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Re-envisioning bibliometric analysis as a tool for transforming the field

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Abstract: New digital technologies can help create equitable educational outcomes. We used bibliometric methods, a powerful tool for analysis of large bibliographic datasets, with an open-source software to map the computer supported collaborative learning literature. Applying a diversity, equity, and inclusion lens, we considered strengths and weaknesses of this method and analyzed the resulting literature map. We offer recommendations to researchers using similar approaches and re-envision the transformational potential of bibliometric analysis.

Introduction

This conference theme, "Building knowledge and sustaining our community" calls for envisioning a new role of technology for building knowledge and community. We connect to the conference theme by focusing on bibliometric literature analysis and the use of this method as a tool that can point the way towards increasing diversity, equity, and inclusion (DEI) in a scholarly field and its community. Bibliometric analysis (BA)–a method for mapping and synthesizing scholarly fields–propagated in recent years with technological advances and the increasing accessibility of bibliographic databases (BDs) such as Web of Science (WoS; Block & Fisch, 2020). We consider this method in the context of our literature synthesis. Due to space limitations, we provide high-level information about our work here and share additional details in the poster at the conference.

Goals of our research project are to map and synthesize literature on computer supported collaborative learning (CSCL), identify topics relevant to K12 practitioners for translation from research to practice, and determine if new research is needed. There are three phases of the project; in this paper we discuss Phase 1, literature mapping. In our work, we take a DEI lens and work to transcend the bounds of bibliometric analysis, re-evaluate it, and re-envision it as a tool for transforming the field. We focus on the following two questions: RQ1) what does a map of CSCL literature look like? and RQ2) what does the map reveal about DEI in this field?

Methods

Bibliometric methods are quantitative methods used to analyze bibliographic datasets (e.g., author and journal names, article titles, abstracts, keywords, publication years) available through BDs (e.g., WoS). These methods identify topic clusters and links between them, impactful authors, articles, and publications, and, reveal author networks; they have the potential to uncover academic silos, and point to research gaps (Block & Fisch, 2020). WoS provided the relevant meta-data for our search on K12 STEM collaborative learning.

Our whole corpus included 16,470 publications. We analyzed this corpus using the existing open-source BiblioMaps tool (Grauwin, n.d.), utilizing the bibliographic coupling (BC) method. BC is based on the overlap between the references of each pair of publications. The resulting visual representation, shows structures of nodes, or topics in the literature. Our goal was to identify key research topics relevant for K12 practice so we worked to refine the initial software-generated CSCL literature map (Figure 1, on the left). We determined the top 10% most relevant publications of our search was most appropriate (Figure 1, on the right). We independently reviewed publications included in each node and excluded irrelevant nodes (i.e., low-back pain). Next, we evaluated node names and determined names that would be informative to researchers and teachers. To ensure that the map created through the BA reflected current knowledge, we compared the map topics to those in the recent "International handbook of computer-supported collaborative learning" (Cress et al., 2021). We noticed that two of the topics in the Handbook, DEI and argumentation, were not in our map. We decided to include these two topics in the project. Throughout the process of map curation, to ensure map's trustworthiness, we engaged in peer-debriefing sessions with researchers not involved in this project to review the map and our curating decisions.

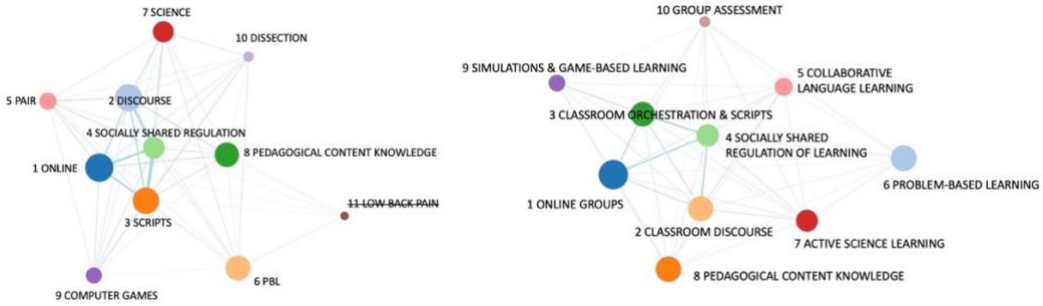
Results

In response to the RQ1, we found the initial whole corpus, software-generated literature map, based on the shared references, gathered publications into 21 topics and 151 subtopics. The initial map of the top 10% most relevant publications (11 topics, 40 subtopics) included some nodes with uninformative names and unrelated literature.

Related to our RQ2, our analysis revealed a relatively small sub-node of works (27 publications) focused on equity, with the majority of publications originating from the U.S. The fact that DEI was not included at the node level in the map means that it did not share enough citations with the publications in other nodes.

Figure 1

The initial map (left) and the final map (right) of CSCL literature (top 10% most relevant publications)



Discussion

Our bibliometric research led us to concur with Gomez et al. (2021) that despite deep concerns with DEI within the CSCL field the existing literature does not reflect a global effort to address DEI as a focal point of CSCL studies. Until a larger number of studies focus on DEI and become linked to the existing publications, bibliometric methods will not reflect changes in literature structure. Researchers using the existing bibliometric tools should be aware of the following three caveats concerning DEI that became evident during our study: a) level of access to BDs, b) biases and lack of algorithmic transparency in the BDs and software tools, and c) accessibility of the research literature. First, as each bibliographic study starts with the extraction of the data corpus from a BD, the level of institutional access to a BD might differ for researchers by institution. Hence, researchers with different levels of access would obtain different output from a BD for the same search terms. Second, there are proprietary search algorithms used by BDs to determine publications' rankings in search results. The criteria for the rankings are obscured so it is not possible to identify biases that might influence the results. The third caveat is ability to access the research literature. Researchers from under-resourced institutions may have less access to publications behind paywalls and may be unable to cite such works. Without these citations, their work will not be included in BC analyses because its references will not connect it to 'mainstream' research. Taking into consideration these caveats, we posit that the first step towards transformative use of bibliometric analysis is acknowledgement that software-generated literature maps reflect inequities, biases, and issues of power that are present and evident in the structure of scholarly fields and in the tools used in them. One recommendation to researchers who want to use bibliometric methods to do more than describe a field's structure is to center DEI in their work by reflecting on what is and is not present, whose voices are included or not, and what literature is yet to be created. Our list of caveats is not all inclusive. Rather, it is meant to start a conversation about envisioning more equitable tools, approaches, and partnerships.

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