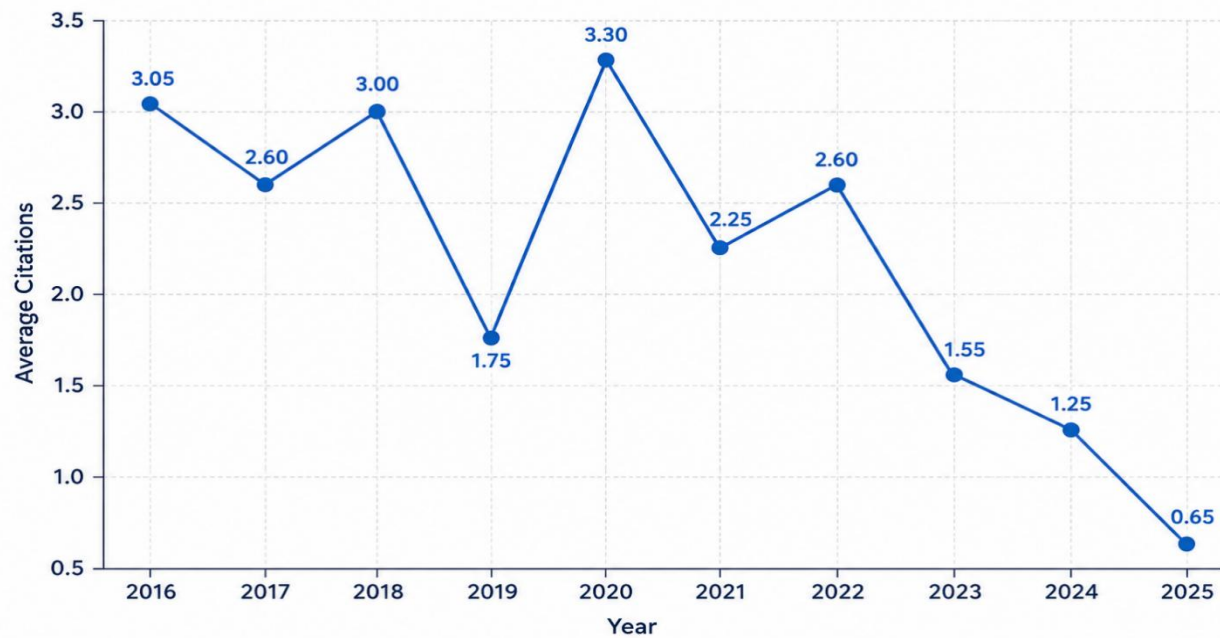
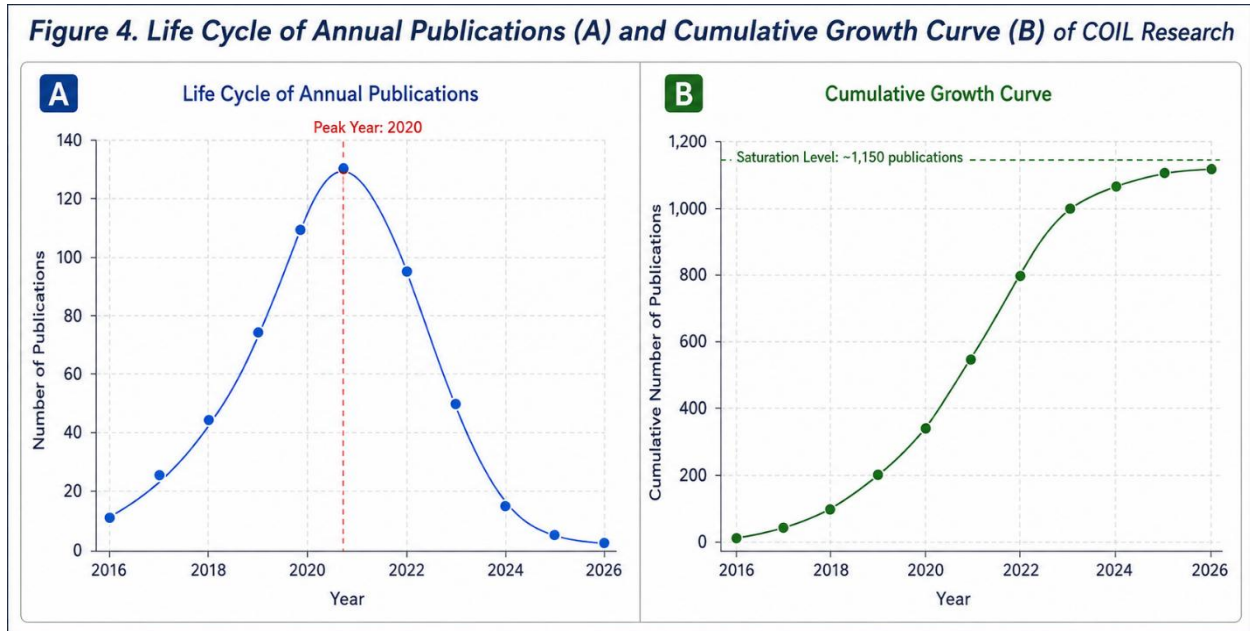


Figure 4 outlines the developmental pathway of COIL research through the life cycle of annual publications and cumulative growth. The life cycle analysis shows that early stage COIL research emerged as a nascent research area with low levels of annual publications, though circulation of research was spurred in 2020 and thereafter, as scholars began to explore the virtual exchange of COIL, digital internationalization, and the global learning framework supported by technologies.

As a result, the cumulative growth curve shows the presence of a continuous positive slope to the publications, as COIL research experienced almost exponential growth after 2020. The sharpness of the growth curve compared to prior years shows that COIL research and practice has become a lively and intensive field of interdisciplinary digital research with elements of pedagogy, intercultural research, and internationalization-integrated frameworks.

Figure 4

Life Cycle of Annual Publications (A) and Cumulative Growth Curve (B) of COIL Research



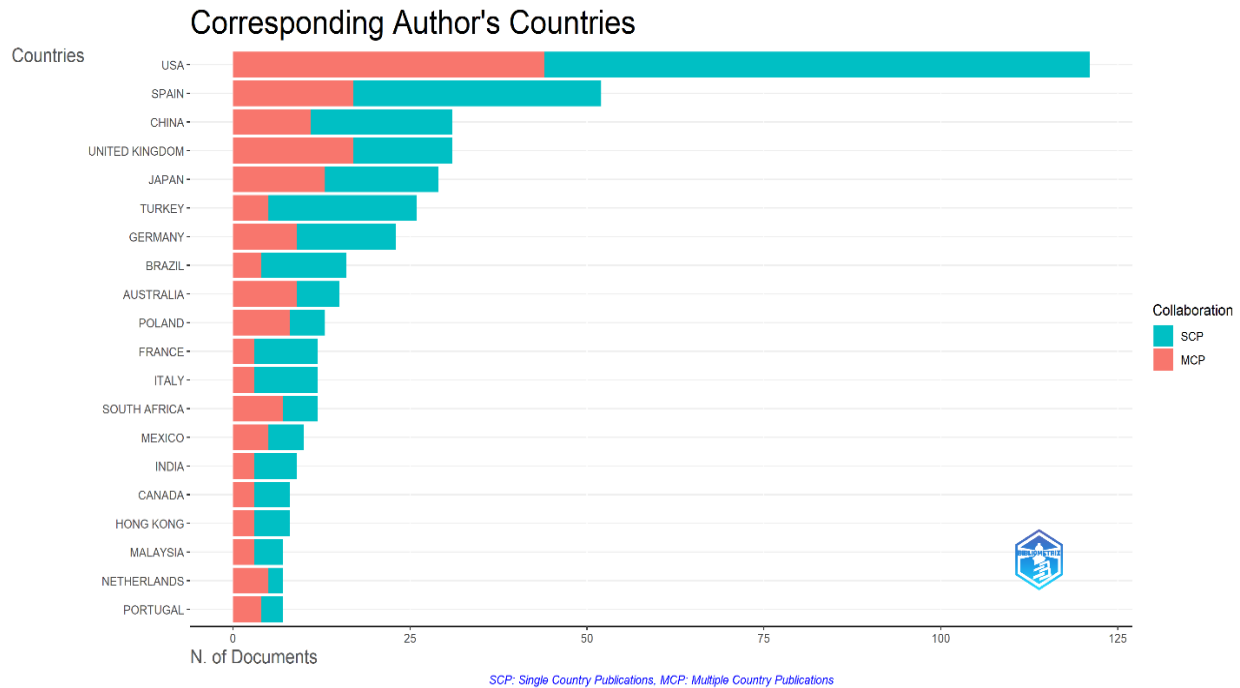
3.3 Global Research Productivity and Collaboration

According to the country productivity analysis, first place for COIL research productivity goes to the United States, and second place goes to Spain, China, and the United Kingdom, in that order. These countries have the most highly internationalized higher education systems, and therefore have the most highly developed COIL research systems. The United States shows evidence of an internationalized research system focused on the other two types of scholarships (internationalization and virtual exchange), as suggested by its high rate of research publication. Spain and China are increasing their research productivity in areas related to digital, international, and intercultural learning.

The country collaboration networks yield more evidence of differing levels and types of international engagement. The United Kingdom, Australia, and the Netherlands are highly integrated countries, having adopted more internationally collaborative and therefore more integrated research frameworks. The opposite is true for countries like Turkey, Brazil, and Italy, among many others. These countries adopted relatively less internationally collaborative research frameworks, signaling more focused domestic research. COIL scholarship is highly nationally based, and simultaneously is more internationally collaborative.

Figure 5

Corresponding Author's Country Collaboration Network of COIL Research (2016–2025)



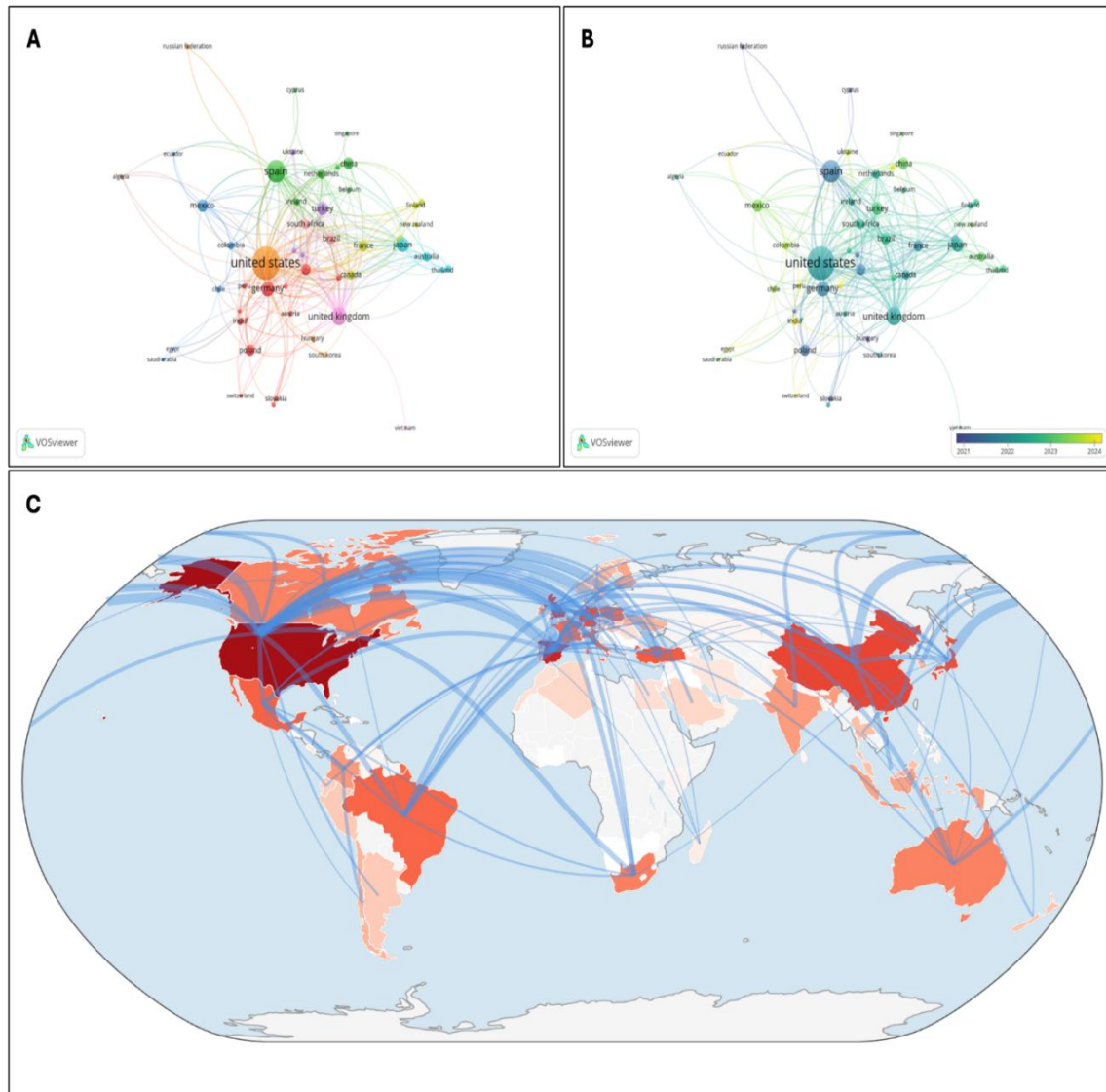
The structure of collaboration indicates a core-periphery pattern that is often noted in global higher education research. In this pattern, a few highly productive countries serve as the primary centers for international collaboration and global knowledge circulation. The unevenness of this pattern is somewhat balanced by the trend of increasing participation by previously less engaged countries, indicating the gradual diversification of geography within the realm of COIL scholarship.

3.4 Co-authorship and Global Collaboration Networks

The analysis of the global co-authorship network for COIL research shows a high degree of interconnectedness as well as a high degree of concentration in collaboration. From Figure 6A, it can be seen that the United States is the largest collaboration node in the network and the most connected country, collaborating with the United Kingdom, Spain, Germany, China, Japan, and Mexico. These countries are secondary collaboration hubs and are likely to connect different regions of the world, if not the entire world, in collaboration.

Figure 6

Co-authorship Collaboration Network of COIL Research Through (A) Network Visualization, (B) Overlay Visualization, and (C) World Collaboration Map



The overlay visualization in Figure 6B shows how collaboration patterns change over time. During the study period, the persistent centrality of the United States, United Kingdom, and Spain was apparent, and the recently central positions of China, Singapore, Brazil, and Finland reflect the greater involvement of emerging and developing regions. Based on the data, it is reasonable to assume that the use of digitally mediated international education is expanding and that there is greater interest in research from these regions.

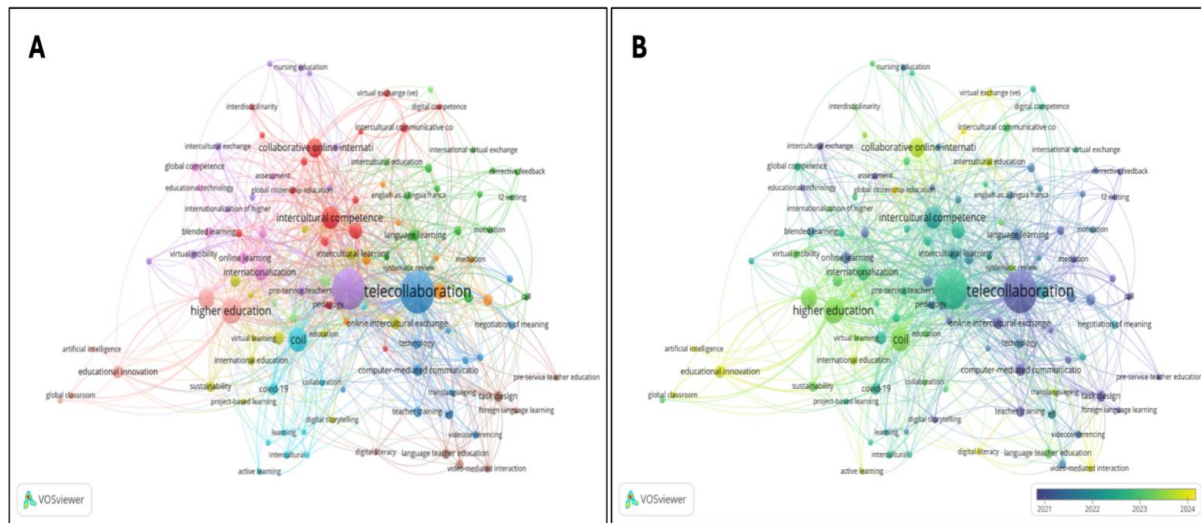
Figure 6C shows the world collaboration map and confirms the global nature of the COIL research community. There was strong publication activity in North America, Western Europe, China, and Australia, and there were strong collaboration ties between these regions. Although there is strong publication activity in the aforementioned regions, there are still gaps in collaboration in Africa, parts of Central Asia and South East Asia, which means that there are still gaps in participation in global research. This also indicates that there is a strong need for regionally balanced international research cooperation in the field of digitally mediated internationalization.

3.5 Intellectual Structure: Keyword Co-occurrence Analysis

The analysis of keyword co-occurrences has revealed four dominant themes that reflect the framework of COIL research. Virtual exchange, coupled with intercultural communication, educational technology, collaborative learning, and internationalization, has been integrated in Figure 7A as a multidimensional conceptual space.

Figure 7

Keyword Co-occurrence Network of COIL Research Through (A) Network Visualization and (B) Overlay Visualization



The first thematic cluster focuses on virtual exchange and intercultural telecollaboration. Here, virtual exchange, telecollaboration, and intercultural competence are the predominating keywords. This cluster is reflective of the conceptual origins of COIL in the framework of computer-mediated intercultural communication and the teaching/learning of languages. The second cluster, through the keywords of students, collaborative learning, and e-learning, is focused on the participant-centered/cooperative and technology-integrated approaches to teaching/learning in the frameworks of COIL.

Educational innovation and higher education are the primary areas of focus for the third cluster. Here, the embedding of COIL within the frameworks of internationalization-at-home is emphasized. Foundational concepts of education are the focus of the fourth cluster. Here, learning, education, and international cooperation are emphasized. This cluster is representative of the context of COIL that is spelled out in the frameworks of education. In total, the thematic clusters are reflective of the COIL research in its conceptual, pedagogical, technological, and institutional breadth.

Figure 7B displays the overlay visualization of COIL research and the shifting of its main focuses over time. The focus of early research was computer-mediated communication and foreign language learning and task design, clearly demonstrating that early scholarship was dominated by language and intercultural education. The more recent focus has been on topics such as virtual exchange and digital and educational integration, as well as a strong focus on both artificial intelligence and global rather than local education. The shift towards a more learner-centered approach is evident.

The introduction of COVID-19, virtual mobility, and online learning further demonstrates that the pandemic has influenced the fostering of COIL and the focusing of attention on it the most. The added focus on project-based learning, sustainability, and interdisciplinary approaches also indicates that COIL is moving beyond language learning into the integration of global competencies and frameworks of internationalization-at-home.

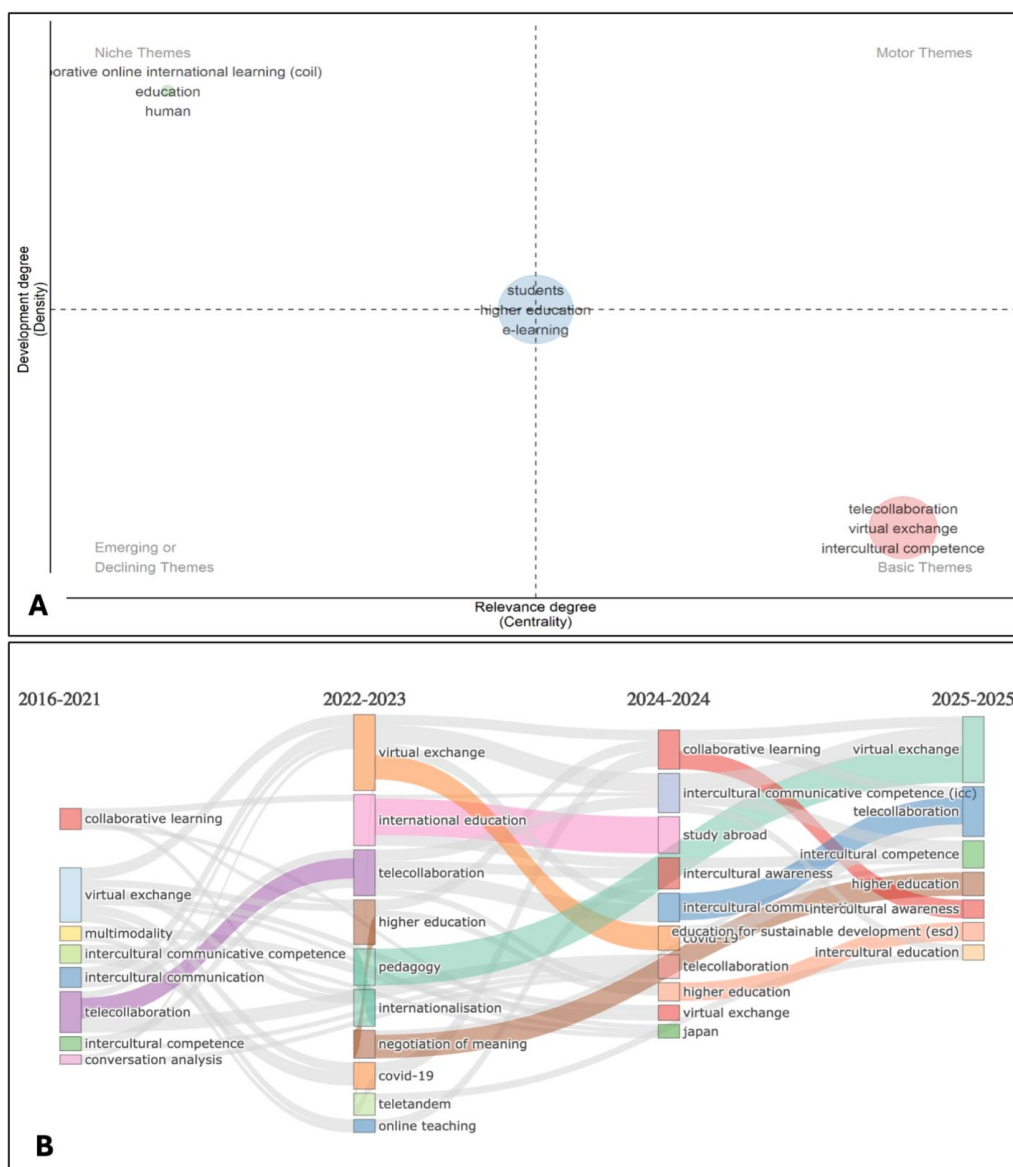
The increasing use of terms such as intercultural competence, collaborative learning, and global learning corresponds with new empirical data showing strong connections between COIL participation and the development of cultural intelligence, intercultural communication, and global mindsets for students involved in virtual exchange. These trends indicate that COIL is being recognized as much more than a technological advancement in higher education.

3.6 Conceptual Structure Mapping and Thematic Evolution

The strategic thematic map in Figure 8A clusters COIL research themes based on density and centrality. This allows for the classification of foundational, specialized, and emerging research domains in thematic COIL research.

Figure 8

Strategic Thematic Map (A) and Thematic Evolution Map (B) of COIL Research



The analysis revealed three main thematic categories. The first category includes telecollaboration, virtual exchange, and intercultural competence. These are foundational themes that demonstrate high centrality and moderate density. This means that while there is limited connectivity and structural cohesion among the themes, these concepts

are likely to be the most connected and important components of COIL scholarship. The second category is COIL, a highly cohesive, specialty theme that is structurally loose and integrates to other concepts and themes in limited capacity.

The third category demonstrates varying degrees of development, density, and centrality and is comprised of the themes, students, higher education, and e-learning. These COIL scholarship themes are likely to have learner-centered pedagogy, digital teaching and learning, and the internationalization of higher education combined with internationalization at home. The absence of dominant motor themes suggests that COIL scholarship is in a phase of conceptual consolidation, and several interrelated themes are evolving rather than COIL scholarship being guided by a single dominant theoretical framework.

The map of thematic evolution shown in Figure 8B illustrates the conceptual advancement spanning from communication-centered telecollaboration to integrated educational frameworks that are globally responsive and institutionally integrated. During the 2016–2021 phase, COIL scholarship was primarily related to telecollaboration, virtual exchange, and intercultural communication, as well as intercultural communicative competence.

During the 2022–2023 phase, COIL scholarship expanded to include international higher education and pedagogy and internationalization. During this phase, higher education institutions adopted COIL within internationalization frameworks, and the COVID-19 pandemic had a strong influence on scholarship regarding online teaching and virtual learning. During the 2024–2025 phase, the COIL scholarship adopted the concepts of intercultural awareness, collaborative learning, Education for Sustainable Development, and Global Competence.

These trends show a movement from a communication-based telecollaborative focus to interdisciplinary, learner-centered pedagogy frameworks that accommodate intercultural competence, sustainability, and inclusive internationalization. The evolution of these themes indicates that COIL has developed into a globally centered pedagogy integrating intercultural learning, digital internationalization, and internationalization-at-home practices within contemporary higher education.

4. DISCUSSION

The results of this bibliometric study show that COIL is a growing field in higher education and in the study of digital internationalization. The number of publications expected between 2016–2025, with an average annual growth rate of 18.13%, reflects the growing interest of the academic community in internationalization-at-home and in digitally internationalized cross-cultural learning. COIL scholarship aims to respond and adapt to the needs of the global academic community and to the trends in higher education that rely more on technology to create learning opportunities, as well as to the field of international education that emphasizes inclusive internationalization beyond traditional cross-border mobility (Altbach & de Wit, 2020; Knight, 2015). The new average age of documents and the greater visibility of citations are other indicators that COIL is a new and engaged field of scholarship.

The increase in the number of publications after 2020 is a clear indication of the impact of the COVID-19 pandemic as a catalyst for research in digital internationalization and virtual exchange. The COVID-19 pandemic forced the world of higher education to pivot to online learning in a matter of days, and created an interest in cross-border digital alternative international mobility. This signifies the importance of COIL as a cross-border digital international mobility scholarship framework (O'Dowd, 2021). The findings of this research suggest that digital internationalized learning environments are at the center of international learning in higher education. Far from being digital cross-border mobility substitutes, COIL is a framework for creating pedagogical structures that enable virtual learning, engagement, and collaboration, and the development of global competencies.

The collaboration and co-authorship patterns found in this study reflect the global and interdisciplinary nature of COIL scholarship. The high rates of international co-authorship and broad transcontinental collaboration show that the networks of cross-border scholarly collaborations are the main shapers of knowledge production in this area. The predominance of the United States, the United Kingdom, Spain, and China is evidence of their international higher education systems and their ability to guide thinking and methods in COIL research. This is in line with Knight (2015)

and other studies that stress that international collaboration and global higher education research is where the greatest gains in research productivity and academic presence are found.

On the other hand, the co-authorship and country collaboration studies show that there are structural inequities in the production of global knowledge. These studies show that a few developed countries dominate network collaboration and the resulting publications, forming a core with a periphery of less developed countries in international research systems. The inequity in participation in global digital internationalization scholarship is especially evident in the lack of representation of institutions from many African countries and other less developed countries. To improve the equity of participation in internationalization and virtual exchange research, it is necessary to create collaboration networks that are more stable and open to different regions. In particular, creating partnerships with Global South institutions will add more geographically centered and contextually grounded perspectives and practices in the scholarship of digital internationalization.

Through keyword co-occurrence analysis, the intellectual structure of COIL scholarship uncovers its interdisciplinary nature, as well as its progression. Relationships among the (virtual exchange, telecollaboration, intercultural, collaborative, and innovative education) clusters suggest that COIL research brings together a variety of theories, including but not limited to: computer-mediated communication, social constructivism, and digital pedagogy (Deardorff, 2006; O'Dowd & Lewis, 2016). The presence and prominence of the terms intercultural competence, collaborative and global learning suggest that COIL is both a technological advancement and a radically new pedagogy that supports the formation of intercultural reflective and collaborative learning, as well as the construction of knowledge in virtual environments.

The bibliometric results presented here are in strong agreement with the new empirical evidence stemming from COIL studies in the Global South. Recent studies of virtual intercultural collaboration environments have shown the development of student engagement, cultural intelligence, and awareness of, and the presence of, a global mindset, in addition to the development of student intercultural awareness, in those participating in COIL activities. Evidence from these studies has shown that active and meaningful participation in virtual exchange environments fosters the development of intercultural competence and collaborative and global thinking. The alignment of bibliometric and empirical results reaffirms the new and existing evidence in the thematic focus.

The overlay visualization analysis demonstrates the COIL research's journey from its early stages of focusing on language learning and computer-mediated communication to the more interdisciplinary and technologically advanced fields. Earlier telecollaboration, foreign language learning, and intercultural communication-focused themes reflect the initial stages of COIL in the online intercultural language exchange (O'Dowd & Lewis, 2016). However, the development of research areas such as digital competence, educational innovation, and artificial intelligence, among others, indicate the extension of COIL research to the pedagogy and the teaching and learning technologies within the framework of global learning.

The emergence of keywords on COVID-19, online learning, and virtual mobility indicate that the COVID-19 pandemic was a catalyst to shifting focus to virtual internationalization in the field. Additionally, the incorporation of sustainability, project-based learning, and the education for sustainability fields into COIL indicate that COIL is slowly shifting to the greater global educational focus of sustainability, global citizenship, and social accountability learning. These gradual shifts suggest that COIL is moving from the language-centered telecollaboration focus to a broader pedagogy of intercultural competence and internationalization frameworks, across the many disciplines, of global competencies, engagement, and collaboration.

Analyses of the evolution of themes and of strategic thematic mapping indicate that COIL is still in the stage of conceptual consolidation, characterized by the concurrent development of multiple, related research streams. As foundational concepts, telecollaboration, virtual exchange, and intercultural competence continue to demonstrate high centrality, their strong positioning in the knowledge structure indicates their continued significance and stability within the field. Concurrently, the developing themes of students, higher education, e-learning, and digital teaching indicate

the field is moving toward a more learner-centered approach and the adoption of virtual internationalization by higher education institutions.

The lack of prominent motor themes indicates that COIL continues to develop by integrating multiple disciplines and is less reliant on a single, dominant perspective in the theory. This supports the view of COIL as an emerging, multidimensional research area at the intersection of internationalization, digital pedagogy, intercultural communication, and collaborative learning. This type of integration is likely to enhance the scope and the relevance of COIL in various educational and institutional settings.

These results have notable consequences for internationalization-at-home practices in Global South higher education institutions. The attention to intercultural competence, collaborative learning, and the global mindset indicates that COIL is a feasible and adaptable approach to offer international learning opportunities in settings with limited resources, where traditional international learning opportunities exist. Through the mediation of technology and digital collaboration to encourage intercultural engagement, COIL may help to eliminate the structural barriers of geography, expense, and mobility inequity, thereby fostering and encouraging engagement in global learning opportunities. This idea is closely connected to the 4th Sustainable Development Goal, which is to achieve inclusive and equitable quality education and promote lifelong learning opportunities (UNESCO, 2020).

The combination of performance analysis, collaboration mapping, keyword analysis, and co-occurrence analysis of thematic evolution indicates that COIL research is an innovative and interrelated global research field that is rapidly adapting to changing focuses and priorities of internationalization in higher education. The alignment of bibliometric data and the emerging evidence in the field suggests that COIL is shifting from a niche telecollaborative practice to a defined and substantial framework for digital internationalization, the development of intercultural competence, and the provision of inclusive global learning. The development and relative value of COIL research will depend on the integration of theory, international collaboration—especially with the Global South—and the participation of underrepresented Global South institutions.

5. CONCLUSION

This study captures the growth and consolidation of COIL research between 2016 and 2025, as well as the global trends and patterns in this research, through a bibliometric analysis. Based on research results, the increase in research productivity, visibility, and international co-authorship demonstrates the central role of co-authorship in global research networks for the advancement of COIL research. The networks of research collaborations display core-periphery structures populated by researchers from highly internationalized countries (e.g. USA, UK, Spain, China) and show the increasing global focus on digitally mediated internationalization, along with the emergence of new international COIL research networks.

The field of COIL research demonstrates strong links to telecollaboration, virtual exchange, and other forms of collaborative and intercultural learning. From a thematic perspective, the COIL research field has moved away from communication and language-oriented telecollaboration toward more informal and interdisciplinary learner-centered approaches which integrate digital and global skills. COIL serves as a flexible and adaptable framework to respond to the contemporary focus in the international research community on sustainable practices, virtual mobility, intercultural collaboration, and collaborative learning.

The bibliometric evidence aligns with evidence from Global South studies on COIL, indicating that engaging in virtual intercultural collaborations enhances students' intercultural competence, cultural intelligence, collaborative learning, and global mindset. This evidence supports the assertion that COIL is a technological innovation, a pedagogical model, and a framework that is inclusive and considers the need to extend international educational opportunities beyond the pedagogical constraints of physical mobility.

While COIL research is expanding, the lack of prevailing motor themes indicates that COIL research is still at the stage of interdisciplinary and methodological mixing and the building of dominant theories. This COIL research landscape calls for further research that builds the theory of COIL, explores the participation of Global South

institutions, and facilitates international research collaborations that are inclusive and address the inequities in the global production of knowledge. The theory and practice of COIL may also greatly benefit from research focused on the use of artificial intelligence, sustainable virtual exchange, intercultural assessment, and the lifelong development of global competence.

The study frames COIL as equitable, scalable, and digitally mediated internationalization and global learning in higher education that is transformative in its nature and practice. Both bibliometric data as well as the empirical evidence agree that COIL in the best way supports collaborative learning in educational contexts and various initiatives for the internationalization at home.

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