Recent trends in collaborative learning: a systematic review and analysis

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Article Info	ABSTRACT
	This study analyses the scientific literature publications from 2015 to 2022 on collaborative learning published in the reputable database Scopus. The study uses the recommended preferred reporting items for systematic reviews and meta-analysis (PRISMA) protocol to conduct a systematic analysis of the literature. A total of 664 relevant journal articles were included following the PRISMA framework. The study examined trends in journal article publications, the field of study in which the collaborative learning approach is applied, the participants used as study subjects, and the first authors' country of affiliation. The review highlights a significant growth in the amount of educational research that utilizes collaborative learning approaches. Researchers paid more attention to studies that focused on tertiary education settings, next on elementary school environments and a few studies examined collaborative learning within the context of the workplace. Based on the International Standard Classification of Education (ISCED) fields of study, many of the collaborative learning studies conducted over the recent four years (2019–2022) were aimed at enhancing students' performance in multidisciplinary settings, followed by computing and physical sciences. The results indicate a considerable rise in technology-enhanced collaborative learning practices. *This is an open access article under the <u>CC BY-SA</u> license.*

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1. INTRODUCTION

The sustainable development goals (SDG) call for concerted and collaborative efforts to achieve prosperity in societies, countries, and the world at large. In this regard, and specifically within the context of SDG 4 (ensuring inclusive and equitable quality and relevant education for all), collaborative learning approaches will be essential to achieving the SDG 4 targets. Collaborative learning is an instructional technique that encourages students of different abilities to work in small groups to accomplish a common goal [1], [2]. In this way, learners are more accountable to not only their own learning, but that of the other members of the group as the focus for success is more on the collective [3]. The constructivist theory serves as the theoretical basis for collaborative learning [4]. Social experiences through collaborative activities are crucial for the cognitive development of children [5]; thus, collaborative learning, particularly at school level, is crucial in creating such social experiences as interaction with peers in real life enhances learners' experiences and thought processes [6].

Despite some distinctions recently starting to gain acceptance, the literature does not clearly distinguish between cooperative and collaborative learning [7]–[9]. Cooperative learning can be distinguished from collaborative learning mainly from a structural standpoint, as it involves the collection of

carefully monitored procedures intended to facilitate learners working together to accomplish a common goal [10]. In this current study, the focus is not on journal article publications that focus on the structural dimensions of learning in groups, but rather on the application of learner groups to achieve a collective goal. Along this line, cooperative learning is therefore a type of collaborative learning, which is now used to refer to a variety of instructional strategies for small group learning [11], [12]. The concept of cooperative learning started in the 1970s [13], and during this period, cooperative learning was used across many spectrums such as controlled classroom environments as in early childhood and school education settings, as well as in other institutes of higher learning [14]. In previous study, Kagan [15] delineates four fundamental principles and prerequisites for the implementation of cooperative learning. These principles include positive interdependence, individual accountability, equitable involvement, and simultaneous interaction. The metrics used in this study exhibit similarities to the five criteria [16], for achieving effective group cooperative learning. Several research works highlighted that cooperative learning broadens students' experiences, improves communication skills and self-esteem, promotes higher order critical thinking, enhances problem-solving abilities, and increases social involvement [13], [15], [17]–[19]. The application of collaborative learning approaches by grouping learners into different categories received attention over the years. Studies found that in terms of students' achievement, heterogeneous groupings outperformed homogeneous groupings [20]–[22].

Collaborative learning approaches continue to be applied across different educational settings. For instance, a significant improvement was found between character values, measured by self-esteem, empathy, and attitude on university students' ability to adapt to village life, culture, and challenges through collaborative experiential learning; with the most improvements being felt in females [23]. A study assessing the mode of operation of information sharing amongst faculty members of independent engineering colleges categorized according to self-financing and government-aided engineering institutions in India, concluded that Government-aided engineering institutions need to do more sensitization of faculty members on the use of effective information exchange mechanisms in a collaborative manner to enhance teaching and learning activities [24]. It is also established that synergistic and cooperative interaction is fundamental to the success of vocational education programs for marginalized populations in India [25].

In terms of civic responsibility, willingness for service participation, awareness of eco-friendly initiatives, and enhanced level of sustainable thinking, collaborative vocational service engagement had a substantial positive impact on undergraduates who actively engaged in skills competitions by grouping [26]. The collaborative approach also improves undergraduate student participants' skills development in constructing single or multi-seat, lightweight, and effective solar automobiles. A study was conducted in Thailand to ascertain the most effective way to enhance learning for the elderly with students enrolled in a training method course through the use of a cooperative project-based learning model. The findings demonstrate that students' attitudes, behaviors, knowledge, abilities, and training-leading experience altered, and their satisfaction was at an all-time high [27]. In Saudi Arabia, it has been found that high school mathematics educators who actively engage in professional development projects centered around lesson study demonstrate enhanced levels of collaborative inquiry skills [28]. As a result, student learning outcomes in mathematics were significantly improved.

The use of digital tools in collaborative learning has grown significantly during the last 20 years. Due to the widespread usage of mobile and wireless technologies and their dependability in the delivery of educational services, because of the ease, connectivity, personalization, and engagement, technology-enabled learning has caught the interest of educators and researchers [29]–[33]. For example, in India, a private university introduced a virtual media-enhanced vocational course that aimed to increase accessibility to technical and vocational education and training, particularly for illiterates and first-time technology users. The model was successful because the trainees (mostly women from marginalized communities) were able to acquire the necessary competencies and have since built over 250 toilets across 21 states in India [34]. Digital game-based collaborative learning has been found to enhance students' capacity to regulate their emotions and behaviors [35], [36]. The role and attributes of virtual laboratories (VLs) in augmenting students' intrinsic and extrinsic motivation during collaborative practical experiments in the absence of physical laboratories was conducted in India [37]. The study concluded that VLs are crucial in facilitating students' desire to collaborate in laboratory activities, boost motivation, confidence, and comprehension, thereby, helping them prepare better for real-life laboratory works.

Collaborative learning takes on different styles including team-games tournament, Jigsaw II method, team assisted individualization, academic controversy, group investigation, peer learning, group discussion, cooperative learning, and think-pair sharing [13], [38]–[41]. The primary emphasis of the present study pertains to scholarly publications that investigate the implementation of collaborative learning methodologies, mainly, those utilizing small-group approaches, either with or without the integration of technology tools, for the purpose of enhancing learner competencies. As far as current literature indicates,

there is a lack of studies that offer a comprehensive overview of the current state and emerging patterns in collaborative learning research publications. The findings offer useful insights that can serve as references and suggestions for policymakers, educators, researchers, and employers. Consequently, this study aims to address the following four research questions: i) what is the status of journal articles on collaborative learning published in Scopus from 2015 to 2022? Is there a rise or fall in the number of journal paper publications on this subject?; ii) what type of sample groups are used in collaborative learning research?; iii) in what fields of study is the collaborative learning approach applied in the selected articles from 2015 to 2022? Do the study fields significantly differ between the first and second four years respectively?; and iv) what is the country of affiliation of the first authors of the published journal articles on collaborative learning from 2015 to 2022?

2. RESEARCH METHOD

This study examines recent trends in collaborative learning journal papers published in the widely acclaimed research database Scopus. The Scopus publications include Elsevier-published journals such as Learning and Motivation, Learning and Individual Differences, Learning and Instruction, and Frontline Learning Research, among others. The Scopus database is considered because it is known to be one of the best abstraction and citation databases for peer-reviewed publications [42]. Different keywords (some with combinations with the "AND" connector) were used during the internet search, namely: i) collaborative learning; ii) cooperative learning; iii) collaborative learning AND student achievement; iv) cooperative learning AND student achievement; and v) computer-supported collaborative learning AND learner achievement. The search was further refined taking into consideration journal article publications from 2015 to 2022, which were in the English language. This yielded a total of 664 papers. The papers include only full-text peer-reviewed journal article publications. The systematic approach employed to reach the final papers selected for the study follows the preferred reporting items for systematic reviews and meta-analysis (PRISMA) 2020 flow diagram [43] for systematic review as shown in Figure 1.

For ease of analysis, the publications included in the study were further categorized by the type of participants that took part as subjects to the study, that is, "elementary school", 'secondary school (comprising of junior and senior high school)", "tertiary education", "adult workers" and "others". In addition, we further classified the articles by field of study in accordance with the International Standard Classification of Education (ISCED) 2011 publication by UNESCO [44], and finally, by the country of the institution the first author is affiliated to. Furthermore, to help establish a trend, the period considered in this study is divided into two mutually exclusive four-year periods i.e. 2015 to 2018 as first four years and 2019 to 2022 as second four years.
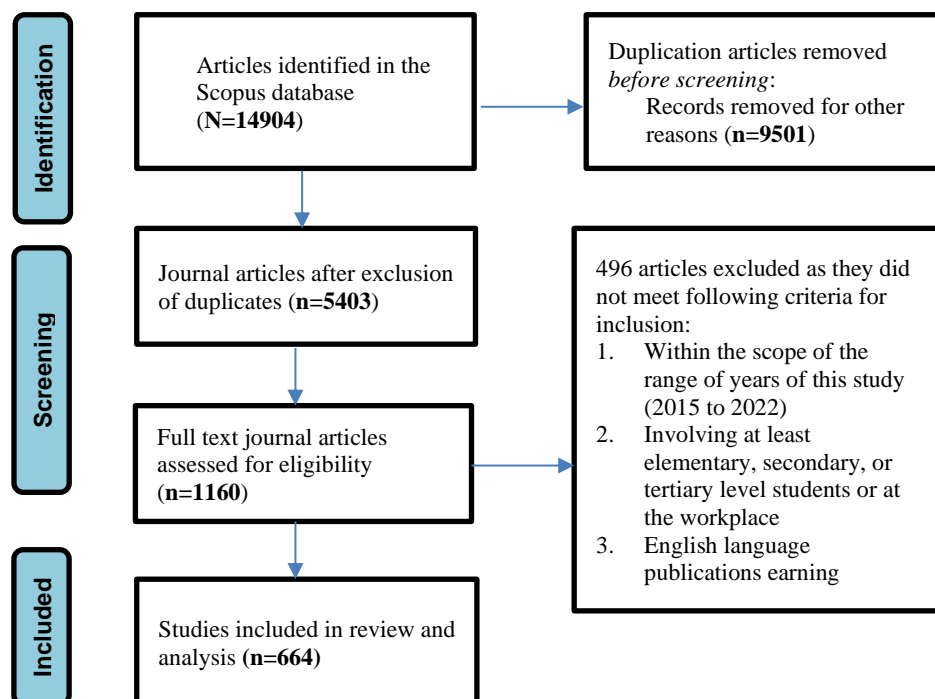

Figure 1. Flow chart diagram on the systematic search process: PRISMA 2020 guideline [43]

3. RESULTS AND DISCUSSION

3.1. Trend on publications

Figure 2 shows the number of publications on collaborative learning from 2015 to 2022. Full text research articles from peer-reviewed journals in the Scopus database made up the publications. It can be noted that the volume of research output in the research topic increased dramatically from 2015. The number of papers published during the second four years (i.e., 389) is greater than the first four years (i.e., 275) by over 100, indicating that research on collaborative learning and its effects on achievement outcomes has increased in the most recent four years.
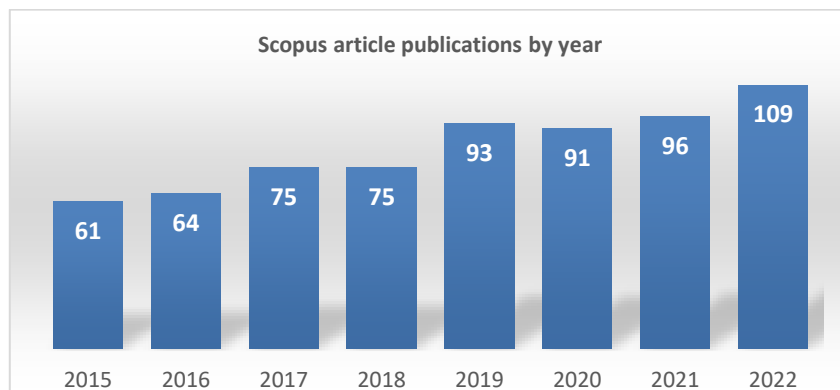

Figure 2. Number of collaborative learning journal article papers published from 2015 to 2022

3.2. Publications by sample group

The distribution of the participants utilized as sample subjects for the included studies on collaborative learning is shown in Table 1. It was discovered that between 2015 and 2022, research samples from tertiary education (469 publications out of 664 publications) were chosen more frequently than those involving elementary school students (54) and secondary school students (46). The "others" category (56) comprised of cross-cutting sample study groups whilst there were 39 research articles that focused on the application of collaborative learning approaches in the workplace. From the perspectives of the two different time periods, the sequence is consistent in that students from tertiary education continue to be the main sample group. However, in the first four years (2015–2018), secondary education students sample groups were the second most frequently used, and in the most recent four years (2019–2022), elementary school sample groups were the second most used participants in collaborative learning research studies. Except for the sample group of adult employees, it can be inferred that all other categories have shown an increase in publications or remained constant between the two time periods.

Table 1. Analysis by target sample research group

Sample group	Adult employees	Elementary school students	Secondary education students	Tertiary education	Others	Total
2015-2018	20	17	23	194	21	275
2018-2022	19	37	23	275	35	389
Total number of publications	39	54	46	469	56	664

3.3. Publications by field of study

Figure 3 shows the selected publications on collaborative learning and its associated effects on achievement outcomes in the first and second four years categorized by ISCED 2011 fields of study. Most studies in the first 4 years (2015–2018) were in physical sciences, followed by computing, health and teacher training, and education science. In the recent 4 years (2019–2022), many of the studies were in the field computing, followed by physical sciences, computing, and humanities. The finding also revealed that, in both time periods, the "others" category had more publications than any single field of study. The reason being this category consists of publications that were mainly multidisciplinary in nature. Veterinary, environmental protection, law, agriculture, forestry, and fishery fields of study, among others, recorded the least amount of collaborative learning publications during the period under review.
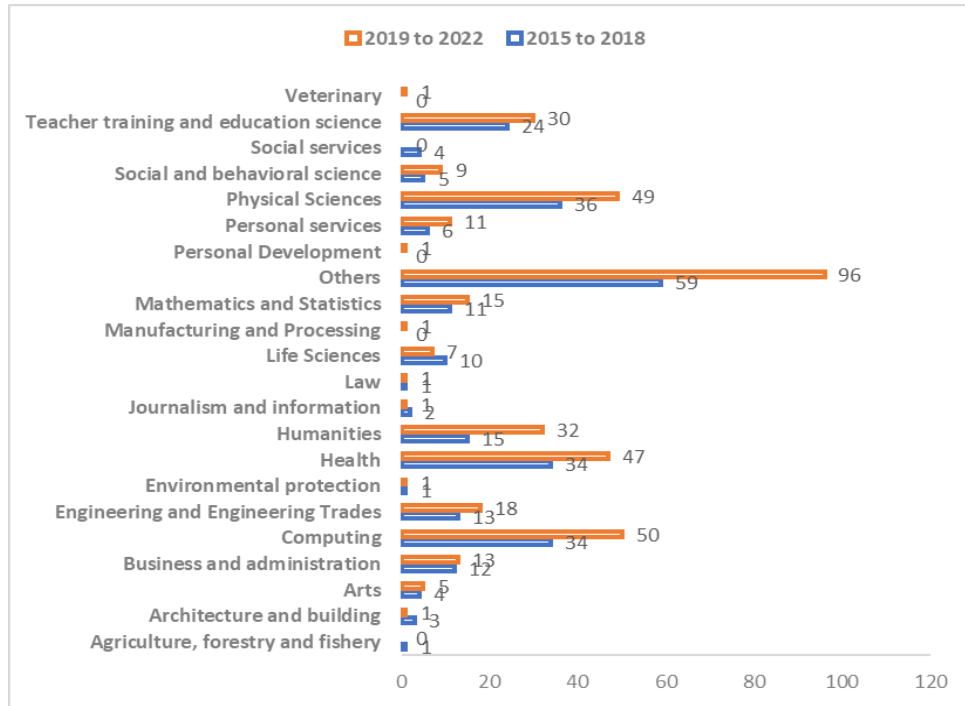
Figure 3. Publications by field of study according to ISCED 2011

3.4. Country of affiliation of first author

Figure 4 presents the major contributing countries to the use of collaborative learning approaches during the two time periods. As shown in Figures 4 (a) and (b), US-affiliated authors contributed the most publications (74 and 97 respectively). In the first 4 years, the other major contributing countries were Taiwan (19), Australia (17), China (15) and United Kingdom (13). However, China (45) ranked second over the second 4 years followed by Spain (26), Taiwan (22), Indonesia (20), India (18), United Kingdom, and Australia (13 each respectively).
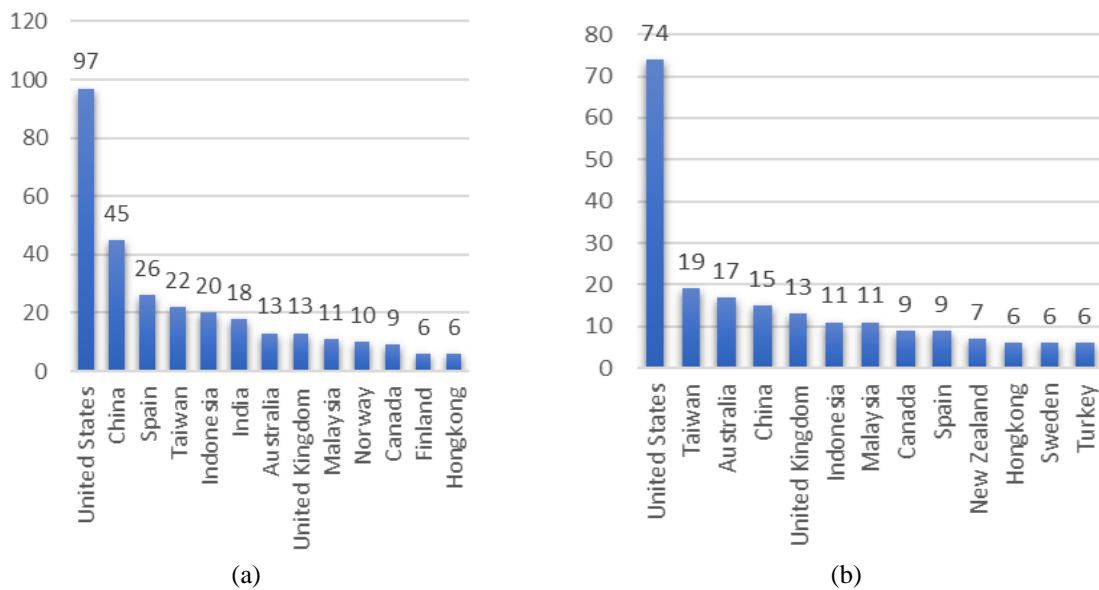

(a)

(b)

Figure 4. Publications by country in (a) 2019 to 2022 publications, (b) 2015 to 2018 publications

3.5. Discussion

This study's major goal was to evaluate the progress of collaborative learning journal article publications between 2015 and 2022. Instructors giving students exact criteria as part of curriculum activities is argued to cause them to limit their attention from productive learning to a focus on "criteria compliance" [45]. The essential goal of education, as highlighted by research studies, should be to foster students' independent and creative thought processes rather than convergent thinking [46], [47]. Collaboration instead of competition, standardization, and test-based accountability promotes the growth of creative knowledge, abilities, and thought patterns in students. This follows because learners can widen their horizons beyond mindsets that are primarily motivated by finding the "correct answer" [48].

The primary objective of SDG 4, specifically Target 4.7, is to ensure that by 2030, every student possesses the necessary knowledge and skills to actively contribute to sustainable development. This includes fostering education for sustainable development and sustainable lifestyles, promoting gender equality, cultivating a culture of peace, encouraging global citizenship, and fostering an appreciation for cultural diversity and its role in sustainable development. To achieve the above in the different educational levels, a collaborative learning approach is required, especially between developed and developing countries as well as between developing countries. The results of the present study on collaborative learning publication trends show that industrialized countries are more likely than developing countries to use collaborative learning approaches in education service delivery and other professional settings. According to previous research findings [49], [50], organized work-integrated learning is a successful method of collaboration for mutual benefit in students' work-based learning because it enhances students' employability and job preparedness and gives them the chance to practice effective teamwork skills. In addition, other studies highlighted that to enhance tertiary education graduates' employability, instructors must take into consideration learner's social self-efficacy as part of the collaborative learning setting [51], [52]. This enables the appropriate assessment of skills-related outcomes such as leadership, confidence levels, self-esteem, and other social efficacy measures.

India, with its vast population, endeavors to integrate science, technology, engineering, and mathematics (STEM) with the humanities and arts in educational methodologies. This integration aims to enhance educational achievements, stimulate innovation and creativity, and cultivate advanced cognitive abilities such as higher-order thinking, problem-solving, teamwork, and social and moral consciousness [53]. India, as an emerging powerhouse, can further widen her tentacles and influence around the globe if collaborative learning approaches are fully integrated across all education levels; thus, is imperative for education systems to include the concept of collaborative teamwork in teaching and learning processes [49], [54]. This will foster sustainable quality education delivery, as it will aid in enhancing creativity and/or creative output which comes about as a function of 21st-century skills and competencies. It also helps learners to be more independent during learning, including taking responsibility for their own learning, improved collaboration and communication, and enhanced higher-order thinking abilities [55].

The analysis further indicates that collaborative learning is beneficial across all spectra of learners from the school level to the university level. The advantages encompass several key aspects: firstly, the significance of acquainting oneself with fellow members within the group; secondly, the prospect of assuming a leadership role within the group; thirdly, the acquisition of knowledge from peers; fourthly, the exploration of self-awareness; and lastly, the acquisition of novel abilities pertaining to effective collaboration with others [14], [45]. The fact that the study only concentrates on the Scopus database, which might not include all the published journal article papers on collaborative learning, is one of the limitations of the study. The theoretical underpinnings of the collaborative learning types employed in the research articles included in this work were not explored by the research study.

4. CONCLUSION

This study looks at how collaborative learning research has evolved between 2015 and 2022. It is found that during the eight years period, there has been a significant increase in the number of journal articles published, with many of these articles originating from first authors having ties to United States' institutions of higher learning. Literature shows the importance of utilizing active learning through collaborative techniques in education and training settings as it improves student achievement outcomes and enhances motivation and self-awareness. This in turn aids students, particularly those in tertiary institutions, to overcome obstacles in the workplace by equipping them with the abilities, teamwork skills, information, and experience to solve problems and be ready to adjust to changes in the labor market. Additionally, it can be deduced from the increase in publications in the field of computing that effective teaching and learning for sustainability depends on successful collaborative learning, particularly with mobile and other communication technologies.

The study revealed that the primary focus of research on collaborative learning during the period under review was directed towards students in tertiary education, with special emphasis in the fields of computing and physical sciences. At the same time, there was also a noticeable interest in the proportion of research studies published on the use of collaborative learning in elementary school settings. The elementary level is a crucial stage for cognitive development because as people get older, they are less willing to experiment with new ideas. In addition, to foster good analytical and autonomous thinking, learners must do away with the strong desire to be right and work cooperatively. The literature highlighted that the three most facilitating factors for change in learners are teamwork, risk-taking, and embracing the opportunity to learn from mistakes and other colleagues. Therefore, these dimensions are essential for education systems to inculcate in learners at different education levels as they embody the principles of collaborative learning. Future research endeavors may delve into the various forms of collaborative learning and ascertain the avenues for further advancement within the realm of collaborative learning, particularly in light of the advent of cutting-edge technologies like artificial intelligence, machine learning, and the Internet of Things.

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