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RESEARCH ARTICLE

Two decades of technology-assisted intercultural communicative competence development: A comprehensive bibliometric review

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ABSTRACT

Due to the significant growth on technology-assisted intercultural communicative competence(ICC) development research over the past two decades, it is crucial to conduct a comprehensive review to track trends, provide up-to-date information, and monitor changes in technology and its applications. This study conducted a bibliometric analysis using the Scopus database, analyzing 553 articles written by 160 researchers from 67 countries, covering the period from 2001 to 2023. The findings reveal an upward trend in the number of published articles in this research domain. The field covers 24 subject areas, with Social Sciences, Computer Sciences, and Arts and Humanities being the most prominent. Extensive research has been conducted globally, with the United States, Spain, Australia, the United Kingdom, and Taiwan being the top five highly cited countries or regions. Among the journals in this field, "Language Learning and Technology" stands out as the most highly cited over the past two decades. The analysis of the keywords map reveals changes in keywords throughout time. Additionally, the term map of title and abstract identifies four primary clusters of research areas: "Technology and Interculturality," "Application in Teaching," "Evaluation Methods and Effects," and "Technology, Language, and Communication." Finally, the paper presents recommendations for future research aimed at advancing technology-assisted intercultural teaching.

Keywords: bibliometric; technology; intercultural communicative competence; intercultural teaching

1. Introduction

Intercultural communicative competence(ICC) is defined as "the ability to interact effectively with people of cultures other than one's own"[1]. The research on ICC reflects growing interests in fostering global citizens in the context of globalization and multiculturalism[2]. As the significance of ICC continues to gain prominence, researchers and educators have been exploring diverse methods to improve and develop ICC skills. Such as intercultural training[3–5], studying abroad and cultural immersion[6,7], constructing ICC models[8,9], etc. The utilization of technology has a significant impact on the acquisition of ICC[10–15]. Yi et al.[15] argued that various technologies positively influence learning outcomes in intercultural learning activities and he suggests future research directions in technology-supported intercultural learning. In the past two decades, there has been widespread concern about technology assisted intercultural projects and the application of technology to enhance ICC development[16–19]. Despite the increasing popularity, there is a lack of bibliometric studies that measure the contribution of research papers to the advancement of this topic. To address this gap, this study

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aims to conduct a bibliometric analysis of the domain, focusing on the publication trends, citation patterns and key study areas to provide a structured overview of its characteristics and developments and assist researchers in gaining insights into the field.

2. Literature review

2.1. Intercultural communicative competence

The study of ICC can generally be divided into three phases: the foundational ideas and concepts related to ICC began to emerge in the 1970s-1980s. Notable figures and topics in this area include Hymes (1972) and his exploration of intercultural communication competence, Hull (1972) and his work on intercultural sensitivity, as well as Hammer et al.'s (1978) research on intercultural communication effectiveness, etc., these contributions collectively form the basis for ICC research. In the phase of 1990s-2000s, scholars engaged in in-depth research to conceptualize ICC and construct ICC models. Key ICC models during this period include the Pyramid Model of Intercultural Competence[20], the Intercultural Competencies Dimensions Model[21], the Integrated Model of Intercultural Communication Competence[22], the Intercultural Communicative Competence Model[23] and so on. The aim of these ICC models was to establish a comprehensive framework for understanding and assessing ICC. In the new century, the phase of ICC research has witnessed a significant expansion in the field, encompassing ICC's application in various fields and contexts, such as education, tourism, business, management and transnational organizations and cross-cultural teams; and focusing on the practical cultivation and assessment of ICC[24-28]. Additionally, there has been a growing interest in exploring the role of technology in facilitating ICC development. According to the Scopus database, the earliest research on technology-assisted ICC study dates back to 2001, during the past two decades, there is an increasing popularity on conducting technology-assisted ICC development research. Researches showed that the incorporation of technology into education has positive effects on intercultural learning by increasing motivation[29–31], enhancing intercultural sensitivity[32,33], fostering linguistic competence and ICC[34–36], satisfying learning needs[37], among other advantages.

2.2. Bibliometric analysis

Some scholars have conducted the reviews on ICC[2, 38-41] or technology assisted intercultural teaching[15, 42-45]. Peng et al. [2]carried out a bibliometric analysis within the field of ICC. They analyzed a collection of 663 research papers, covering the period from 2000 to 2018, sourced from the Web of Science database.Yi et al.[15] presents a systematic review on technology-assisted intercultural learning published from 2012 to 2021. This study identified the relationships among research variables such as participants, technology, main findings, instruments, and study types. Shadiev and Dang[45] conducted an analysis of articles concerning technology-facilitated intercultural education across various disciplines. Their assessment encompassed seven distinct aspects: (a) research focus, (b) theoretical foundation, (c) technologies, (d) learning contexts and how they connected to intercultural learning, (e) learning activity, (f) data collection, and (g) findings. On the other hand, Shadiev and Yu[43] reviewed articles on computer-assisted intercultural teaching published in the last five years(2018–2022) investigating the following aspects:the theoretical foundation; the technologies; the languages and cultures; the methodology and the findings. So far few efforts have been made to conduct the bibliometric analysis on technology assisted ICC development. Bibliometric analysis has been extensively utilized to assess trends and influence, encompassing factors such as publishing countries, research areas, journals, and author keywords[46-50]. Over the last two decades, research in technology assisted intercultural teaching has made significant progress, with notable authors, influential works, prominent publication outlets, and established research themes. This study aims to identify the dominant trends and frontiers in this field by

examining the leading subject areas and journals in terms of publications, highly cited articles, and countries (regions), and research hotspots. The research questions of this study are:

1) What are the current publication trends in technology-assisted intercultural teaching?

2) What are the citation patterns in technology-assisted intercultural teaching?

3) What are the research hotspots in technology-assisted intercultural teaching?

3. Methodology

3.1. Identification of sources

The Scopus database was selected as a data source because Scopus stands as one of the most extensive online databases globally, encompassing more than 20,000 peer-reviewed journals. It offers smart tools suitable for basic visualization and statistical analysis of research papers. Moreover, Scopus provides comprehensive records of literature in the RIS (Research Information Systems) and CSV (Comma-Separated Value) format, enabling seamless importation and analysis using bibliometric software tools for further research and examination[51]. The specific retrieval strategy was designed as follows: TITLE-ABS-KEY= (“intercultural teaching” OR “Intercultural education” OR “intercultural learning” OR “cross cultural competence” OR “global competence” OR “intercultural competence” OR “intercultural communicative competence” OR “intercultural communication competence” AND TITLE-ABS-KEY = (“Skype” OR “blog” OR “facebook” OR “Blended Learning” OR “virtual” OR “technolog*” OR “computer” OR “online” OR “Digital” OR “telecollaboration” OR “internet” OR “E-learning”) AND NOT TITLE-ABS-KEY (“online survey” OR “online investigation” OR “online questionnaire”). The wildcard ‘*’ serves as the fuzzy search strategy that is employed to encompass term variations. To illustrate, the terms technology and technological, all could meet technolog*. TITLE-ABS-KEY outlines the approach for topic-based searches, wherein a document is chosen if the specified terms are present in any segment of the title, abstract, or keywords. The sample data was updated till June 30, 2023.

A total of 1065 papers were found from the search. Subsequently, the selection of the research documents were narrowed down based on the following criteria: (1) published in English; (2) belong to articles and conference paper source type, after the two steps, 768 articles were retrieved. Finally, the author reviewed the title and abstract, two filtering criteria were established to choose papers that corresponded with the research topic. The first filter was that the papers related with any kind of technology (such as digital, virtual, tellecollaboration, online learning); the second filter is the papers related with technology assisted intercultural teaching or ICC development (the articles only mentioned technology and ICC, but did not talk about the function of technology on ICC development are not included.) In total, 553 publications related to this topic were identified for bibliometric analysis. The document types are articles (n = 407, 73.6%) and conference papers (n = 146, 26.4%). **Figure 1** shows the flow diagram of the search strategy.

3.2. Data analysis

After finalizing the articles for literature analysis, the author exported three files from the Scopus database, including one refine values to CSV file, one in RIS format file, and one in CSV format file. Subsequently, the researcher utilized these files for various analyses. This research employed various bibliometric analysis tools such as Excel, Harzing Publish or Perish, and VOSViewer. Initially, the researcher exported refined data from Scopus into Excel to examine fundamental information such as publication year, author name, document type, subject area, etc. Afterwards, the RIS file was imported into Harzing Publish or Perish to conduct a comprehensive analysis on the impact of the articles and the positioning of the articles and authors within the research field. Furthermore, the CSV file obtained from Scopus was imported into VOSViewer software, enabling the creation of bibliometric network maps that illustrate the citation by countries, the co-occurrence of author keywords and terms of title and abstract.

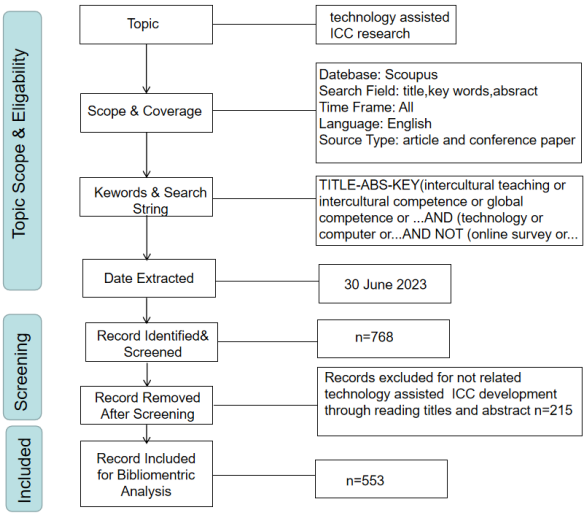


Figure 1. Flow diagram of the search strategy.

4. Results and findings

4.1. Publication trends

The analysis of publication trends for Question 1 involves examining the number of publications per year as well as categorizing publications based on subject area. **Figure 2** depicts an overall upward trend on technology assisted ICC development from 2001 to 2023 since the first study on it appeared in 2001. Initially, from 2001 to 2006, there was slow growth and a limited number of publications, indicating insufficient attention given to this domain. After 2006, the number of published papers experienced rapid growth, peaking at 72 in 2022 (with the potential for further increase in 2023). This surge in publication can be attributed to two primary factors. Firstly, the expanding perspective on globalization and diversity has broadened the literature on intercultural communication, encompassing both theoretical and practical aspects in the 21st century[52]. The growing attention has triggered an ICC research boom. Secondly, the continuous advancement of technology has introduced a wide range of tools and instruments that serve as valuable aids for intercultural teaching. Overall, the increasing number of published papers reflects the growing recognition of technology assisted ICC development.

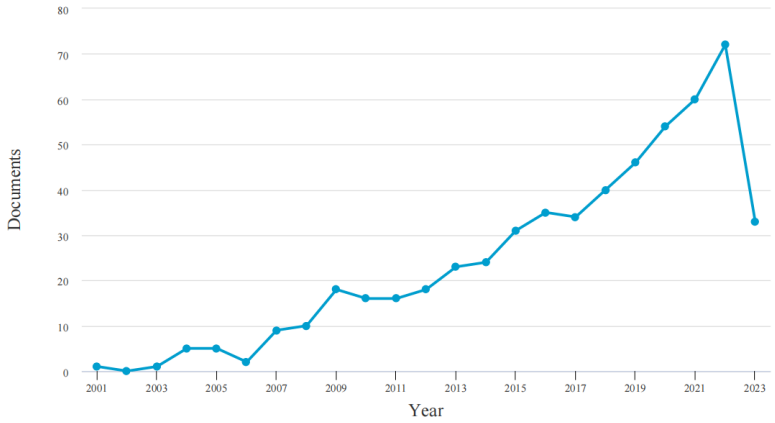


Figure 2. Publication by year.

The subject area on technology-assisted intercultural teaching spans across 24 subject areas, some of which exhibit interdisciplinary characteristics. These fields encompass a wide spectrum of academic disciplines, including Social Sciences, Psychology, Medicine, Mathematics, Economics, Business, Management and Accounting, etc. Among the subject areas, Social Sciences emerge as the most widely

explored, followed by Computer Sciences, and Arts and Humanities (as indicated in **Figure 3**). The presence of such a diverse range of fields indicates the wide-ranging applications and potential impact of technology in enhancing intercultural teaching practices. Researchers and practitioners from these fields have contributed significantly to the development and advancement of technology-assisted ICC development, fostering cross-disciplinary collaborations and knowledge exchange.

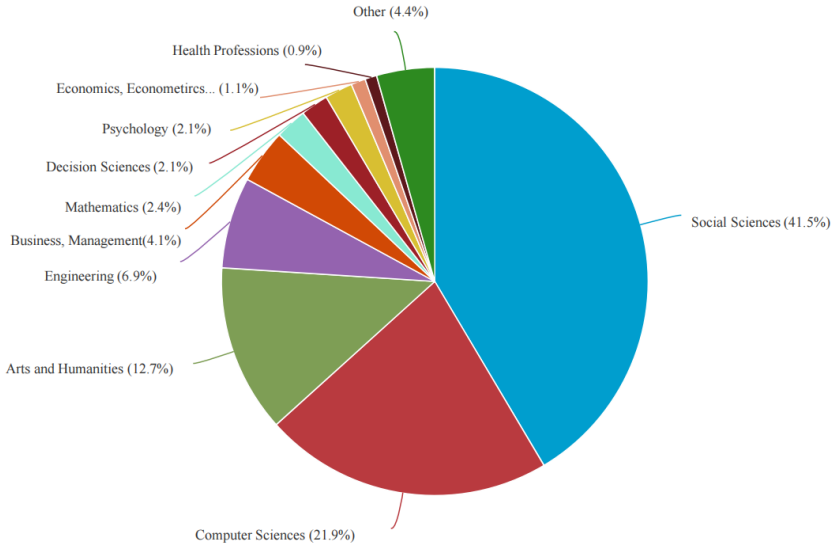


Figure 3. Publication by subject area.

4.2. Citation patterns

For Question 2, citation patterns are explored by analyzing Citations Metrics, highly cited articles, highly cited journals, and highly cited countries. The Citation Metrics was produced by Harzing's Publish and Perish software. As indicated in **Table 1**, the study of technology-assisted ICC development has produced 553 papers over a 22-year period (2001–2023), which reflects the scholarly output in this field. These papers have received a total of 5,480 citations, indicating their impact and influence as references in other researchers' work. The average number of citations per year is 249.09, it provides insights into the ongoing impact of the research. On average, each paper has received 9.91 citations, demonstrating their visibility and recognition within the field. Collaborative efforts are evident, with an average of 2.44 authors per paper, bringing diverse perspectives and expertise. The h-index of 38 and the g-index of 57 indicates that there is a substantial number of papers within the set that have received a significant number of citations. These metrics collectively indicate the impact and recognition of technology-assisted intercultural teaching within the scholarly community. The collaborative nature of research further highlights the interdisciplinary and cooperative aspects of this field.

Table 1. Citations metrics.

Metrics	Data
Papers	553
Citations	5480
Years	22 (2001–2023)
Cites_Year	249.09
Cites_Paper	9.91
Authors_Paper	2.44
h_index	38
g_index	57

Analyzing the top 10 highly cited articles (See **Table 2**) allows researchers to gain a comprehensive understanding of the field's landscape, recognize research trends, and identify potential avenues for further research. The ten articles published between 2003 and 2014 continue to hold significant influence despite the time gap from the present year (2023). These articles are all empirical studies, focusing on undergraduates as the primary subjects. The research methods mainly employed were mixed methods, including surveys, interviews, and content analysis etc.These studies utilized a range of technological tools, such as blogs, email, podcasts, e-forums, Twitter, and web-based boards, video conferencing and other Web 2.0 Technologies, mostly of them are asynchronous communication tools, allowing for communication between students residing in different time zones[53]. These technologies can be categorized into three groups according to their specific functions: content creation, content sharing, and communication. Among them, the first highly cited literature is "Linguistic perspectives on the development of intercultural competence in telecollaboration" by Belz[54], which has amassed a total of 315 citations, making it highly influential in the field. The study presents a detailed case study of ICC development in a German-American e-mail partnership, examining the impact of electronic interaction. This comprehensive case study contributed insights into the development of ICC within telecollaborative settings. The other highly cited references similarly showcase the positive impact of employing technology tools in enhancing ICC, promoting learner autonomy, creating an immersive and interactive learning environment, and so on. They provided evidence of the benefits and effectiveness of incorporating technology in intercultural teaching practices, although many of them had relatively small sample sizes and covered a limited time span. The top ten cited articles contribute valuable findings and shed light on the potential of incorporating technology in intercultural education.

Table 2. Top ten cited articles.

No.	Authors	Title	Technologies	TC	C/Y
1	Belz(2003)	Linguistic perspectives on the development of intercultural competence in telecollaboration	Email	315	15.75
2	GuillÃ©n-Nieto,Aleson-Carbonell (2012)	Serious games and learning effectiveness: The case of It's a Deal!	Visionaire Studio 3.0	211	19.18
3	Lee(2011)	Blogging: Promoting learner autonomy and intercultural competence through study abroad	Blog	138	11.5
4	Elola, Oskoz(2008)	Blogging: Fostering intercultural competence development in foreign language and study abroad contexts	Blog	116	7.73
5	Liaw(2006)	E-learning and the development of intercultural competence	Online forum, Electronic dictionary, Online conversation tools	111	6.53
6	Lee, Markey(2014)	A study of learners' perceptions of online intercultural exchange through Web 2.0 technologies	Twitter, Blog, Podcasts	89	9.89
7	O'Dowd(2007)	Evaluating the outcomes of online intercultural exchange	Email, Web-based message boards, Video conferencing	86	5.38
8	Schenker(2012)	Intercultural competence and cultural learning through telecollaboration	Email exchange	85	7.73
9	Chun(2011)	Developing intercultural communicative competence through online exchanges	online forum discussions	79	6.58
10	Yang et al.(2014)	Strategies for smooth and effective cross-cultural online collaborative learning	Blackboard platform	72	8

TC total citations, C/Y total citations per year.

Table 3 presents a list of the top ten highly-cited journals on technology assisted ICC development, they are journals that focus primarily on language learning, technology-assisted language learning, intercultural communication, and education. Out of these journals, "Language Learning and Technology" is the most highly cited and widely recognized in the field of computer-assisted language learning (CALL) and technology-enhanced language learning (TELL). It has garnered a substantial number of citations (860) compared to the other journals in the list. Moreover, the journal's Total Link Strength of 78 signifies a strong interconnectedness among its articles through citations, indicating a robust research network and knowledge exchange. In addition, "Computer-assisted Language Learning" and "ReCALL" also boast significant citation counts, with 402 and 324 citations, respectively. The top ten highly cited journals highlight the strong connection between technology-assisted intercultural teaching, language teaching, and education technology. It is evident that these journals have made noteworthy contributions to the field.

Table 3. Top ten cited journals.

No.	Source	Documents	Citations	Total link strength
1	Language learning and Technology	11	860	78
2	Computer assisted Language Learning	18	402	65
3	ReCALL	9	324	40
4	Foreign Language Annals	9	277	24
5	Calico Journal	6	244	36
6	Language and Intercultural communication	8	115	12
7	Intercultural education	10	87	5
8	Lecture Notes in Computer Science	17	70	1
9	Education and information Technologies	5	53	15
10	Innovations in education and teaching international	5	49	3

Table 4 shows that the United States stands out prominently with the highest number of documents (178) and citations (2427), indicating its strong presence and contribution to the field. The total link strength, which represents the overall influence and connectivity of the country's research, is also quite substantial at 349. Spain follows the United States with 47 documents and 749 citations, demonstrating its significant involvement and impact. Although its total link strength is lower at 161, it still showcases a considerable level of collaboration and influence. Australia, with 32 documents and 447 citations, exhibits a moderate level of research activity in this field. It is noteworthy that China ranks second in terms of the number of documents but lags behind in citations. Several factors could contribute to this observation, such as the relatively later development of computer-assisted intercultural teaching research in China, the need for strengthening research networks and collaborations, or variations in study contexts, etc.

The analysis of country/region citations is further analyzed through a network visual map (see **Figure 4**) the map illustrates that extensive research has been conducted in this field in various countries and regions within this field. Notably, there is a prevailing trend of transnational cooperation, which offers significant benefits such as resource sharing and the promotion of understanding and collaboration among countries and regions. The visual map is divided into different time periods, each represented by distinct colors. The color distribution and corresponding countries can be divided into three periods. The early period (Before 2016) is represented by purple to blue, encompassing countries and regions such as Australia, Germany, the United Kingdom, the United States, and Taiwan. The middle period (2016–2018), transitions to shades of green,

including countries like Canada, Hong Kong, Spain, and others. The recent period (after 2018) ranges from light green to yellow, cover countries/regions such as Turkey, China, Malaysia, Indonesia, Brazil, Belgium, and others.

Table 4. Top ten cited countries/regions.

No.	Country/region	Documents	Citations	Total link strength
1	United States	178	2427	349
2	Spain	47	749	161
3	Australia	32	447	39
4	United Kingdom	37	415	94
5	Taiwan	21	411	135
6	Germany	38	357	53
7	China	51	324	111
8	Turkey	14	243	91
9	Canada	22	212	26
10	Italy	17	148	24

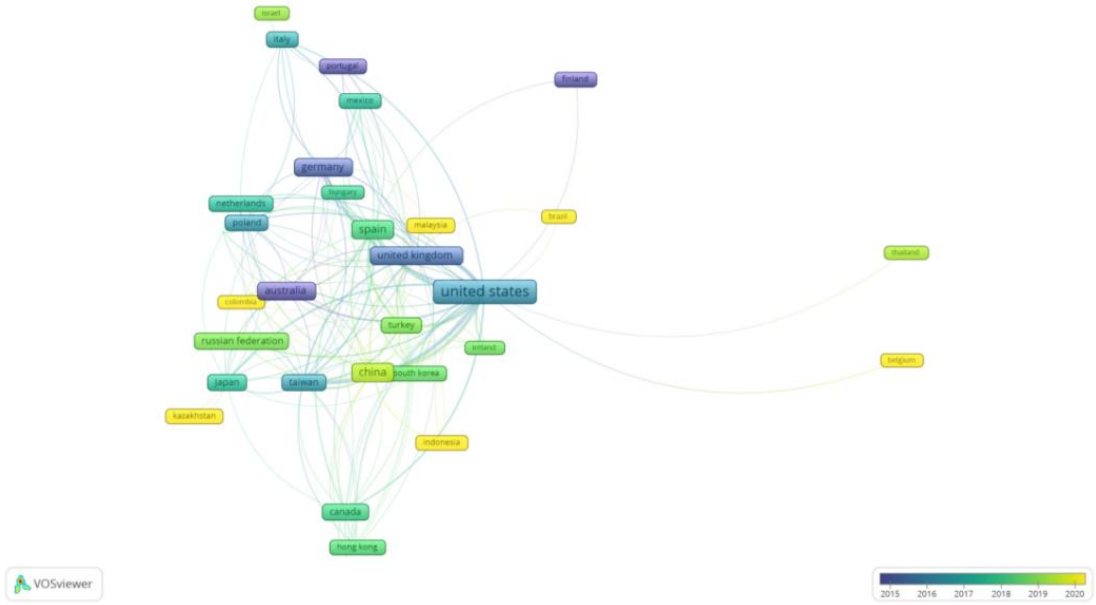


Figure 4. Network visual map of the citation by countries/ regions.
(Minimum number of documents of a country = 5; Maximum number of countries per document= 25).

Overall, the trend of computer-assisted ICC development shows that western countries, such as the United States, the United Kingdom, and Germany, had an earlier and relatively more developed start. This is likely due to their extensive experience in educational technology development and application, providing them with an advantage in this field. On the other hand, Asian countries/regions. started the development of computer-assisted intercultural teaching relatively later but have been progressively catching up and making advancements. Countries/regions like China, Japan, and Malaysia have made continuous investments and developments in education and technology.

4.3. Research hotspots

As "keywords represent a generalization of the topic in articles, the analysis of the keywords from a certain research field benefits the discovery of the research hotspots" (Peng and Zhu, p.65)[2]. The analysis in **Table 5** reveals the most prominent author keywords during the past two decades. It is observed that "intercultural competence" is the top keyword in terms of both occurrence and total link strength. Scholars use different terms to refer to this concept, "intercultural competence" ranks the highest, followed by "intercultural communicative competence", "global competence", "cross-cultural competence" and "intercultural communication competence". This highlights the multidimensionality and evolution of terminology in the context of technology-assisted intercultural teaching.

Telecollaboration, commonly known as online intercultural exchange or virtual exchange, ranks as the second most frequently used keyword. It refers to the use of technology to facilitate communication and collaboration between individuals or groups from different cultural backgrounds in geographically distant locations[54]. To apply telecollaboration for ICC development, educators and practitioners can design and implement virtual exchange programs that enable students or participants to interact with peers from diverse cultures. These exchanges can take various forms, such as video conferencing, online forums, joint projects, or language partnerships. Through telecollaboration, individuals can engage in authentic intercultural interactions, gain exposure to different perspectives, and develop essential intercultural communication skills, etc. [13-14,54]Telecollaboration has become increasingly popular recently due to several reasons: the impact of globalization, the advancement of digital technologies, the influence of the COVID-19 pandemic, and the growing research that highlights its effectiveness in fostering intercultural understanding and communication skills in an increasingly interconnected world.

Additionally, several other keywords are prominent in the table including "Higher education", "Virtual exchange", "Collaborative learning", "E-learning", "Blended learning", "Social media", "Global virtual teams", and "Computer-mediated communication". These keywords suggest that ICC development has been influenced and expanded by various technological advancements and educational approaches. They highlight the importance of incorporating digital tools, virtual interactions, and collaborative approaches in facilitating intercultural teaching and learning, especially in higher education context.

Table 5. Co-occurrence author keywords.

No.	Keyword	Occurrences	Total link strength
1	Intercultural competence	124	144
2	telecollaboration	55	101
3	Intercultural learning	40	52
4	Intercultural communication	36	48
5	Intercultural communicative competence	36	42
6	Global competence	25	30
7	Higher education	23	35
8	Virtual exchange	22	36
9	Intercultural education	17	15
10	Collaborative learning	16	29
11	E-learning	15	27
12	Virtual reality	14	18
13	Study abroad	13	26
14	communication	12	25

15	cultural	12	19
16	internationalization	12	19
17	Blended learning	11	17
18	assessment	10	22
19	Cultural awareness	10	15
20	Social media	10	14
21	Intercultural communication competence	10	12
22	Cross cultural competence	10	8
23	intercultural	9	19
24	Information and communication technology	9	15
25	Computer-mediated communication	9	13
26	Cultural competence	9	10
27	interculturality	9	10
28	Global virtual teams	8	19
29	technology	8	17
30	education	8	12

Keywords are further analyzed by the co-occurrence analysis of author keywords using VOSviewer (see **Figure 5**), which enables a deeper understanding of keywords development and the identification of hot topics within the research field. The co-occurrence patterns are visualized by four distinct colors, and related keywords, indicating by the same colour, are commonly listed together, with each representing different time periods. The purple to blue color means the key words of early period in the year or before 2015, they are cross-culture competence, experience learning, e-learning, web 2.0 and cooperative learning; the middle period are in the year 2016 to 2017 green color, key words are intercultural competence, intercultural exchange, English as a foreign language, blended learning, telecollaboration, videoconferencing, social media, and global citizenship; the more recent period are in the year of 2018 or after, key words in yellow are global competence, virtual exchange, virtual teams, multicultural education, and teacher training.

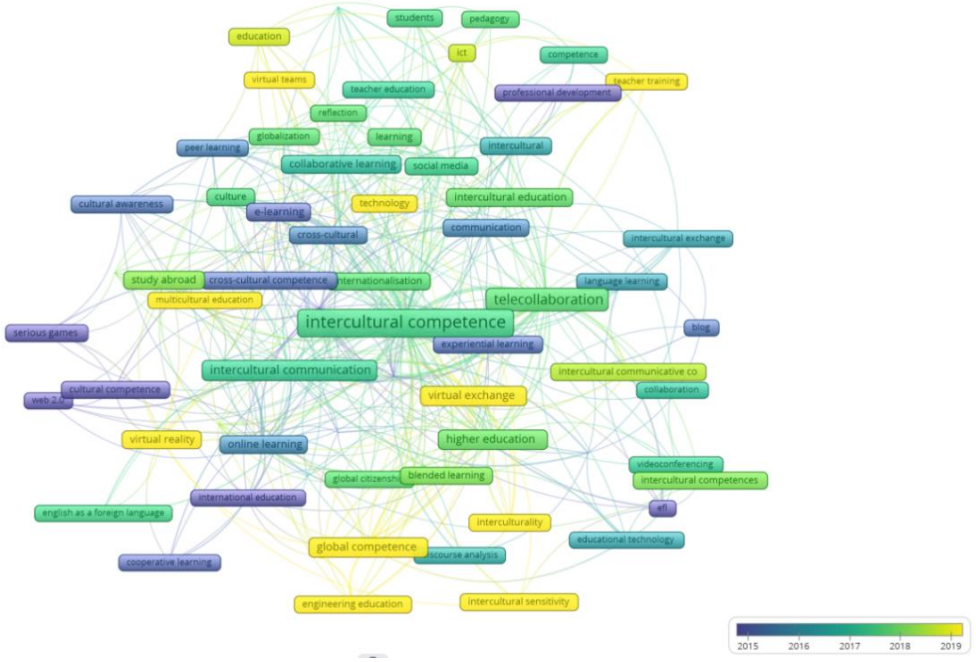


Figure 5. Overlay visualisation of the co-occurrence of author keyword. (Minimum number of occurrence of a keyword 5).

In summary, the visualization map reveals a shift in the keywords used to describe technology assisted intercultural teaching over time. The change suggests the emergence of new concepts and approaches in this field at different periods. From web 2.0 tools to telecollaboration and advanced technologies like virtual reality and virtual teams indicated a wider range of technological integration, and highlights the ongoing importance of technology in facilitating intercultural communication, collaboration, and learning. On the other hand, the focus on developing ICC has shifted from an initial emphasis on intercultural aspects to experience learning to foster global citizenship, and more recently, to promoting multicultural education. These trends signify a deeper understanding and a broader commitment to comprehensive intercultural education. In addition, the shift in focus towards "teaching training" signifies an enhanced understanding of the significance of equipping educators with the competence to seamlessly incorporate technology tools and strategies into their instructional methods. With technology playing a crucial role in facilitating intercultural communication and learning, it is essential for teachers to possess the essential skills and knowledge to flexibly apply these tools effectively in the implementation of intercultural teaching practices. Moreover, it is important to note that while technology can be a powerful facilitator, the effectiveness of its impact on ICC acquisition also depends on how it is implemented and utilized in specific educational or organizational context[12,43,45,54].

The term co-occurrence network visualization based on title and abstract fields (as depicted in **Figure 6**) reveals the grouping of subject areas. Each frame represents a term or concept, and the distance between them indicates the relationship between each term[55]. There are four colors representing four themes.



Figure 6. VOSviewer visualisation of a term co-occurrence network based on title and abstract fields. (Minimum number of occurrence of a keyword 10).

Theme one, "Technology and Interculturality" represented by the color blue, focuses on utilizing technology to facilitate communication and collaboration in intercultural teaching from a broader perspective. It emphasizes the importance of leveraging tools and platforms such as "communication technology", "e-learning", "online environments", "blog" in the context of "globalization", "society" to promote "intercultural interaction", "intercultural understanding" and "intercultural education".

Theme two, "Application in teaching" depicted in red, explores the practical implementation of technology in intercultural teaching at a more detailed level. It encompasses keywords such as pedagogy, pandemic, challenges, demand, collaborative learning, interventions, programs, teams, global competence, and higher education, underscoring the significance of employing appropriate teaching strategies to meet learners' needs.

Theme three "evaluation methods and effects" represented by the color green, underscores the need for employing suitable research methods to evaluate the effectiveness of technology-assisted approaches. Keywords such as interviews, questionnaires, content analysis, control groups, qualitative data, motivation, cultural awareness and significant differences are key terms in this theme.

Theme four, represented by the color yellow, centers around the intersection of "technology, language and communication". Key terms in this theme include "foreign language", "language learning", "target language", "ICC", "computer-mediated communication", "telecollaboration", "virtual exchange", "video", and "web", demonstrating that ICC development is closely related to the study of foreign language teaching. This theme explores the integration of technology into language learning contexts, emphasizing the use of digital tools and platforms to enhance language acquisition, communication skills, and ICC.

Overall, the four themes provide a quick understanding of the focus and content of this field, and offers an overview to comprehend the research directions of technology-assisted intercultural teaching.

5. Conclusion and recommendation

Technology assisted ICC development is one key trend to cultivate ICC in the 21st century, with the rapid development of information technology and increased globalization, it is estimated that technology assisted ICC development research will continue to increase in the coming year. As a result, it is of utmost importance to consolidate the existing studies and pinpoint the pivotal research domains, enabling the identification of future research directions. This study conducts a thorough bibliometric analysis of the literature on technology assisted ICC development from 2001 to 2023, examining temporal distribution, subject areas, highly cited journals, highly cited references, highly cited countries, and research areas, providing an objective and accurate reflection of the research trends in this field. The findings are as follows:

1) Using the Scopus database, a total of 553 publications written by 160 researchers from 67 countries, covering the period from 2001 to 2023 from 24 subject areas are retreeved for bibliomentric analysis. The majority of these publications were articles (73.6%) and conference papers (26.4%).

2) Research on technology assisted ICC development shows a positive development trend and potential, with an increasing number of publications each year. The field encompasses a wide range of subject areas, Social Sciences are the most extensively explored subject area, followed by Computer Sciences and Arts and Humanities.

3) The top ten highly cited articles are all empirical studies, utilized a range of technological tools, such as blogs, email, podcasts, e-forums, Twitter, and web-based boards, video conferencing, etc. These studies proved the positive role of technology in enhancing intercultural interaction and ICC development. The analysis helps readers to gain a comprehensive understanding of the field's landscape, recognize research trends, and identify potential avenues for further research.

4) Extensive research has been conducted globally, with the USA, Spain, Australia, UK, and Taiwan being the top five highly cited countries or regions. Notably, there is a prevailing trend of transnational cooperation, which offers significant benefits such as resource sharing and the promotion of understanding and collaboration among countries and regions.

5) The analysis of the keywords map reveals changes in the usage of keywords throughout time. Additionally, the term map identifies four primary clusters of research areas: "Technology and Interculturality," "Application in Teaching," "Evaluation Methods and Effects," and "Technology, Language, and Communication."

Based on the research findings, future research directions can explore in the following aspects: first, focus on integrating more innovative technologies and tools into the cultivation of ICC. For example, combining artificial intelligence, virtual reality, or augmented reality technologies to provide a more immersive and practical intercultural learning experience. Second, future research can emphasize interdisciplinary collaboration. This will facilitate in-depth exploration of different disciplines' contributions to the development of ICC and promote more comprehensive and holistic research outcomes. Third, emphasis can be placed on researching the significance and impact of ICC in international collaboration. Exploring how technology-assisted methods can facilitate effective intercultural communication and understanding during cooperation between different countries and cultures. Finally, future research can investigate how to effectively provide teacher training for technology-assisted ICC development. This includes designing and implementing professional development courses for teachers on how to utilize technology to enhance students' ICC.

Addressing these aspects in future research is expected to further advance the development of ICC and provide valuable guidance for its practical applications. However, this study has limitations. Firstly, the chosen keywords includes two aspects ICC and technology, even though this article retrieve data from title, keywords, abstract to maximize the documents, but terms used in searching this domain may not as inclusive as expected, there may be some valuable documents excluded. Second, the focus on english-based articles from the Scopus databases may neglect publications in other languages and other database. To ensure a more comprehensive analysis, future studies should consider including publications in multiple languages and exploring diverse academic databases.

Conflict of interest

The authors declare no conflict of interest.

References

1. Byram M. Routledge Encyclopedia of Language Teaching. 2000.
2. Peng RZ, Zhu C, Wu WP. Visualizing the knowledge domain of intercultural competence research: A bibliometric analysis. International Journal of Intercultural Relations. 2020, 74: 58-68. doi: 10.1016/j.ijintrel.2019.10.008
3. Landis D, Bennett J, Bennett M. Handbook of Intercultural Training. SAGE Publications, Inc., 2004. doi: 10.4135/9781452231129
4. Huang LJD. Developing intercultural communicative competence in foreign language classrooms – A study of EFL learners in Taiwan. International Journal of Intercultural Relations. 2021, 83: 55-66. doi: 10.1016/j.ijintrel.2021.04.015
5. Morris MW, Savani K, Roberts RD. Intercultural Training and Assessment. Policy Insights from the Behavioral and Brain Sciences. 2014, 1(1): 63-71. doi: 10.1177/2372732214550404
6. Terzuolo ER. Intercultural development in study abroad: Influence of student and program characteristics. International Journal of Intercultural Relations. 2018, 65: 86-95. doi: 10.1016/j.ijintrel.2018.05.001
7. Hanada S. A Quantitative Assessment of Japanese Students' Intercultural Competence Developed Through Study Abroad Programs. Journal of International Students. 2019, 9(4): 1015-1037. doi: 10.32674/jis.v9i4.391
8. Huang L. Co-curricular activity-based intercultural competence development: students' outcome of internationalisation at universities. Innovations in Education and Teaching International. 2016, 54(3): 184-193. doi: 10.1080/14703297.2016.1184098
9. Feng JB. Improving intercultural competence in the classroom: A reflective development model. Journal of Teaching in International Business. 2016 Jan 2;27(1):4-22.

10. Hackett S, Janssen J, Beach P, et al. The effectiveness of Collaborative Online International Learning (COIL) on intercultural competence development in higher education. International Journal of Educational Technology in Higher Education. 2023, 20(1). doi: 10.1186/s41239-022-00373-3
11. Jung Y, Kim Y, Lee H, et al. Learner perception of multimodal synchronous computer‐mediated communication in foreign language classrooms. Language Teaching Research. 2017, 23(3): 287-309. doi: 10.1177/1362168817731910
12. Lee J, Park S. Analysis of critical success factors of online international learning exchange of Korean school pupils with English‐speaking counterparts. British Journal of Educational Technology. 2016, 48(6): 1228-1238. doi: 10.1111/bjet.12516
13. Yang P, Samat NA. Using Telecollaboration to Develop English Learners' Intercultural Competence in the Chinese Context. Theory and Practice in Language Studies. 2023, 13(6): 1564-1572. doi: 10.17507/tpls.1306.26
14. Üzüm B, Akayoglu S, Yazan B. Using telecollaboration to promote intercultural competence in teacher training classrooms in Turkey and the USA. ReCALL. 2020, 32(2): 162-177. doi: 10.1017/s0958344019000235
15. Yi S, Shadiev R, Zhang Y. A systematic review on intercultural learning supported by technology: identifying strength of evidence and relationship among research variables. Interactive Learning Environments. Published online January 24, 2023: 1-27. doi: 10.1080/10494820.2022.2164784
16. Shen L. An Investigation of Learners' Perception of an Online Intercultural Communicative Competence (ICC) Training Model. International Journal of Emerging Technologies in Learning (iJET). 2021, 16(13): 186. doi: 10.3991/ijet.v16i13.24389
17. Tecedor M, Vasseur R. Videoconferencing and the development of intercultural competence: Insights from students' self‐reflections. Foreign Language Annals. 2020, 53(4): 761-784. doi: 10.1111/flan.12495
18. Hirotani M, Fujii K. Learning proverbs through telecollaboration with Japanese native speakers: facilitating L2 learners' intercultural communicative competence. Asian-Pacific Journal of Second and Foreign Language Education. 2019, 4(1). doi: 10.1186/s40862-019-0067-5
19. Ryshina-Pankova M. Discourse moves and intercultural communicative competence in telecollaborative chats. Lang. Learn. Technol. 2018, 22(1), 218–239.
20. Deardorff DK. Identification and Assessment of Intercultural Competence as a Student Outcome of Internationalization. Journal of Studies in International Education. 2006, 10(3): 241-266. doi: 10.1177/1028315306287002
21. Fantini AE. A central concern: Developing intercultural competence. SIT Occas. Pap. Ser. 2000, 1(1), 25–42.
22. Arasaratnam LA. Further Testing of a New Model of Intercultural Communication Competence. Communication Research Reports. 2006, 23(2): 93-99. doi: 10.1080/08824090600668923
23. Byram M. Teaching and assessing intercultural communicative competence (Multilingual Matters). Multilingual Matters, 1997.
24. Mu Y, Yu B. Developing intercultural competence in college business English students: A study of innovative teaching in China. International Journal of Intercultural Relations. 2023, 92: 101747. doi: 10.1016/j.ijintrel.2022.101747
25. Gu X, Zhao Y. Integration of Teaching and Assessing Intercultural Communicative Competence. Chinese Journal of Applied Linguistics. 2021, 44(2): 241-258. doi: 10.1515/cjal-2021-0014
26. Arshavskaya E. Promoting intercultural competence in diverse US classrooms through ethnographic interviews. Teaching Education. 2017, 29(2): 194-210. doi: 10.1080/10476210.2017.1373277
27. Rezaei S, Naghibian M. Developing intercultural communicative competence through short stories: A qualitative inquiry. Iran. J. Lang. Teach. Res. 2018, 6(2), 77–96.
28. Tran TQ, Duong TM. The effectiveness of the intercultural language communicative teaching model for EFL learners. Asian-Pacific Journal of Second and Foreign Language Education. 2018, 3(1). doi: 10.1186/s40862-018-0048-0
29. Ko B, Boswell B, Yoon S. Developing intercultural competence through global link experiences in physical education. Physical Education and Sport Pedagogy. 2015 Jul 4;20(4):366-80.
30. Abeysekera L, Dawson P. Motivation and cognitive load in the flipped classroom: definition, rationale and a call for research. Higher education research & development. 2015 Jan 2;34(1):1-4.
31. Al-Abdali AI. The Benefits of Using Written and Oral Blogs to Improve 4th Grade EFL Students' Fluency and Accuracy, Cultural Competence, and with Motivation in Iraqi Schools. Benefits.;7(15):2020.
32. Hua J, Kondo A, Moross J. Enhancing intercultural sensitivity in Japanese nursing students through international online nursing courses: A quasi-experimental study. Nurse Education Today. 2023, 128: 105870. doi: 10.1016/j.nedt.2023.105870
33. Khabir M, Jabbari AA, Razmi MH. Flipped Presentation of Authentic Audio-Visual Materials: Impacts on Intercultural Sensitivity and Intercultural Effectiveness in an EFL Context. Frontiers in Psychology. 2022, 13. doi: 10.3389/fpsyg.2022.832862

34. Çiftçi EY, Savaş P. The role of telecollaboration in language and intercultural learning: A synthesis of studies published between 2010 and 2015. ReCALL. 2017, 30(3): 278-298. doi: 10.1017/s0958344017000313
35. Lee TY, Ho YC, Chen CH. Integrating intercultural communicative competence into an online EFL classroom: an empirical study of a secondary school in Thailand. Asian-Pacific Journal of Second and Foreign Language Education. 2023, 8(1). doi: 10.1186/s40862-022-00174-1
36. Lenkaitis CA, Calo S, Venegas Escobar S. Exploring the intersection of language and culture via telecollaboration: Utilizing videoconferencing for intercultural competence development. International Multilingual Research Journal. 2019, 13(2): 102-115. doi: 10.1080/19313152.2019.1570772
37. Liu Shuzi. The effectiveness of the modern computer information-technology-assisted of college Chinese teaching. 2014 IEEE Workshop on Advanced Research and Technology in Industry Applications (WARTIA). Published online September 2014. doi: 10.1109/wartia.2014.6976335
38. Wang J, Zhang S. Cross-Cultural Learning: A Visualized Bibliometric Analysis Based on Bibliometrix from 2002 to 2021. Mobile Information Systems. 2022 May 9;2022.
39. Yari N, Lankut E, Alon I, Richter NF. Cultural intelligence, global mindset, and cross-cultural competencies: A systematic review using bibliometric methods. European Journal of International Management. 2020;14(2):210-50.
40. Ruiyang R, Hassan H. Trend in the Study of Intercultural Competence: Bibliometric Analysis by Citespace. resmilitaris. 2022 Nov 1;12(2):2235-53.
41. Gao H, Chen L, Song B. A Bibliometric Literature Review of Intercultural Competence From 2002 to 2022. 3(2), 23–34.
42. Shadiev R, Sintawati W. A review of research on intercultural learning supported by technology. Educational Research Review. 2020, 31: 100338. doi: 10.1016/j.edurev.2020.100338
43. Shadiev R, Yu J. Review of research on computer-assisted language learning with a focus on intercultural education. Computer Assisted Language Learning. Published online May 28, 2022: 1-31. doi: 10.1080/09588221.2022.2056616
44. Zhang X, Zhou M. Information and digital technology-assisted interventions to improve intercultural competence: A meta-analytical review. Computers & Education. 2023 Mar 1;194:104697.
45. Shadiev R, Dang C. A systematic review study on integrating technology-assisted intercultural learning in various learning context. Education and Information Technologies. 2022, 27(5): 6753-6785. doi: 10.1007/s10639-021-10877-6
46. Chen H, Ho YS. Highly cited articles in biomass research: A bibliometric analysis. Renewable and Sustainable Energy Reviews. 2015, 49: 12-20. doi: 10.1016/j.rser.2015.04.060
47. Dong B, Xu G, Luo X, et al. A bibliometric analysis of solar power research from 1991 to 2010. Scientometrics. 2012, 93(3): 1101-1117. doi: 10.1007/s11192-012-0730-9
48. Zhang Y. College English Intercultural Teaching Strategies Based on Network Construction under the Concept of Teaching to the Future. Lakshmanna K, ed. Wireless Communications and Mobile Computing. 2022, 2022: 1-8. doi: 10.1155/2022/7830491
49. Kushairi N, Ahmi A. Flipped classroom in the second decade of the Millenia: a Bibliometrics analysis with Lotka's law. Education and Information Technologies. 2021, 26(4): 4401-4431. doi: 10.1007/s10639-021-10457-8
50. Tian Y, Suki NM. Evaluating Future Trends of Digital Storytelling in Higher Education: A Bibliometric Analysis. International Journal of Interactive Mobile Technologies. 2023 Sep 1;17(17).
51. Geng Y, Chen W, Liu Z, et al. A bibliometric review: Energy consumption and greenhouse gas emissions in the residential sector. Journal of Cleaner Production. 2017, 159: 301-316. doi: 10.1016/j.jclepro.2017.05.091
52. Kim YY, Bhawuk DPS. Globalization and diversity: Contributions from intercultural research. International Journal of Intercultural Relations. 2008, 32(4): 301-304. doi: 10.1016/j.ijintrel.2008.06.001
53. Sevilla‐Pavón A. L1 versus L2 online intercultural exchanges for the development of 21st century competences: The students' perspective. British Journal of Educational Technology. 2018, 50(2): 779-805. doi: 10.1111/bjet.12602
54. Belz JA. Linguistic perspectives on the development of intercultural competence in telecollaboration. Lang. Learn. Technol. 2003, 7(2), 68–99.
55. Sedighi M. Application of word co-occurrence analysis method in mapping of the scientific fields (case study: the field of Informetrics). Library Review. 2016, 65(1/2): 52-64. doi: 10.1108/lr-07-2015-0075