Cross-Cultural Learning: A Visualized Bibliometric Analysis Based on Bibliometrix from 2002 to 2021

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With the significant increase of studies on cross-cultural learning (CCL) in the recent two decades, it is essential to conduct a systematic review of various literature and their development processes. This article is aimed at revealing research hotspots and emerging trends in CCL studies. This study adapted a visualized bibliometric approach to analyze research articles in the Cross-Cultural Learning-Internet of Things area. We extracted papers published in respected journals as the dataset. Based on bibliometrix, this study collects 1,899 records indexed in the Core Collection of Web of Science (WoS) in the domain of CCL from 2002 to 2021. The findings indicate that the number of published articles shows an apparently upward trend; the United States occupies the leading position, while the most productive journal is Computers & Education; King from Nanyang Technological University of Singapore is the most prolific author, and Nielsen ranks the first in terms of citation; cross-cultural, culture, learning, cross-cultural comparison, and cross-cultural research are found to be the most high-frequency keywords used by authors; cross-cultural projects, students and teachers, cross-cultural research, and educational technologies are the most discussed topics in this field; several notable topics related to CCL and Internet of Things. Visualization study is beneficial to track the hotspots and frontiers of CCL studies in order to effectively grasp the breakthrough points for future research. The results provide helpful information for newcomers, researchers, scholars, and practitioners to identify knowledge gaps, point out future research directions, and move this field forward.

1. Introduction

Cultural differences and diversity lie in different countries/regions, and cross-cultural communication is commonly shared by people from different cultures. With the progressive acceleration of globalization in human society, both a mass of cultural conflicts and cultural integration occur in cross-cultural communication. Consequently, the significance of CCL in cultivating cross-cultural competence is highlighted. That is why CCL studies have appealed to a helluva lot of researchers and practitioners over the years. For example, Li examined the Chinese model of learning from an emic perspective [1]. Shadiel et al. proposed speech-enabled language translation (SELT) technology that consists of speech-to-text recognition (STR) and computer aided translation (CAT) systems to support intercultural communication [2]. It is thus critical to systematically review previous studies related to CCL. A literature review is considered as an objective and systematic process to achieve the purpose of the research by analyzing articles published in high-impact journals [3]. Nonetheless, the existing works of this type are extremely scarce. Shadiel et al. [4] focused on technology-supported CCL through making an integrative review of the literature. Allen [5] performed a systematic summary of the available literature to guide cross-cultural teaching and learning regarding global health care for nursing students. Kempf and Holtbrügge [6] developed an encompassing conceptual model of cross-cultural training (CCT) effectiveness which elaborated the relationship between cross-cultural competence and CCL based on conducting a review of cross-cultural education.
To the best of our knowledge, the reviews described above were either on the basis of subjective judgment or qualitative research. Each of these retrospective reviews only provided an in-depth perspective, but they did not offer an overall picture of cross-cultural literature. As a matter of fact, they not only had deficiencies in visibility but also lacked necessary bibliometric analysis. Bibliometrics is defined as the use of statistical methodologies for quantitative analysis of publications using their metadata or attributes including the title, countries/regions, authors, journals, articles, keywords, and references [7]. Bibliometric analysis can reasonably and precisely evaluate the contribution of research productivity and publications that are given to the progress of knowledge in a subject, providing an objective, empirical, and unbiased insight into the study [8]. Technically, bibliometric analysis dramatically enhances the quality of the literature review based on introducing a systematic, transparent, and reproducible review process [9].

Bibliometrics is widely used in cross-cultural research. We usually need scientific mapping to study a large and controversial research stream. Compared to previous research, the present study used bibliometrix, the latest information visualization software, to undertake a holistic bibliometric analysis of the past literature in the aspect of countries/regions, journals, authors, articles, author keywords, and research hotspots. Science mapping analysis is complex because it entails several steps that employ numerous and diverse analyses and mapping software tools. Bibliometrix is programmed in R, the proposed tool is flexible and can be rapidly upgraded and integrated with other statistical R-packages. It is therefore useful in a constantly changing science such as bibliometrics [10]. The results will unveil academic hotspots and frontiers of CCL studies. In addition, the visualization study by means of formulating graphs is beneficial to scholars who have an interest in this field. This is helpful to track the development of CCL and effectively grasp the breakthrough points for future research as well.

In this study, we consider the following questions to be solved:

(RQ1) What is the distribution of annual publication output? What is the interrelation between countries, journals and keywords?
(RQ2) Which countries/regions, journals, authors, and articles contributed most?
(RQ3) What are the most frequent author keywords? What are the main topics?

2. Methodology

In this study, WoS, a comprehensive online literature database in the United States, was taken as the data source. For bibliometric analysis, this study used “Biblioshiny” the web-based interface of R-package (Bibliometrix 4.1.2), a new bibliometric literature analysis tool written in R language that was initiated by Dr. Aria from the University of Naples Federico II, Italy [10]. We employed “cross-cultural learning” as the topic browsing term. The publication period was limited to “2002–2021” so as to collect related literature in the past 20 years. The language was “English” only, and the document type was restricted to “articles,” excluding articles in proceedings, dissertations, book reviews, editorial material, etc. After eliminating crude materials that do not meet the needs of the current study, a total of 1,899 articles were accessed via bibliometric analysis. The database was last updated on 31st December 2021. The results were exported in Bibtex format.

Bibliometrix 4.1.2 allows obtaining multiple results in the shape of graphs and tables, which is not common in other software. With its help, a complete set of bibliometric analyses and information visualization can be carried out on the input data.

3. Results

3.1. Main Information and Three-Fields Plot. Some specific descriptive characteristics of CCL studies are listed in Table 1. 1,899 documents from 908 sources exploited 78,008 references over the past two decades. The average citations per document were equal to 18.16, implying that a large volume of articles owned few citations [11]. In the meantime, a total of 5,691 authors used 5,108 author keywords as well as 3,233 keywords plus (ID) in these studies. The document per author ratio was only 0.334. We can discover that on average, almost three authors have finished one article [9]. The number of single-authored articles reached 418, accounting for 22.01% of all documents, which suggested that the collaboration of the authors was not enough to some extent [12].

Table 1: Main information about the collection.

| Timespan          | 2002–2021 |
|-------------------|-----------|
| Sources (journals, books, etc.) | 908       |
| Documents         | 1,899     |
| Average years from publication | 8.04     |
| Average citations per document | 18.16   |
| Average citations per year per document | 1.851   |
| References       | 78,008    |
| Document contents |           |
| Keywords plus (ID) | 3,233    |
| Author’s keywords (DE) | 5,108   |
| Authors           |           |
| Authors           | 5,691     |
| Author appearances | 6,357    |
| Authors of single-authored documents | 397     |
| Authors of multiauthored documents | 5,294   |
| Author collaboration |           |
| Single-authored documents | 418     |
| Documents per author | 0.334   |
| Authors per document | 3        |
| Coauthors per document | 3.35    |
| Collaboration index | 3.57     |

Figure 1 shows an innovative three-fields plot on the basis of a Sankey diagram, showing how productive countries (left), the most relevant sources (middle), and frequent author keywords (right) were correlated [13]. It should be apparent that the overwhelming majority of articles on cross-cultural projects published in Computers & Education are mainly conducted by scholars from the USA, the UK, and
China. Likewise, American scholars were highly productive in studies on cross-cultural, most of which were published in Journal of Cross-Cultural Psychology and Frontier in Psychology. On an aggregate level, Germany issued considerable articles in Journal of Cross-Cultural Psychology; Computers & Education excelled in the topic of learning; and International Journal of Intercultural Relations performed well in cross-cultural.

3.2 Temporal Distribution of Publications. An annual number of publications pertaining to CCL is presented in Figure 2; the overall trend is increasing year by year, with an annual growth rate of 7.07% between the timespan from 2002 to 2021. Most notably, the global production of ICC articles experienced a 4.33 time upsurge from 2002 (n = 39) to 2021 (n = 169). From 2002 to 2007, there was a moderate increase in the publication output, with the number of articles released each year being less than 50 as a whole. Although there were ups and downs in the output, the overall trend continued to rise from 2008 to 2014. The number of CCL articles has shown up significant growth with more than 110 articles issued per year from 2015 onwards and reached the peak of 169 in 2021, accounting for 8.9% of the total amount.

3.3 Countries/Regions. The node type was set as “country” and the standard of node data extraction was confined to “top10.” The results show that a total of 103 countries/regions contributed to studies on CCL from the decades 2002 to 2021. We can evidently find from Table 2 that only the USA, China, the United Kingdom, Australia, and Canada published more than 100 articles among the top 10 prolific countries. In contrast, no less than 49 countries/regions...
had only 1–5 articles, implying that there was still much room for CCL studies in these countries/regions [14]. The USA produced most articles \((n=605)\), followed by China \((n=207)\), and the United Kingdom \((n=166)\), which were far ahead of other countries.

### 3.4. Journals

The retrieved articles were published in a wide range of 908 journals as well as involving 151 subject categories in accordance with the classification code of WoS. Table 3 presents the data regarding the top 10 corresponding productive journals. As far as subject categories are concerned, education and educational research \((558, 29.38\%)\) was the most common topic in CCL, followed by computer management \((134, 7.06\%)\), psychology multidisciplinary \((133, 7\%)\), linguistics \((124, 6.53\%)\), and psychology educational \((87, 4.58\%)\) according to the treemap of the top 10 subject categories (see Figure 3). These journals covered the following subject categories: computer science, education, medicine, linguistics, psychology, sociology, nursing, and environmental science. *Computer & Education* was on top with 38 related research articles, but *Frontiers in Psychology* was in the first position when it came to citations \((24,199)\). Furthermore, *Computer & Education* was the only journal in computer science which obtained the highest h-index \((149)\) as well as IF \((8.538)\).

The annual growth of prolific journals is illustrated in Figure 4. Something to note is that *Frontier in Psychology* has just begun to produce articles in this field since 2013 and yet ranked second place with 26 publications by 2021. *Sustainability* ranked the top 10 of the total \((n=13)\) as well as most articles in 2021 \((n=9)\). In general, the publication

| Rank | Source title                              | Frequency | Subject category                     | H-index | IF (2020) | Total citation (2020) |
|------|------------------------------------------|-----------|--------------------------------------|---------|-----------|-----------------------|
| 1    | *Computers & Education*                  | 38        | Computer science & education          | 149     | 8.538     | 6,272                 |
| 2    | *Frontiers in Psychology*                | 26        | Psychology                            | 110     | 2.130     | 24,199                |
| 3    | *Journal of Cross-Cultural Psychology*   | 24        | Psychology                            | 109     | 2.618     | 655                   |
| 4    | *International Journal of Intercultural Relations* | 23 | Sociology                             | 80      | 2.667     | 500                   |
| 5    | *Journal of Studies in International Education* | 19 | Education                             | 61      | 2.810     | 281                   |
| 6    | *BMC Medical Education*                  | 15        | Medicine & education                  | 68      | 2.463     | 2,830                 |
| 7    | *Nurse Education Today*                  | 15        | Nursing                               | 78      | 3.108     | 3,124                 |
| 8    | *Teaching and Teacher Education*         | 14        | Education                             | 123     | 3.272     | 2,974                 |
| 9    | *Foreign Language Annals*                | 13        | Linguistics                           | 49      | 2.067     | 284                   |
| 10   | *Sustainability*                          | 13        | Environmental science                 | 85      | 3.251     | 52,097                |

Table 3: Top 10 productive journals (2002–2021).
outputs of *BMC Medical Education, Nurse Education Today, Teaching and Teacher Education, Foreign Language Annals, and Sustainability* were all around 15 articles.

### 3.5. Authors

As is graphically illustrated in Figure 5, we can notice the production of top authors over time. The size of the circle indicates the number of publications, and the darkness of the circle is proportional to the total citations per year (TC/Y) [14]. The top 10 authors published a total of 63 articles in the field of CCL in the past 20 years, and the majority of them were relatively prolific in 2014 and 2017. King from Nanyang Technological University of Singapore had the largest number of productions ($n = 11$), and his research interest was in cross-cultural investigations of learning motivation. The results of the research suggested that a mastery goal has become a positive driver of self-regulation and deep learning in cross-culture in his article "A Cross-Cultural Analysis of Achievement and Social Goals among Chinese and Filipino Annual occurrence"
Students” [15]. In terms of longevity, both King and MacFarlane covered the widest timespan (2012–2021). Huang from National Cheng Kung University was dedicated to CCL in a collaborative cyber community (3C) online environment [16]. He, in [17], analyzed the influence of cultural constructs and social networks on online CCL. Just before this article, he in [2] made a close study of the application of speech-enabled language translation (SELT) as a support for CCL activities. He in [18], proceeded with exploring CCL in a virtual reality environment in 2021. Drawing on the application of computer-aided translation systems and speech-to-text recognition, he proposed that CCL activities be implemented with no common language by them, as these two systems can help participants communicate and exchange information in CCL [19]. His article with the largest number of citations was “Facilitating Cross-Cultural Understanding with Learning Activities Supported by Speech-to-Text Recognition and Computer-Aided Translation” published in 2016 (37 citations) [20].

3.6. Articles. Cited literature composes the foundations of intelligence in bibliometrics [21]. It is well known that the citation frequency of a document can reflect its influence to a certain extent. With the support of the histNetwork and histPlot functions of Bibliometrix, the historical direct citation network of the top 20 articles was generated from a dynamic perspective [15].

In Figure 6, each node
represented a key article, and the citation relationships were defined by the links between nodes [22]. Three subnetworks marked with different colors were demonstrated as depicted in the historical direct citation network. The blue subnetwork consisted of two remarkable articles [23, 24]. One was the earliest node referring to the article “Resident Physicians Preparedness to Provide Cross-Cultural Care,” written by Weissman et al. in 2005 (see Table 4). It proposed that cross-cultural education should be significantly improved to help eliminate ethnic and racial differences in health care [23]. The other node stood for the article written by Smith et al. [24], which discussed the specific objectives of CCL and gave suggestions for teaching about ethnic and racial differences in health care.

Moreover, the pink subnetwork encompassed five influential articles [25–29] committed to social learning and
cross-cultural psychology of children’s imitation. It started from the article which possessed the highest number of citations (222 citations) published by Nielsen and Tomaselli in 2010, triggering four distinct citation chains. In this study, children from the Kalahari Desert and western cities have shown similar imitations through tests. No previous study has recorded imitative behaviors across such sharply contrasting cultures and test environments [25].

Additionally, the three articles [30–32] were included in the green subnetwork. All of them were devoted to the implementation of CCL, and training initiatives contributed to the improvement of cross-cultural communication in primary care based on linked qualitative case studies from migrants and primary health care in Europe. Skilled interpreters and professionals with cross-cultural competence to deal with language and cultural barriers between doctors and migrants were urgently needed [31].

3.7. Keywords and Hotspots. To determine the active research hotspots in scientific subjects and fields effectively [33], the word cloud of author keywords is intuitively plotted in Figure 7 to identify the most popular research topics [12]. This word cloud visualizes the top 40 author keywords of all retrieved documents. The larger the size of the keywords, the more frequently they appear in a dataset [9]. There is little doubt that cross-cultural (n = 157) is considered as the most frequently used author keywords, followed by culture (80), learning (50), cross-cultural comparison (42), cross-cultural research (39), cross-cultural projects (37), cultural competence (34), higher education (32), education (31), China (29), CCL (26), and cross-cultural study (26). Taking advantage of the concept structure function of Bibliometrix, these 40 author keywords were analyzed by multidimensional scaling grounded on a two-dimensional graph, and then two clusters were generated automatically. For instance, Shibaura Institute of Technology (SIT) has established 62 global Project-Based Learning (gPBL) groups around the world for students coming from different backgrounds to promote their thinking, CCL, and problem-solving skills with peers in other fields [34]. As can be seen in Figure 8, which is extracted from the biblioshiny of R-package (Bibliometrix), cross-cultural projects, computer-mediated communication, and interactive learning environment which has similarities and connections with each other to a certain degree were contained in the blue cluster. Cross-cultural projects are hotly discussed by researchers and scholars as it is the closest to the center dot.

In addition to that, the spatial distribution of 45 author keywords in the red cluster has clearly exhibited different topics, contents, or approaches in the study of CCL, which can be summarized by performing factorial analysis as follows.

3.7.1. Students and Teachers: Motivation, Emotion, Assessment, Pedagogy, and Teacher Education. An interest in students and teachers in cross-cultural education has grown in recent decades, resulting in a large number of models and cross-cultural programs to stimulate learning and teacher education. Ingulsrud et al. created a holistic model for evaluating cross-cultural experience by comprehensively applying authenticity assessment and quantitative methods, which solved the
multifaceted nature of students’ cross-cultural experience [35]. A Sino-British adult education English Language Teaching (ELT) project was carried out to investigate the potential reasons for the success and failure of cross-cultural continuing career development plan, helping teacher education improve in ways that would make it possible to address the challenges it faced [36]. Li pointed out that the existing framework in the west did not clearly distinguish learning from achievement motivation. He also believed that motivation and emotion were of central importance in facilitating CCL for Chinese students [1].

3.7.2. Cross-Cultural Research: CCL, Cross-Cultural Comparison, Study Abroad, Cross-Cultural Competence, Cross-Cultural Communication. With the aid of cross-cultural communication, learners from different cultures learned each other’s culture by contrasting and comparing [3]. It was explicitly stated that lacking cross-cultural competence made it difficult for a great number of students studying abroad to merge themselves into the target-language culture [37]. The effect of studying abroad, living overseas, and short-term training programs on improving cross-cultural was illustrated [38]. On a similar line, Root and Ngampornchai put forward that the advancement of cross-cultural competence was helpful for overseas students to adapt to exotic cultures as much as possible.

3.7.3. Educational Technologies: E-Learning, Experiential Learning, Machine Learning, Electronic Dictionary, Online Learning. Considerable studies explored how various cultures use or respond to e-learning and assessed the usability of e-learning system in multiple ways and approaches to get a good idea of its applicability and learnability in different circumstances [39, 40]. Based on an International Cross-Cultural Experiential Learning Evaluation Toolkit, the results displayed that participants tended to learn from their own experiences through approximate and concrete situations [39]. A cross-cultural teaching model based on the perspective of language subjectivity of modern information technology (MIT) can effectively improve college students’ cross-cultural communication and CCL skills [41].

3.7.4. Health Care Education: Medical Education, Global Health, Cross-Cultural Psychology, Social Learning, Nursing Education. According to the research findings, health care education is a key topic in the field of CCL around the world. Reitmanov reviewed a theoretical concept and educational approach, teaching and learning in medicine in cross-cultural undergraduate medical education in North America [42]. Plumb et al. spared no effort to introduce case studies of cross-national collaborations in the domain of global health from Rwanda and Mexico [43]. Using care sites across Europe, MacFarlane et al. [30] employed a participatory learning and action to survey and support the implementation of relevant guidelines and training initiatives in daily practice.

Figure 9 describes the trend topics of CCL by year. The maximum number of words per year was restricted to five and the timespan was set as “2012–2021.” Therefore, 38 trend topics were acquired. Terms with high frequency are more in dot size. Evidently, cross-cultural learning (frequency = 26), experiential learning (22), Chinese (18), and development (10) were the most popular topics in 2012. Cross-cultural (157), cultural competence (34), education (31), and diversity (22) acted as significant research topics in 2016. Machine learning (14) and self-efficacy (10) were hotly explored in 2020.

4. Discussion

Firstly, as mentioned here above, the study of CCL has developed quickly and has yielded a rich harvest over the past two decades. In recent years, it has become an active research hotspot in many countries, as the inevitable result of economic globalization and immigration tides.

Secondly, it should be noted that the results of this study implied a low level of collaboration among authors in the field as discussed previously. Efforts should be dedicated to the cooperation of authors as working together contributes to academic progress. It is believed that highly collaborative behavior is inclined to increase in recent years and has become a common practice in most scientific disciplines [44].

Thirdly, it is worth noting that the United States is the dominating country in the field. In other words, it has made outstanding contributions to the most publications, exceeding other countries. This is not surprising as a typical country of immigrants; the United States is passionately interested in pursuing a lot of CCL studies in order to help immigrant people navigate the acculturation process as smoothly as possible and hence succeed in their work [45].

Finally, as stated in Table 3, the 10 most prolific journals in the field covered distinct disciplines such as computer science, education, psychology, sociology, medicine, nursing, linguistics, and environmental science. Multidisciplinary participation has become the main feature of CCL studies in recent years. We suppose that there is a more wide range of CCL research in the future. It may transform from diverse independent disciplines to a combination of a multidisciplinary field. Scholars from all over the world have placed more and more emphasis on it during the past two decades.

Despite its contributions, limitations existing in the current research include the following: firstly, WoS was the only retrieval source, and some other databases such as Scopus and EI Compendex were not used as study subjects; secondly, the articles in non-English languages were not discussed. Our study of CCL can be done by extending more related articles published in a greater variety of references. In addition, the presented results of this study are influenced by the methods and algorithms implemented in the used tools, Bibliometrix in particular, whose effectiveness can be further checked in future work.

5. Conclusion

This is a preliminary review of CCL studies with the assistance of Bibliometrix. The purpose of this article is to systematically review the studies in this field over the past 20 years. It adopts visualized bibliometric research methods to sort out the knowledge domain in terms of publication output, countries/regions, journals, authors, articles, keywords, and hotspots in the field of CCL studies during 2002 to 2021. We can see that the number
of documents concerning CCL has increased year by year. The United States contributed most and Computers & Education ranked the first with the highest production. King was the most prolific writer and Nielsen was on top according to citation. The most frequent author keywords were cross-cultural, culture, learning, cross-cultural comparison, and cross-cultural research. Finally, based on the Bibiloshiny R-package of Bibliometrix, we found that cross-cultural projects, students and teachers, cross-cultural research, educational technologies, and health care education are active research topics. Compared with similar studies, we used bibliometrics to analyze and used R language tools to carry out econometric analysis of the literature then make use of the advantages of the software to visually display the research results.

Besides, proceedings, dissertations, book reviews, editorial material, etc., were excluded from the analysis. Therefore, it is urgent to contrast analyses of diverse languages with broader data sources in further study.

To sum up, this study expands the literature reviews of CCL. It provides helpful information for newcomers, researchers, scholars, and practitioners to identify knowledge gaps, concentrate on the emphasis, point out future research directions, and move this field forward.

Data Availability

The data used to support the findings of this study are included within the article.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Authors’ Contributions

Jing Wang is mainly responsible for data collection and model building, as well as writing the full text of the paper; Sihong Zhang gave some guidance.

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