

A Review of the Literature on Online Collaborative Learning in K- 12 and Post-Secondary
Education During COVID 19

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Abstract

The COVID-19 pandemic posed challenges to familiar instructional practices as the national and international response to a global pandemic precipitated a shift to online teaching and learning. This en masse transition offered a novel opportunity to examine the benefits and challenges of the now more widespread context of technologically mediated education and its impact on collaborative group learning. This conceptual review of the literature reports the findings on the impact of COVID-19 on collaborative learning in Education between the years 2020-2022. Twenty-nine of the 54 published articles from K-12 to post-secondary education contexts met the criteria established for this review and were included in the review. Three themes emerged from the review: 1) impacts of online learning on collaboration; 2) student responsibility; and 3) collaborative knowledge building. The literature on online learning and student responsibility described widely varied results with collaborative learning while the literature on online Knowledge Building learning environments indicated many of the issues had been anticipated and reported learning gains were maintained in the shift to online learning. Our review of the studies conducted during COVID-19 indicates a need for increased proactive intentional design to support learners in online learning environments.

Keywords: COVID-19 education, online education, hybrid learning, blended learning, collaborative learning, technology accessibility, student responsibility, knowledge building, collective cognitive responsibility

A Review of the Literature on Collaborative Learning in K- 12 and Post-Secondary Education During COVID 19

“The Covid-19 pandemic has precipitated dramatic changes in education systems around the world” (Korucu-Kıř, 2021, p. 6949) – changes such as remote learning and shifts in collaborative pedagogical strategies (Korucu-Kıř, 2021) to name a few. As discussed in this paper, the pandemic, and the transition to education within safety guidelines precipitated difficulties for students and stakeholders in education. However, rather than conceiving of the pandemic’s online learning environments as potentially limiting and diminishing students’ progress, this review found that online Knowledge Building (KB) (Scardamalia, 2002) learning environments that focused on collective collaborative responsibility continued to make learning gains. The pandemic and emerging post-pandemic moment are replete with new possibilities for designing for productive collaboration. Addressing education during the pandemic, Järvelä and Rosé (2020) fittingly wrote: “we have entered into a worldwide process of mediated sensemaking and search for a path forward... We have taken the leap to a reality of online instruction shared by students, teachers, parents, administrators as well as researchers” (p. 143). This literature review seeks to answer the question “how did the COVID-19 pandemic influence student collaborative work in K-12 and post-secondary contexts?”

Theoretical Framework

This review draws upon sociocultural theories of learning. Vygotsky (1978) in his seminal work “Mind in Society: The Development of Higher Psychological Processes” proposes the sociocultural theory of development in which children and learning is not isolated to internal growth but happens external to the self, within social and collaborative contexts (p. 90). He

writes, “an essential feature of learning is that it creates the zone of proximal development; that is, learning awakens a variety of internal developmental processes that are able to operate only when the child is interacting with people in his environment and in cooperation with his peers” (Vygotsky, 1978, p. 90). So, in his theory, student learning is inextricable from the environment it occurs in (Vygotsky, 1978).

Importantly for this review, Vygotsky (1978) articulates the practical significance of reconceiving of learning as socially and culturally embedded:

“...properly organized learning results in mental development and sets in motion a variety of developmental processes that would be impossible apart from learning. Thus, learning is a necessary and universal aspect of the process of developing culturally organized, specifically human, psychological functions.” (p. 90).

Vygotsky emphasizes this idea of “properly organized learning” in both sentences of this quotation suggesting the *design of learning environments* is not merely inextricable but critical to effective learning and teaching. It is the design of learning during COVID-19 that is the subject of this literary review and indeed crucial to enhancing learning environments as remote learning becomes more widespread. It is possible remote learning could be thought of as just a different or increased use of tools in the classroom, specifically computers. Cripps Clark, Jacobs, and MacCallum (2020), inspired by Vygotsky and remarking on the COVID-19 learning moment, insist that tools have the potential to “fundamentally change the activity” (p. 612) – the tools used in learning alter the design and essential task of learning altogether (Cripps Clark et al., 2020).

However, given the pandemic crisis, Cripps Clark et al. (2020) also noted the task for the education discourse and educators at large is “thinking about the relationships rather than the

thing itself, not the online or the face-to-face communication; not the times we call stability or the times we call crisis, but it is the movement between those things which needs to be the focus of our attention” (p. 614). This review seeks to do this by first presenting findings regarding how the shift to COVID-19 educational contexts has occurred and then highlighting the literature that focused on online collaborative collective Knowledge Building (KB) learning environments.

The COVID-19 Education Context

Though the collective reality of the pandemic is perhaps one of the most shared human experiences of our time, a brief context of the pandemic’s impact on education must be established for the purposes of this review. While studies are still being conducted and published, data on the impact of the pandemic has been collected in various regions across the globe.

In Alberta, Canada – the context from which we experience, pandemic schooling as an undergraduate student and from which perspective we write this review – a group of University of Calgary researchers gathered experiential data from approximately 2000 families with young children to compile a descriptive report on immediate “psychological, economic, and social” (McDonald et al., 2020, p. 5) effects of COVID-19. According to survey respondents, mostly mothers of young children, students’ use of electronic devices increased by two hours per day from pre-pandemic reports (McDonald et al., 2020, p. 10). Moreover, online spaces like social media or virtual platforms are where 93% of respondents were making primary social connections (McDonald et al., 2020, p. 10). Digital and virtual spaces were indelibly a mark of COVID-19 schooling and how connections were being made between people. However, 60% of survey respondents, reported that managing children’s schoolwork was “somewhat to very difficult” (McDonald et al., 2020, p. 10) online and 8% reported that their own unfamiliarity with technology made helping with schoolwork “very difficult” (McDonald et al., 2020, p. 10). In

Germany, Austria, and Switzerland, Huber and Helm's (2020) School Barometer survey responses saw teachers reporting mediocre self-competency in using digital media (p. 252). Reports also varied between countries and was primarily linked to technology accessibility (Huber & Helm, 2020, p. 252). So, already within only the four aforementioned regions – Alberta, Germany, Austria, and Switzerland – the COVID-19 context, the shift to digital spaces and its impact on education varied widely.

Moving forward, Huber and Helm (2020) suggested that “It can be assumed that schools with a supportive culture of collaboration will be more likely to master current challenges, like the organisation of digital instruction.” (p. 254). Yet, Järvelä and Rosé (2020) provided a keen reminder that “the CSCL (Computer Supported Collaborative Learning) field holds as uncontroversial the truth that collaborative learning is not best conducted in a spontaneous fashion, but careful design” (p. 145). Put more simply, it seems logical that with restrictions on physical collaborative spaces, the solution was simply to instate virtual ones; however, as indicated by Järvelä and Rosé, this reinstatement of collaborative learning and the process of supporting collaboration in the online setting is not a foregone or uncomplicated conclusion. The shift to digital learning requires intentional, research-based redesign of learning on the part of educators (Järvelä & Rosé, 2020). Amid shifting restrictions, varied reports, and the development of new educational strategies and practices post-pandemic, it was critical that educators, as well as education discourse, understand specifically how student collaboration was occurring in online learning contexts.

Methodology

This article presents a conceptual review (Grant et al., 2009) of the literature published between the years 2020-2022 on collaborative learning practises within the blended, hybrid, and online digital contexts arising out of COVID-19 emergency. This review is organized into three themes which were evident in the literature pertaining to pandemic education: collaborative group work online, student responsibility during remote learning, and Collaborative Knowledge Building during the pandemic.

Search Strategy

Literature collection and analysis were conducted from May-August 2022. Keywords for this search included “collective/collaborative learning”, “Collaborative Knowledge Building”, “small groups”, “small group cohorts”, “cohorts”, “remote learning”, “COVID-19 Pandemic”, and “novel coronavirus”. Academic Search Complete (EBSCO), ERIC (EBSCO), and Google Scholar databases were used to conduct the search. Advanced searches within the University of Calgary Library catalogue were also completed. Additionally, a manual review of reference lists of pertinent articles and books was also conducted and relevant sources that met search criteria were added to this literary review.

Selection Criteria

The literature review was guided by several selection criteria: peer-reviewed articles, books, and research reports published from 2020-2022. Reviewed literature included both qualitative and quantitative research methodologies. Fifty-four articles in a range of formats – meta-analyses, peer-reviewed articles, and descriptive reports – were collected and reviewed regarding the COVID-19 remote learning context and the factors contributing to it. Twenty-nine articles met the criteria for inclusion in this review. Inclusion criteria required articles within the

years 2020-2022, conducted during COVID 19, and contained reference to collaborative group work. Due to the global and interconnected nature of the remote learning during the COVID-19 pandemic, studies from global contexts were included as the effects of the pandemic on education were global. Search was limited to publications accessible through and written in the English language.

Collaborative Online Learning During COVID-19

Collaboration in the COVID-19 context was done through the intermediary of technology; however, the direct impact and processes of online learning continue to be an evolving and rich subject of inquiry, particularly in the field of Computer Supported Collaborative Learning (CSCL). Punjani et al. (2021) stated, “Research on online learning in pre-COVID-19 times has indicated mixed results on the efficacy of online learning systems when assessed through various contexts” (p. 292). The current studies on collaborative group work during the COVID-19 pandemic showed the same mixed results; upon analysis of the literature, two major issues were evident: 1) issues of technology accessibility and 2) impacted social dynamics due to digital interruptions.

Technology Accessibility

Of primary concern was the shift to online learning environments, given COVID restrictions, were no longer optional due to social distancing requirements imposed by governments. With this measure in place, issues of accessibility and equity had to be addressed as teaching and learning moved online. While matters of accessibility and equity are an issue for education at large, it posed a significant challenge for educators during the shift to online as many of them were new to creating supportive spaces for online collaborative group work.

In South African universities, a reflective paper (Czerniewicz et al., 2020) reported that “Not only did many faculties not have laptops or desktops at home, but also no Wi-Fi, or the skills and competencies to engage with remote teaching” (p. 954). Or in Pakistan, “online learning cannot produce desired results in underdeveloped countries like Pakistan, where a vast majority of students are unable to access the internet due to technical as well as monetary issues” (Adnan & Anwar, 2020, p. 48). In Pillay et al.’s (2020) study of 116 pre-service teachers in South Africa, pre-service teacher responses demonstrated the attrition to student learning when isolated due to lack of material resources for online learning. Participants reported having to share laptops with siblings, accessing lectures and materials from their phone, and having little to no network connection (Pillay et al., 2020, p. 17).

Contrarily, a student with adequate online access remarked that “remote online learning has shown me how I can have access to so much knowledge at my fingertips” (Pillay et al., 2020, p. 18) implying remote contexts provided them opportunities to expand their learning. These competing reports suggest that the mixed results of remote learning continued throughout the COVID-19 pandemic. Additionally, some students with access to whatsapp (requiring a mobile phone number, mobile device, and internet access) “were able to mentor or gain mentorship from peers” (Pillay et al., 2020, p. 17). This experience was substantiated by Chen et al.’s (2018) meta-analysis in CSCL which found that learners using computer supported *collaborative* learning had significantly better knowledge achievement than those who used computer-based *individual* learning; so, students with adequate online access had course materials and they also experienced accessory benefits to their learning by being able to contact peers for support. These findings suggest that students without access to technology or adequate internet did not get the added benefits of digital connection with peers and were also restricted from accessing even

regular course material. The isolation of COVID-19 safety restrictions exacerbated the visibility of economic barriers and students' intellectual isolation as a result of such barriers (Czerniewicz et al., 2020).

Notably, a number of studies did not report significant issues with technology accessibility; specifically, Huber and Helm's (2020) School Barometer survey, Lo and Liu (2022) study in Hong Kong, Patel and Taggar's (2021) study in the UK, and McDonald et al.'s (2020) Alberta report. The variation of accessibility from region to region may be attributed to the ability to supply local infrastructure. More importantly, however, was that even in regions with infrastructure such as Alberta, Hong Kong, and the United Kingdom challenged researchers to take a closer look at the students' context.

“The enforced visibility (of the pandemic) has made the covert overt: the lockdown has forced us to look much closer to where our students are, where they are positioned, what resources they have, what opportunities to engage in teaching and learning” (Czerniewicz et al., 2020, p. 950).

Students' accessibility or lack thereof in countries around the globe presented a barrier to their ability to engage in online collaborative group work.

Social Dynamics

Still more critical for online collaborative group work post-pandemic was that even when students did have access to technologies, most findings on delivery methods using traditional online platforms (like videoconferencing or social media) suggested disruption to collaboration, as these learning environments were not necessarily designed with the nuances of an active, collaborative learning environment in mind.

Lo and Liu (2022) conducted a case-study on students from a dozen university students from multiple fields of study and universities across Hong Kong. Even in this region with advanced infrastructure and online accessibility, students reported primary points for improvement during online lectures are lack of “IT skills”, “network connectivity”, and “stability of electronic devices” (Lo & Liu, 2022, p. 5). Lecturers’ unfamiliarity with the platform, garbled microphones, and general lack of clear communication due to technological error made lectures difficult (Lo & Liu, 2022, p. 5).

During group discussions which primarily took place on web-conferencing platforms, the challenge to effective social dynamics in collaborative group work only increased. Adnan and Anwar’s (2020) survey of 126 higher education students reported that although 77% felt “comfortable communicating electronically” only 43% found it “easy to complete assignments digitally” (p. 48). The discrepancy between those students who were comfortable communicating using a digital device and those who were challenged to complete the assignments digitally is somewhat unsettling. In another study, (Lo & Liu, 2022) participants reported very simply that there were “poor group dynamics” (p. 1) when web-conferencing in group discussions.

Important to the discussion on social dynamics is the concept of “flow”. Flow is “a state of experience in which an individual is intensely focused on and absorbed by an activity, so much so that the experience is inherently self-motivating” (Armstrong, 2008, p. 102); thus, referencing Sawyer’s earlier article, Armstrong (2008) considered group flow as a “collective state that occurs when a group is performing at the peak of its abilities” (Sawyer, 2003, p. 167) which can be a measure used for effective collaborative group work. Importantly, for collaborative group work in the COVID-19 context, Armstrong (2008) contended that group flow was manifested as a fragile verbal and physical synchronicity. Armstrong indicated that

within group flow, group members were aligning and rapidly responding back to each other – a fragility that was potentially at risk given reported disruptions in many online learning contexts.

For most synchronous web conferencing platforms, only one person can speak audibly at a time and visual cues like body language are restricted to whatever is showing on the screen when the camera is turned on. Such a restriction of the technology constrains the possibility for group flow. To take an example from Sharmaine's own experience, in a group discussion on critical race theory and its implementation in public schools, a point of contention arose within her group's discussion and ultimately one member felt they had been discouraged from participating. Reflections as a group revealed that the lack of tonal and body-language cues and the restricted ability of the discouraged teammate to break into the conversation which resulted in group members speaking one after the other without realizing the discomfort being caused – effectively making this teammate feel silenced. In Lo and Liu's (2022) study, participants reported "after entering the Breakout Rooms, many students actually muted their microphones. Even though the instructor was in the room, no one would answer him." (Lo & Liu, 2022, p. 6). Rather than supporting effective collaboration, findings from Lo and Liu suggested their student participants experienced miscommunication or no communication in online synchronous formats.

Despite these issues, there were a few reports of the transition to online formats fostering new social dynamics that contributed to collaboration and creating deeper connection. In Pillay et al.'s (2020) study, those student participants with access to mobile online platforms like whatsapp reported that "studying the novel online on various social network platforms actually facilitated collaborative learning" (p. 16). Participants felt more motivated due to restrictions to initiate *whatsapp* discussion and other collaborative communication (Pillay et al., 2020). These

findings corroborate studies in a 2017 study by Sung et al. that in mCSCL (Mobile-Computer Supported Collaborative Learning) “portability and mobility” (p. 768) of mobile devices made collaboration more instantaneous and subsequently learners were more empowered to collaborate. Similarly, in a study of eleven pre-service teachers participating in practicum, Korucu-Kış (2021) suggested chat boxes and emojis allowed students to work synchronously and discuss and exchange ideas, and even communicate feelings in a way that emulated real-life experience (p. 6963). Lo and Liu’s (2022) also indicated that the student participants in their study preferred using a chat room. “[I like] Sharing my ideas in the chat room because I think texting gives me time to think more carefully before answering the question” (Lo & Liu, 2022, p. 7). While a number of the studies highlighted the ways in which students drew upon a number of applications to support their collaboration during formal learning sessions, Pillay et al. (2020) reported that “collaborative learning occurred *outside scheduled teaching and learning hours*” (p. 17). Taken together, these studies suggested that the successful use of applications such as chat boxes and emojis supported group collaboration in online learning environments during COVID-19.

Student Responsibility

The literature reviewed indicated that students’ individual responsibility for their own learning became increasingly emphasized which appeared to impact student collaboration or lack thereof, specifically individual student responsibility and accountability. Pillay et al. (2022) wrote that the “main characteristics of collaborative learning are a common task or activity, small-group learning, co-operative behavior, interdependence, and individual responsibility and accountability” (p. 10). Evident in Pillay et al. (2022) was the connection between student

responsibility and active learning. Similarly, Korucu-Kıř (2021) referred to learner responsibility as part of “intentional learning” where “learners try to achieve a cognitive goal and responsibly monitor the process of fulfilling it” (p. 6952) – in short, learners taking ownership of and directing their own learning. We were reminded of Scardamalia (2002) who provided a definition of collective responsibility in Knowledge Building communities, “a condition in which responsibility for the success of a group effort is distributed across all the members rather than being concentrated in the leader” (p. 2). While both Pillay et al. and Korucu-Kıř highlight the role of student responsibility within collaboration, Scardamalia (2003) cautioned that personal responsibility, while having collaborative knowledge building value, does not in and of itself necessarily lead to Knowledge Building, as defined by Scardamalia (2002, 2003) or even effective collaboration. The literature collected on the impact of COVID-19 reflected this distinction.

Student Responsibility and Collaboration

In remote contexts, students felt the loss of accountability and the increased need for self-driven responsibility due to the loss of physical immediacy of teachers and peers in remote learning (Bubb & Jones, 2020). Brought on by the urgency of not having a teacher “hanging over your shoulder and telling you what you’re going to do” (Bubb & Jones, 2020, p. 216) in online learning environments, Norwegian students (ages 6-16) experienced “a sense of ownership and increased motivation by taking responsibility for their own routines and their own learning” (Bubb & Jones, 2020, p. 216). Student responsibility also appeared in Korucu-Kıř’ (2021) study of eleven Turkish preservice teachers and highlighted those times when student responsibility did in fact result in collaboration. In the Korucu-Kıř’ study, which examined the necessary components for participants to have vicarious practicum experience in online contexts, the

second significant characteristic in the process of successful participants was “intentional”, meaning the pre-service teacher participants “taking responsibility and action to manage [their own] experiential learning” (Korucu-Kıř, 2021, p. 6962). This was exhibited in “collaborating with more knowledgeable others (i.e. mentors, instructors and school teachers) and peers ... [and] conducting a literature review by means of various sources (e.g. the Internet and books)” (Korucu-Kıř, 2021, p. 6962). In this way, students’ responsibility was exhibited through efforts towards collaboration (Korucu-Kıř, 2021).

Interestingly, Pillay et al. (2020) found that student responsibility led to students taking initiative toward collaboration with peers or with other perspectives online (scholarly or not). Student participants reported taking ownership of learning by writing: “remote teaching and learning is not easy, but you have to make a plan. I understood the novel because I made the effort. I want to pass” (Pillay et al., 2020, p. 19). However, though this student’s “efforts” manifested collaboratively as initiating peer mentorship within the Pillay et al. study, establishing social media connections to support learning and accessing online communities, were subordinate and perhaps even unintended outcomes. The outcome was that students would eventually be able to accomplish the learning tasks on their own (Pillay et al., 2020). The student collaboration that occurred appeared to foster a “strong sense of independence” (Pillay et al., 2020, p. 19).

Furthermore, lack of student responsibility altogether was a concern among many educational stakeholders (Bubb & Jones, 2021; Daniels et al. 2021). Although the majority of survey participants in Bubb & Jones’ (2021) study answered that students did experience higher independence and personal responsibility in learning, a small number of respondents reported the opposite. Parent respondents reported their children had “become overly dependent on them [the

parents/carers]” (p. 217), and teacher respondents worried that completed learning tasks were “not the student’s work” (p. 217). Additionally, at the post-secondary level of education, Daniels et al. (2021), referencing Watson and Sottile’s (2010) article on online learning, established that within remote learning contexts “concern for increased cheating under remote delivery was warranted because students report being almost four times more likely to be dishonest in online courses (42%) than in-person courses (10%)” (p. 302). Daniels’ et al. (2021) found that during the COVID-19 pandemic “the change in learning conditions had a meaningful impact on students’ achievement goals” (p. 311) with results showing a “uniform decrease in all four achievement goals and all three forms of engagement” (p. 311) that were tested by comparison to results from prior to COVID-19.

Despite these concerns surrounding student responsibility and engagement, Lo and Liu’s (2022) study suggested that self-organization was an important opportunity to encourage students to take responsibility of learning through collaborative group discussion. They found that “student disengagement in group discussions was due to their instructors’ random assignment of group members” (Lo & Liu, 2022, p. 9). Students’ suggestion was “allowing students to form their own groups” (Lo & Liu, 2022, p. 1). This is corroborated by Melzner and Greisel’s (2020) who suggested the importance of an externally imposed structure in collaborative learning: “Learning in groups is challenging when there is no external structure, i.e., when groups are completely free to decide when, where, what, and for how long to study” (Melzner & Greisel, 2020, p. 152). Melzner and Greisel (2020) extended Volet’s (2009) research to demonstrate that self-organized groups in computer supported collaborative learning (CSCL) contexts can provide the necessary structure for effective collaboration. Self-organization was successful “the more homogeneous their [the groups’] problem perceptions are within their

group, (b) the more they apply immediate (rather than non-immediate) strategies to remedy their regulation problems, and (c) the more frequently they apply regulation strategies” (Melzner & Greisel, 2020, p. 152). Once again, these findings suggest 1) variable existence of student responsibility and 2) variable effect of student responsibility on collaboration (Korucu-Kıř, 2021; Pillay et al, 2022; Lo & Liu, 2022); therefore, throughout the emergency shift to remote learning, findings suggest collaborative learning environments even when focussed on student-driven initiatives continue to require “careful design” (Järvelä & Rosé, 2020, p. 145).

Collaborative Collective Knowledge Building

In 2002 Scardamalia presented a radical approach to designing online learning environments to foster effective collaborative collective learning and learning at large. Although written nearly twenty years prior to COVID-19, Scardamalia’s framework continues to address many issues with current digital online student collaboration and student responsibility and addresses a critical issue in the design of remote learning that the current body of literature has shown to be characteristic of remote learning and particularly appropriate for the COVID-19 context. As most schools globally shifted towards incorporating digital technologies, applications, and the related infrastructure during this time; however, did not appear to make a “fundamental change in the structure of classroom discourse . . . but generally not in ways that play a transformative role” (p. 5-6).

The fundamental change Scardamalia (2002) referred to and advocated is shifting the design of online collaborative group work to alter “day-to-day discourse patterns” (p. 6) – allowing students to assume collaborative collective cognitive responsibility of their learning. Hmelo-Silver and Barrows (2008) described these “day-to day discourse patterns” with reference to the initiation, response, evaluation (IRE) discourse pattern where “the teacher initiates a

question, generally aimed at getting a student to display their knowledge, the student responds, and the teacher evaluates that response” (p. 7). The IRE discourse pattern, whether in physically co-located learning environments or online learning environments positions students as respondents to known facts and procedures rather than active knowledge creators in which students have agency over their own learning (Hmelo-Silver & Barrows, 2008). Scardamalia (2002) provides a way digital context requires and indeed allows for intentional, embedded, and disruptive design as reported in the Melzner and Greisel (2020) study.

To better understand the CSCL context that Melzner and Greisel (2020) studied, it is helpful to review Scardamalia’s (2002) overview of Knowledge Building (KB). The KB framework is guided by twelve determinant principles (Scardamalia, 2002) one of which is Collective Cognitive Responsibility. Scardamalia defines Collective Knowledge Building as the condition when learners “produce ideas of value to others and share responsibility for the overall advancement of knowledge in the community” (p. 10). While the principle of Collective Cognitive Responsibility is important to understanding the literature that reported findings from online learning KB environments, two other principles are also pertinent to understanding this context, i) Democratizing Knowledge – “all participants are legitimate contributors to the shared goals of the community, all take pride in knowledge advances achieved by the group” (Scardamalia, 2002, p. 11) and ii) Improvable Ideas – “All ideas are treated as improvable. Participants work continuously to improve the quality, coherence, and utility of ideas. For such work to prosper, the culture must be one of psychological safety, so that people feel safe in taking risks—revealing ignorance, voicing half-baked notions, giving and receiving criticism.” (Scardamalia, 2002, p. 9).

The democratization of knowledge principle also embodies the reorganization of the normative classroom discourse Scardamalia advocates (Scardamalia, 2002). This principle relocates students as knowledge makers/ knowledge creators that share the “responsibility for the success of the effort...instead of [the responsibility for learning] being borne by the teacher alone” (Scardamalia, 2002, p. 8).

Collaborative and collective KB seeks to achieve more than the sharing of information and evenly dispersed contributions: “if students believe that collaborative writing in computer forums merely involves the sharing of information, they would engage in superficial moves rather than deep inquiry for knowledge co-construction” (Chan & Chan, 2008, p. 1445).

Collaborative and Collective KB is designed so students *build/create* knowledge, to improve upon the current discourse, their own ideas, and their peers’ ideas – to create “a culture in which the creation and improvement of ideas pervades social life” (Scardamalia, 2002, p. 24).

Particularly pertinent to COVID-19 online learning contexts, collaborative and collective KB is designed to produce discourse and ideas that are shared by all participating in the learning community as opposed to student-driven, personal responsibility that showed mixed results throughout COVID-19 literature (Korucu-Kıř, 2021; Lo & Liu, 2022; Pillay et al, 2020;).

Collaborative Collective Knowledge Building for the Digital Context

Regarding the previously noted issues that impacted social dynamics during COVID-19 in online learning environments, collaborative and collective KB though not restricted to online formats (Cacciamani et al., 2021), took advantage of the unique benefits of online technologies. Aptly, Cacciamani et al. (2021) wrote that in the current COVID-19 moment “advances in technologies now affords us an opportunity to transform teaching and learning practices towards more participatory and community learning” (p. 1171). Collaborative and collective KB in many

ways anticipates many of the issues reported in this review when globally teaching and learning shifted to online (Lo & Liu, 2022; Pillay et al., 2022). Many of the online environments provided teachers/instructors with a variety of synchronous and asynchronous applications. Some studies reported using a variety of web-conferencing platforms, including WhatsApp for synchronous online teaching and learning. One of the asynchronous applications reported in this review was Knowledge Forum which provided an asynchronous discourse medium in which students engaged in collaborative, collective knowledge building (Cacciamani et al., 2021; Chai & Zhu, (2021) Soliman et al., 2021). Student experiences with the Knowledge Forum platform as reported by Scardamalia (2002), were corroborated by the findings of Soliman et al. (2021). The Soliman et al. (2021) study was conducted with 23 graduate student participants during the COVID-19 pandemic, in blended learning contexts. The researchers were interested in determining whether KB required in-person components and in what ways blended formats could be leveraged to better engage students better.

Reflecting on the affordances of Knowledge Forum in the Soliman et al. (2021) study, one student participant wrote of their individual engagement with the course material: “Most of the notes lie in design thinking and beyond the centralized mindset. This could be the evidence that I am engaging in the design mode for the past month. I also consider myself having some sense of thinking fast and slow” (p. 18). Another wrote: “I have been using the learning analytics embedded in KF to review my notes, scaffold my understanding of KB, and support my design, which can be proved by the total number and type of scaffolds I used in the month” (Soliman et al., 2021, p. 15-16). Findings from Soliman et al. (2021) suggested students were able to metacognitively become aware of their own understanding of materials due to the KF platform’s organization of their own notes. This corroborates the technological dynamic Scardamalia

(2002) proposed to achieve the principles of Improvable Ideas, “Background operations reflect change: continual improvement, revision, theory refinement” (p. 10). Though published prior to COVID-19, Chan and Chan (2011) also found that within remote learning contexts using KF results are “consistent with prior qualitative analyses showing that students with higher forum participation exhibit such knowledge-building characteristics as epistemic agency and improvable ideas” (p. 1454).

When discussing their experience using Knowledge Forum a student in the Soliman et al. (2021) study reported: “I have admittedly fallen behind keeping up with the other groups’ design projects over the course of the last month of the class. I do see areas in which my work intersects with that of the other two groups” (p. 14). This suggests the student was again able to become aware of the learning of the group as the student had access to other groups’ KB and understanding. It is also evident that the student gained insights into those areas where their own knowledge intersected with others – suggesting not just efforts towards collaboration but meta-level understanding of the collaborative endeavour of the whole community. In part this can be attributed to the design of the Knowledge Forum platform and its ability to reorganize knowledge non-linearly. Soliman et al. (2021) found that within a KB environment using Knowledge Forum “all students were connected at some level” (p. 13).

It is important to note that while collaborative and collective KB has a technology component and uses digital contexts to disrupt discourse patterns, Scardamalia (2002) acknowledged “in principle you could have the practices without the technology” (p. 8). Although, “we have found the technology to be important not only for practical reasons—to overcome the objective obstacles created by classroom conditions—but also for conceptual reasons” (Scardamalia, 2002, p. 8). However the literature by Cacciamani et al. (2021) and

Soliman et al. (2021) suggests that Knowledge Forum was required to create online KB environments during COVID-19. The strategic uses of collaborative and collective KB in blended synchronous and asynchronous formats as well as blended online and in-person learning environments were the focus of both the Cacciamani et al. and Soliman et al. studies.

Cacciamani et al. (2021) tested three different iterations of a course. Each iteration was structured with different combinations of blended-blended, blended-online, and blended-in person. Cacciamani et al. found that the second iteration, blended-online, with longer time spent in online contexts, specifically in the Knowledge Forum platform, was most effective for KB. “The longer period for creating and sharing knowledge and strategy assessments in KF, compared to the other iterations (15 min) can enhance, through a self-reflective activity, the change from the individualistic cognitive responsibility toward a collective cognitive responsibility” (Cacciamani et al., 2021, p. 1188). In Soliman et al.’s (2021) study, researchers were interested in whether “courses that introduce Knowledge Building require an in-person or synchronous component”, findings showed that synchronous components proved helpful to KB by offering opportunities for collaborative working in real-time, immediate feedback, and teams learning about other teams’ designs.

Collaborative Knowledge Building for Collective Cognitive Responsibility

Collaborative and collective KB addresses not just technological dynamics but socio-cognitive dynamics (Scardamalia, 2002). Both the technological and the socio-cognitive dynamics contribute to the overall CKB framework: “The combined practices and technology also help align participants and their environment so that knowledge advancement: 1. is in the social fabric of the organization; 2. is enhanced through primacy given to creative work with

ideas; and 3. represents sustained work at the frontiers of understanding” (Scardamalia, 2002, p. 8).

In many ways, collective cognitive responsibility is the central idea and goal of collaborative and collective knowledge building. Collective cognitive responsibility is collective in the sense that effort is distributed across all members, not merely the responsibility of an individual; it is cognitive in the sense that all members “also take responsibility for knowing what needs to be known and for insuring that others know what needs to be known” (Scardamalia, 2002, p. 2). Collaborative and collective cognitive responsibility is difficult to achieve in many non-KB classrooms (Scardamalia, 2002), again anticipating some of the issues of engagement and ineffective social dynamics faced during COVID-19 education. Scardamalia (2002) described how even in a physically co-located classrooms with a firm grasp on cognitive responsibility – students truly taking ownership and directing their own learning and knowledge production, not just completing tasks in a responsible way – move to turn over cognitive responsibility are constrained due to 30-1 student-teacher ratios.

As evident in much of the literature reviewed for this report, small group teaching pedagogies were used to reorganize classroom discourse in attempts to turn over cognitive responsibility to students but many were reported to be unmanageable or lacked student engagement (Bubb & Jones, 2020; Daniels et al., 2021; Korucu-Kıř, 2021; Lo & Liu, 2022; Pillay et al., 2020). Scardamalia (2002) noted that small group teaching “may prove unmanageable unless the groups have definite and limited tasks, but this reduces the cognitive responsibility exercised by the students” (p. 5). The unmanageability of small groups and group collaboration were reported in online learning environments during COVID-19. Attempts at fostering collaboration and/or student responsibility were minimal (Bubb & Jones, 2020; Daniels

et al., 202; Korucu-Kıř, 2021; Lo & Liu, 2022; Pillay et al., 2020). Collaborative and collective KB requires an altogether different structure due to the asynchronous Knowledge Forum format designed to enhance collaboration and KB. With this structure shift comes an embedded in classroom culture towards pedagogies that aim for collective cognitive responsibility; rather, than focussing on student individual responsibility or delivering individual or group assignments without transferring responsibility to students.

In the Soliman et al.'s (2021) study another feature of a KB environment was highlighted—the ways in which KB continued beyond scheduled class times. Many student groups met with one another both inside and outside of scheduled class time demonstrating an increased propensity for collaboration and simultaneously suggesting that students took initiative and responsibility. An artifact of student communication from Soliman et al.'s (2021) a participant reported “If anyone needs some connecting, let’s make it happen. We can create a whatsapp group to check in on each other and meet through zoom if necessary” (p. 19).

Chai and Zhu’s (2021) study was concerned with determining the impact of student adoption of CKB principles on the quality of KB. Analysis of student discourse indicated frequent adoption of collective cognitive responsibility using collaborative and collective KB and Knowledge Forum (Chai & Zhu, 2021). However, it was notable that in the student’s self-reported survey only two of 21 students reported adopting collective responsibility while the discourse analysis indicated much more frequent adoption of collective cognitive responsibility (Chai & Zhu, 2021). “The discrepancy may be that the students had a high threshold for what contributions meet the criteria” (Chai & Zhu, 2021, p. 803). Importantly, Chai and Zhu also found that “high-performance groups tended to adopt the democratizing knowledge, embedded and transformative assessment, and symmetric knowledge advancement more than the medium

and low performance groups” (Chai & Zhu, 2021, p. 803). These findings and analysis suggested a possible connection between higher performance in learning goals and a shift to an overall embedded culture of collective cognitive responsibility (Chai & Zhu, 2021). Specifically, this manifested as: 1) inviting others to contribute – insuring others know what needs to be known and 2) evaluating their knowledge progress – knowing what needs to be known. The evidence suggests that the actions of high performing groups align with taking collective cognitive responsibility.

Collaborative Knowledge Building and the Role of the Instructor

The two studies, Chai and Zhu (2021) and Soliman et al. (2012) reported using Knowledge Forum resulted in a fundamental shift in both discourse patterns and classroom culture to the benefit of online learners. With these shifts, the teacher/instructor was displaced from their traditional role of delivering knowledge in ways that disrupted familiar IRE discourse patterns. As online and physically co-located learning environments continue to evolve, our review of the literature suggests it is increasingly important to articulate the role of the teacher in collaborative group work. In previous literature, Hmelo-Silver and Barrows (2008) identified effective strategies for teachers when employing collaborative and collective KB. They found that meta-statements from the teacher “helped support student elaboration and causal reasoning” (Hmelo-Silver & Barrows, 2008, p. 82), thereby deepening student understanding. Chai and Zhu (2021) expanded on the Hmelo-Silver and Barrows’ study, by expanding a definition of teachers within collaborative and collective KB environments. Chai and Zhu reported while collaborative and collective KB was widely adopted by students, students reported that “they did not intentionally use the twelve principles” (Chai & Zhu, 2021, p. 805) of KB. They suggested that *both* teachers and researchers “need to study how to design strategies to help students to adopt

these principles” (p. 805). They suggested that it is not just teachers who facilitate deeper reasoning, as reported by Hmelo-Silver and Barrows (2008), but also that teachers may also serve a role similar to researchers, studying and designing strategies for higher adoption of collaborative and collective KB in online learning environment.

At the time of writing this review, the global COVID-19 pandemic is still present in various strains and post-pandemic education continues with a proliferation of local and national responses to its ongoing presence. While it might be tempting to return to pre-pandemic familiar practices, this review of the literature invites teachers/instructors in K-12 and post-secondary institutions and researchers to benefit from the lessons learned during the pandemic. Cacciamani et al. (2021), Chai and Zhu (2021), and Soliman et al. (2021) proposed continued study in the various contexts of blended and fully online environments, mobile online environments, and assessment practices in collaborative and collective KB environments.

Conclusion

This review of the literature reflects a need for increased intentional design to ensure collaborative and collective learning in online, blended, and physically co-located learning environments precipitated by the emergency shift online due to COVID-19. The literature reviewed suggested that online learning efforts during the pandemic education necessitated an increased emphasis on student responsibility and collaboration with varying results and success rates. Several studies reported issues with technology, in particular, technology accessibility and interrupted social dynamics, creating a learning environment that depended on an increased reliance on student-driven initiative without an intentional design needed to support productive collaborative learning. Studies that focused on the KB, with particular emphasis on collective cognitive responsibility, improvable ideas, and democratizing knowledge presented a viable

alternative for the redesign of online collaborative group work. This review of the literature suggests an imperative for teachers/instructors to proactively seek out ways to engage in the design of blended, in-person, and online iterations of intentionally designed environments as technologically mediated education expanded during the height of the pandemic and continues to expand.

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