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A Bibliometric Analysis of ICT Development at The Comparative & International Education Society (CIES) from 2014 through 2019

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ABSTRACT

This study is a follow up of Kang's study published in 2014. The purpose is to further examine the development pattern of Information and Communication Technology (ICT) as a topic and research area at the Comparative and International Education Society (CIES) conferences by analyzing ICT-related CIES conference papers from 2014 through 2019 (2016 CIES conference papers were not included because they were not accessible to the author at the time of this study). The Bibliometrics method was used to collect and analyse data. The findings include: 1) ICT has developed a much stronger presence at CIES since Kang's study in 2014; 2) Geography-based digital divide remains; 3) Educational institutions and non-governmental organizations (NGOs) continue to be the main players in ICT development at CIES; 4) The omnipresence of ICT in other topic and research areas is present; and, 5) The interaction of ICT with special interest groups (SIGs) and standing committees have doubled. Additional observations were made, and future research studies were suggested.

Keywords: *ICT; Development Trend; Educational Technology; Comparative Education; International*

INTRODUCTION

After years of development and advancement, Information and Communication Technology (ICT) has weaved its way into every stage of our lives from childhood to adulthood. Further, the interplay of ICT with every part of our education systems as well as our everyday educational practices, formal, nonformal, or informal, are multiple-layered and ever-changing (Balakina & Frolova, 2020; Bedasso, 2019).

In an effort to tackle this complex subject, Kang (2014) examined how ICT had evolved as a topic and research area at The Comparative and International Education Society (CIES) and indicated that the field of ICT had grown rapidly as a topic and research area at CIES but would benefit more from knowing: What are some of the key sub-areas under the big ICT umbrella; who benefits and who suffers from ICT development; how to encourage and support ICT development at underrepresented countries and regions; how to increase both the quality and quantity of international comparative ICT studies and practices; and what are some of the key indicators of ICT's contributions to the Education For All (EFA) global movement led by UNESCO (2011).

These types of research studies are needed to help researchers and practitioners understand the overall development trend of ICT as a field as presented at annual CIES conferences. This, in turn, helps the ICT community at large to define "who we are" and "what we do". These types of research can also showcase what ICT has accomplished as a community of practice (Lave & Wenger, 1991) at CIES and offers an opportunity to evaluate current issues related to ICT and to recognize the directions for future theory, research, policy, and practice developments.

This study is to further the same effort by examining ICT conference papers presented at annual CIES conferences from 2014 through 2019 and by triangulating with the findings from Kang's study (2014) to see if any new areas and research tracks have emerged and if any improvements have been made between 2014 and 2019. This study is to help the field understand the rapidly changing

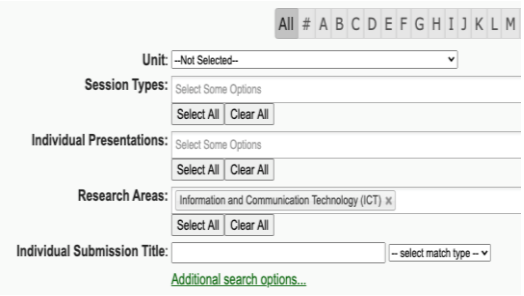
emphasis and orientation of the ICT research area and to provide objective evidence on the growing diversity and maturity of the field itself.

RESEARCH DESIGN

Because the nature of this study was to explore the development patterns of ICT as a topic and research area at the annual conferences of CIES, the bibliometrics method (Gingras, 2016) was used. Bibliometrics is often used in library and information sciences. This method relies on quantitative analysis and statistics to identify and describe patterns of publication within a given body of literature. In this study the bibliometrics method was used to identify and describe the development patterns of ICT as demonstrated within CIES conference papers from 2014 through 2019.

All conference papers from 2014 through 2019 were retrieved from http://www.allacademic.com where most CIES conference papers were archived and indexed. 2016 CIES conference papers were not available through this online database so were not included in this study. Further, CIES simplified the digital online database interface in 2015 by replacing the customizable search interface with the nine mostly used search categories. As shown in Figure 1, the new interface is more user friendly and is especially useful for those who are not familiar with how to navigate through this mega international conference. With the new online database interface, people can quickly locate conference papers of their interests by “day”, “time”, “person”, “room”, “committee or SIG”, “session type”, “research areas”, “region”, and “country”.

Database Search Interface Before 2014



Database Search Interface After 2015

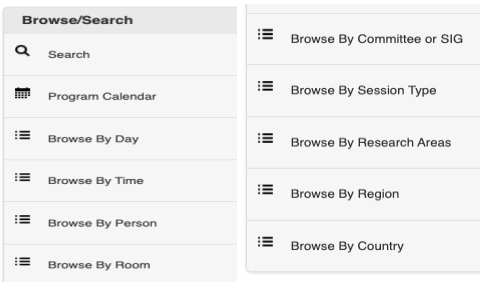


Figure 1*:* CIES Digital Database Interfaces Comparison

The data pool for this study was created following multiple steps. First, a raw data pool was developed by selecting the preset category “research areas” on the main menu. This first step was to be as inclusive as possible to locate all ICT related conference papers officially identified by CIES without minimizing the chance of missing the global development themes/structures as situated within the context of CIES. Second, all conference papers located through the first step were fully reviewed. Papers tagged with ICT in the digital database but did not have an ICT focus were considered as irrelevant and removed from the data pool.

Using 2015 CIES conference as an example: The search for ICT in the “research areas” field yielded 31 results. After further review of individual conference papers, the following 3 sessions were removed even though they were tagged with ICT in the digital database.

- ICT for Development (ICT4D) SIG business meeting
- Participation of diverse stakeholders in education: Students, schools, families and communities
- Cultivating education innovation

The first one was a business meeting for ICT4D SIG members, and the other two sessions had been tagged with ICT by error because they did not have ICT-related papers. Therefore, 28 sessions with a total of 63 individual conference papers presented at the annual CIES conference in 2015 were included in the final data pool.

The last step was to code individual conference papers included in the final data pool by conference year, target region, target country, conference physical location, presenter's affiliation, and committee/SIG. Data mapping and bibliometric analysis were conducted to examine each category for commonalities and differences, and also to identify sub-areas under the big umbrella of ICT. Finally, common development patterns, opportunities, and challenges were identified and discussed within the context of CIES.

FINDINGS AND DISCUSSIONS

Increased Presence of ICT at CIES

The data in Table 1 below indicates that ICT continued to be an important field of study at CIES from 2014 through 2019. CIES' annual conference normally spans for 5 days each year, which means there were on average 6.16 ICT related sessions or 15.24 ICT related individual paper presentations at each day of the conference in the past five years. Following the norms of 3 papers per session with each session 1.5 hours long, a 15-minute break in between sessions, and each conference day is from 8am to 5pm, ICT-related conference papers could easily occupy one full day of conference each year.

Comparing with the data from 2009 to 2013 (Kang, 2014), the number of ICT-related conference sessions and the number of individual ICT-related conference papers increased by 37.5% and 65.7% respectively in the time period from 2014 to 2019. This means more conference sessions included ICT-related individual papers and more ICT-related individual conference papers were included in each session in the time period from 2014 to 2019. This is consistent with current ICT development. As the cost of technology decreases, along with the wide integration of technology in all aspects of our social lives, technology becomes an indefensible component of our everyday activities. This increased presence of ICT at annual CIES conferences also indicates that people are paying more attention to the role ICT has played in the different aspects of our social lives and activities and that people are trying to understand the influence of ICT on all aspects of our social lives and activities.

Table 1: *A summary of the Number of ICT-related Papers at CIES (2014~2019)*

Year	Research Areas	No. of Sessions	No. of Presentations ICT Related
2014	Information and Communication Technology	28	63
2015		36	96
2016		N/A	N/A
2017		13	33
2018		39	85
2019		38	104
	Total	**154**	**381**

Geography-Based Digital Divide at CIES

To see a clear trend from Kang's study (2014), the same United Nations' country classification by major area and region (2012) was used to code ICT-related conference papers at annual CIES conferences from 2014 to 2019. The purpose was to understand how many countries and regions were represented in ICT related conference papers during this time period. Country groupings were based on the geographic regions as defined under the Standard Country or Area Codes for Statistical Use (known as M49) of the United Nations Statistics Division. Under the Sustainable Development Goals (SDG) initiatives, the UN developed regional groupings into the following seven groups: (1) Sub-Saharan Africa, (2) Northern Africa and Western Asia, (3) Central and Southern Asia, (4) Eastern and South-Eastern Asia, (5) Latin America and the Caribbean, (6), Oceania, and (7) Europe and Northern America.

Conference papers not focusing on specific countries or regions were coded "global". The rationale behind this coding strategy is that technology is not necessarily country or region bound. Unless the researcher(s) clearly specified the country or region context in which his/her research study was conducted, it would make better sense to code ICT-related conference papers "global" indicating that the findings could be applicable to all countries and regions. Below are examples of how different types of ICT-related conference papers were handled during the coding process for country and region representation:

- If the original researcher(s) clearly specified the country or region in which the study was conducted, the conference paper was tagged with that specific country or region. For example, at 2014 CIES conference, the authors of the conference paper titled "*Enhancing education for all: New media literacies and mobile technologies in rural communities*" made it clear that their study was "a discourse analysis of policy briefs and annual reports from the Communications Commission of Kenya." This paper, therefore, was tagged with country "Kenya" and region "Eastern Africa".

- If a conference paper did not specify country or region or only used broader terms such as developing countries or listed multiple countries or regions, this conference paper was put into the "global" category. For example, the presenters of the 2014 conference paper entitled "*Building scalable and cost-effective solutions to enhance early-grade literacy*" indicated that the purpose of their study was to improve early-grade reading outcomes worldwide by "articulating key successes and constraints in utilizing technology to improve early-grade literacy outcomes in the developing world context." In another 2014 conference paper entitled "*Enhancing education for all: New media literacies and mobile technologies in rural communities*," the author made it clear that she focused on "…how the burgeoning of mobile phone technology use in many parts of sub-Saharan Africa, Latin America and Asia." In a 2015 conference paper entitled "*Computer and information literacy gaps based on gender, rurality and SES: A cross-country comparison*," no country or region was specified, and the data was gathered from multiple countries. Conference papers like these three were coded "global".

After all the ICT-related conference papers were coded by countries and regions, frequency analysis was conducted, and a histogram was drawn to show country/region representation.
indicates that Africa and Asia were the two regions most represented at annual CIES conferences between 2014 and 2019, followed by Northern America and Latin American and the Caribbean. It is also noteworthy that, in comparison with the time period from 2009 through 2014 (Kang, 2014), Oceania remains as the region least represented in ICT-related conference papers at annual CIES conferences.

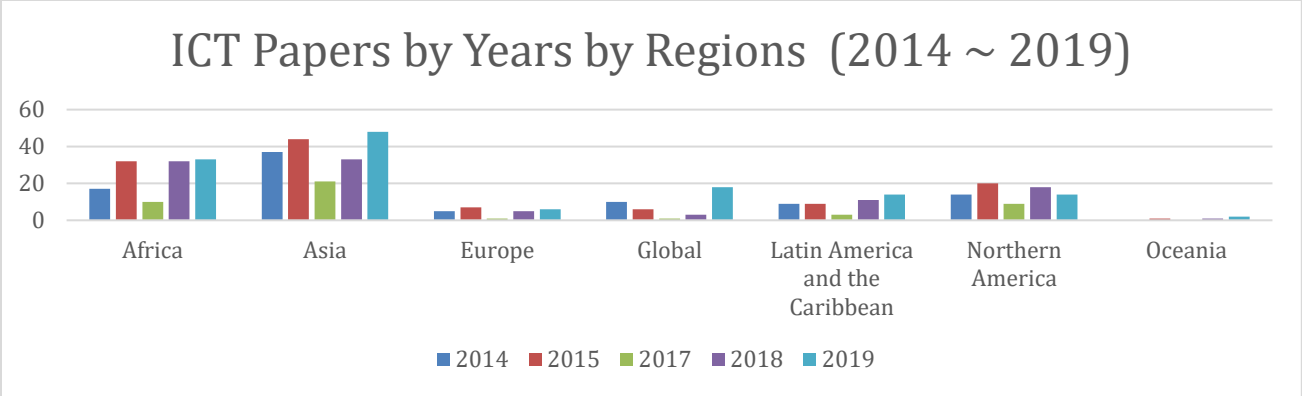


Figure 2: ICT papers by years by regions (2014 to 2019)

In regard to which countries were most represented, the data in Table 2 shows that the USA from the Northern American region was the most represented country at CIES for the period from 2014 through 2019, followed by Jordan from the Asia region in 2014, by China from the Asia region in 2015 and 2017 respectively, by Kenya from the Africa region and Mexico from the Latin America and the Caribbean region in 2018, and by India from the Asia region in 2019. This finding is consistent with the region representation finding above that the annual CIES conferences from 2014 to 2019 highlighted countries from the Asia, Africa, and Northern America regions.

Table 2: *Country mapping (2014 to 2019)*

Year	No. of Countries Represented	No. 1 Represented	No. 2 Represented	No. 3 Represented
2014	>39	USA (11)	Jordan (5)	Canada (4), India (4), Kenya (4)
2015	>54	USA (21)	China (10)	Kenya (6)
2017	>19	USA (9)	China (4)	Mongolia (3)
2018	> 41	USA (18)	Kenya (9), Mexico (9)	China (5), Syria (5)
2019	>57	USA (13)	India (8)	Pakistan (5)

Table 3 below lists the physical location of each year's conference, which provides a possible reason to explain why a country was the most represented at a given year. For example, Mexico was 2nd in the most represented countries at the 2018 CIES conference because the conference was held in Mexico City, Mexico. Canada was among the top 3 represented in the country list at the 2014 CIES conference when the conference was held in Toronto, Canada in that year.

Table 3*: CIES conference locations (2014 to 2019)*

Conference Year	Conference Place
2019	San Francisco, California, USA
2018	Mexico City, Mexico
2017	Atlanta, Georgia, USA
2016	Vancouver, BC, Canada
2015	Washington D.C., USA
2014	Toronto, Ontario Canada

Players Spearheading ICT Development at CIES

To find out who were the driving forces of ICT development as represented in ICT-related conference papers at annual CIES conferences from 2014 through 2019, a cluster analysis was conducted using the presenters' institution affiliations. Adapting the player classification system created by Kang (2014), the data was organized into four categories, including: (1) Government agencies (that is, Department of Education, etc.); (2) Non-government organizations (that is, NGOs, consulting companies, etc.); (3) Educational institutions; and, (4) Others (that is, independent consultant, etc.).

To get a big picture of how many institutions were represented at annual CIES conferences from 2014 through 2019, presenters' institution affiliation data from all five years were combined. Duplicated institution affiliation data entries were removed. This process was to ensure that each institution was only counted once in the final analysis, regardless of how many presenters from the same institution presented at CIES within this five-year period. As a result, 249 institutions were identified. This was a 76.6% increase in the number of institutions represented at annual CIES conferences in comparison with the period from 2009 through 2013 (Kang, 2014). Educational institutions accounted for 53.3% and NGOs accounted for 39.0%. So, educational institutions together with NGOs were the major driving forces of ICT development as represented in ICT-related conference papers at annual CIES conferences from 2014 through 2019. This finding is consistent with Kang's 2014 study.

To validate this finding and to further identify the institutions that were most active at each year's CIES conference from 2014 through 2019, presenters' institution affiliation data were sorted by year. Duplicated institution affiliation data entries attached to each conference paper were removed. This process was to make sure that each conference paper was treated as one data entry regardless of how many presenters coming from the same institution were attached to this paper. Table 4 below lists the total number of institutions and ICT-related conference papers at annual CIES conferences in the time period from 2014 through 2019. The first three institutions that sent the largest delegation of presenters to present on ICT-related topics at annual CIES conferences are also listed in Table 4 with the number of ICT-related conference papers presented included in parenthesis.

Table 4: *Players spearheading ICT development at CIES (2014 ~ 2019)*

Year	No. of Inst.	No. 1 Inst. Represented	No. 2 Inst. Represented	No. 3 Inst. Represented
2014	59	Penn State University (6)	University of Toronto (5), Columbia University (5)	University of Pennsylvania (3), Seattle Pacific University (3), Marywood University (3), Lehigh University (3), Education Development Center (3), Concordia University (3)
2015	81	Penn State University (10)	University of Pennsylvania (6), RTI International (6)	University of Illinois at Urbana-Champaign (5), Tokyo Institute of Technology (5), Education Development Center (5)
2017	35	Tokyo Institute of Technology (8)	Indiana University (4)	Kenyatta University (3), Lehigh University (3), Oslo and Akershus University College (3)
2018	68	Penn State University (8), Tsinghua University (8)	Save the Children (7)	Columbia University (6), Tokyo Institute of Technology (6), Worldreader (6)
2019	105	Education Development Center (9)	Tokyo Institute of Technology (7)	Bridge International Academies (6)

The results indicate that about 76% of institutions on the top 3 list of each year's CIES conference were educational institutions. Tokyo Institute of Technology championed by staying on the top 3 list for 4 out of 5 years, followed by the Pennsylvania State University (3 out of 5 years). About 24% of institutions on the top 3 list of each year's CIES conference were NGOs. The Education Development Center (EDC) was the most active player by staying on the top 3 list for 3 out of 5 years, followed by RTI International, Save the Children, Worldreader, and the Bridge International Academies. This finding reaffirms that educational institutions and NGOs were the two major forces driving ICT development as a topic and research area at annual CIES conferences in the time period from 2014 through 2019 and this is consistent with Kang's 2014 study.

Omnipresence of ICT in Other Research Areas and SIGs at CIES

Two sets of data analysis were conducted to assess the interplay between ICT and other research areas and other special research interest groups (SIGs) at CIES. First, the titles of ICT-related conference papers presented within the time period from 2014 through 2019 were collected and compared for common themes. To be more specific, a word cloud analysis was conducted to visualize the interplays between ICT and other research areas. Word cloud analysis can provide a clear synopsis of the patterns contained within the text (McNaught & Lam, 2010). The size of a word positively corelates with how many times this word appears in the text. The more frequently a word appears in the titles of ICT-related conference papers, the larger its size is as shown in Figure 3. This analysis helped to visualize the most prominent terms and to determine its relative prominence to ICT.

Figure 3*:* The Interplay between ICT and other Research Areas at CIES (2014 through 2019)

The second round of data analysis was conducted to see which SIGs sponsored ICT-related conference papers at CIES during the time period from 2014 to 2019. At CIES, presenters always have the option of either submitting their conference papers to a SIG or to the general pool. Understanding which SIGs these ICT-related conference papers were submitted to can also provide evidence on the interplay between ICT and other research areas pursued by CIES members.

As shown in **Error! No bookmark name given.** below, 16 topic SIGs had sponsored ICT-related conference papers during the time period from 2014 through 2019. ICT also interplayed with 3 regional SIGs (East Asia, Latin America, South Asia), and two standing committees (Gender &

Education, New Scholars). Comparing with Kang's study (2014), two times more SIGs interplayed with ICT from 2014 through 2019. The newly added topic SIGs are underlined in Figure 4. East Asia and Latin America were the two new regional SIGs represented within the same time period. Gender & Education and New Scholars continued to be the standing committees that sponsored ICT-related conference papers. The analysis demonstrated increased and strong interplays between ICT and other research areas that CIES members pursue either individually or collectively through SIGs and committees.

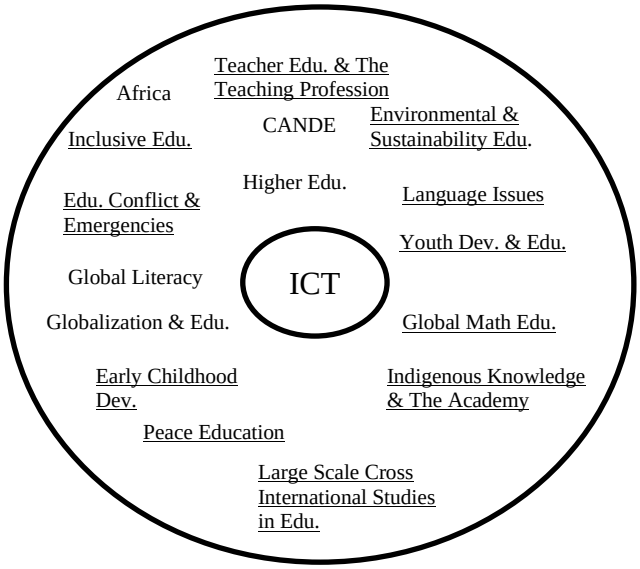


Figure 4: The Interplay between ICT and SIGs at CIES (2014 through 2019)

CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE STUDIES

This study examined the development of ICT as a topic and research area at CIES by conducting bibliometric and statistical analysis on ICT-related conference papers published from 2014 through 2019 and by comparing the findings with Kang's study published in 2014. The findings indicate that the presence of ICT as a topic and research area at CIES has significantly increased during the time period from 2014 through 2019 in comparison to the time period from 2009 to 2013. Such increased presence is a strong indicator of ICT's penetration into our everyday social and professional lives. Data analysis also shows a clear geography-based digital divide that spotlights ICT's wide development in the Africa and Asia regions, which leaves countries in the Oceania region outside of the mainstream dialogue around global ICT development at annual CIES conferences. Educational institutions and NGOs continue to be the major forces driving the development of ICT at annual CIES conferences with more and more new educational institutions and NOGs joining the force. The deep penetration of ICT into our everyday lives is also shown in its omnipresence in other topic and research areas and its interplay with two times more SIGs and standing committees in comparison to the time period from 2009 to 2013.

This study also made several observations. First, the coding category "global" yields interesting findings in that there has been a steadily increased interest in cross-country comparative ICT studies as well as studying ICT related topics that are not country/region bound. This finding seems to be a direct response to Kang's study in 2014 that more cross-country/culture comparative ICT4D studies and more exploration in sub-research areas under the big ICT umbrella were needed.

Second, the findings on the countries and regions mostly represented as well as the key players and forces that drive ICT development at CIES, seem to allude to a possible but hypothetical connection between why Africa and Asia were the two most represented regions and educational institutions and NGOs were the two main forces driving ICT development at CIES. One possible explanation or hypothesis that needs future research could be that there are a large number of faculty, researchers and students studying ICT development in the Africa and Asia regions. If so, conducting research studies that include the demographic characteristics of the conference presenters could provide a better view of why the Africa and Asian regions were most represented in ICT-related conference papers at CIES from 2014 through 2019. The second possible explanation or hypothesis that needs future research is that many NGOs had received funding specifically targeting ICT development in the Africa and Asia regions. Conducting a systematic analysis of these NGOs and their funding sources can help us understand how the African and Asian regions became the two most represented regions represented in ICT-related conference papers at CIES from 2014 through 2019. Third, the diversified connections of ICT with other topic and research areas at CIES and its connections with more SIGs at CIES indicate that the opportunity for ICT community to collaborate with colleagues from other fields has arrived. Future research studies diving deeper into how ICT has been interacting with other topic and research areas and how ICT community has been connecting with other communities are encouraged. This type of research studies would help the field understand better what can be done so that ICT can better connect with other fields, and advanced ICT can be used more efficiently and effectively to help address societal and educational issues in diverse education and training contexts (Kang, 2014).

This research is not without limitations. Utilizing the key word “research areas” as predetermined by the conference digital online database would systematically exclude those conference papers that focused on ICT development but weren’t tagged with ICT as a research area due to the presenters’ varying perceptions and background experiences with ICT. Not being able to secure the 2016 CIES conference proceedings did not skew the overall ICT development trend at CIES but left a gap that hopefully future research studies could help bridge. The data coding process and strategies were described in detail for the purpose of inviting future researchers and practitioners to critique, contribute, and improve. Doing so also makes it more feasible for future research studies to either replicate this study of CIES in future years or to conduct similar research studies to examine ICT development as represented at other conferences and events. Lastly, the number of ICT-related conference papers was small in 2017, however there might have been a glitch in the system that caused an incomplete account of ICT development at CIES in 2017. To maintain the consistency of the data collection process, no additional manipulated efforts were made to find out why data collected for 2017 were unproportionally low, which, nevertheless, provides an interesting topic for future research studies focusing on building robust conference database for exploration.

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