Revisiting collaborative learning and CSCL in the age of social media

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Abstract: Research on collaboration and collaborative learning (CL) has a much longer history than ICT use for learning and collaboration. The emergence of CSCL has brought new possibilities and practices to CL, and facilitated advances in theories of socially constituted learning. The first CSCL tools were products from academic research, often underpinned by theories of collaborative learning. However, these research artefacts have a much lower uptake than commercially available digital communication tools. The latter are now overtaken by social media as the most likely technology mediating social communication and CSCL settings, if broadly defined. This symposium aims to (1) analyze the extent to which CSCL research has contributed to uses of different generations of digital technologies to support collaboration in formal education, (2) consider the affordances of social media for CSCL applications, and (3) explore the scalability potential of CSCL platforms as artefacts from research vs. commercial products and social media.

Keywords: CSCL technologies, open source, principle-based CSCL technologies, scalability

Introduction

Collaborative learning has been around as a pedagogy before the advent of digital technology. Email and listservs are possibly the earliest digital communication technology deployed to support collaboration. Since then, there has been a plethora of digital technologies that have been used to support different forms of collaboration. These technologies may be proprietory commercial products or open source software designed for more general usage, or software developed in research laboratories specifically to support principle-based CSCL pedagogies. Unlike technologies developed by commercial enterprises targeting the general public such as the Google suite of collaborative tools, or ones targeting use by teachers such as Edmodo, the penetration or spread of research-based CSCL technologies into schools tend to be limited.

Considering the issue of scaling up of CSCL pedagogies, should we be concerned that technologies successfully scaled for "collaborative learning" even in formal education settings are those that are not principle-based (i.e. grounded on identifiable theories of collaborative learning, e.g., intersubjectivity, shared problems, scripting, scaffolding, knowledge building, orchestration) or domain specific (e.g., for algebra or biology)? There is a tension between learning-principle-based technology tools and commercially available tools that cater more for social communication and networking and are not necessarily designed for learning or knowledge building. At the same time, the wide adoption of commercially available digital communication tools and social media have popularized the concept of collaboration and CSCL. What strategies should the CSCL community take with regard to the development of CSCL technology? Is such development still necessary? Should CSCL researchers focus their energy on leveraging generally available communication/collaboration technology and help teachers and learners create/implement designs for CSCL practices using popularly available technology? Or, alternatively, should CSCL researchers establish partnerships with commercial developers (e.g. social media) to create the next generation of learning-principle-based CSCL technology?

To date, we distinguish four main types of technology used in CSCL settings based on their functionality: asynchronous tools, synchronous tools, shared visualization with synchronous chat, and social media. Each of the symposium presenters will draw on the research literature associated with one key type of CSCL mediation tool to support their perspectives on the above questions related to the strategic role of CSCL researchers in order to bring the greatest impact on pedagogical practices in different contextual settings.

Conceptual framework

ICT has not made significant impact on learning and teaching practices in schools in general (e.g., Collins and Halverson, 2009). This lack of pedagogical change is reported also in international comparative studies of teachers' ICT-using practices in schools (Law, Pelgrum and Plomp 2008). To realize the "transformative" potential of ICT requires the redesign of teaching and learning activities to serve new goals (Oblinger & Hawkins, 2006). Collaboration supported by the Internet is on the increase and research on collaborative learning has also increased (Palomo-Duarte *et al.,* 2014, Strijbos, 2011). CSCL activity design is primarily focused on studying and supporting collaboration on digital platforms and tools. Previous studies as well as basic learning theories (Barab and Duffy, 2000; Pea and Gomez, 1994; Riel and Polin, 2004; Stahl, Koschmann and Suthers, 2006) and group and social network theories and others inform such activity (see Table 1). It is thus no accident that many CSCL research teams also develop their own CSCL technology to facilitate/prioritize/enforce specific learning support and interactions based on the team's specific theory of collaborative learning. However, it has proved difficult to disseminate research projects in educational institutions. Another challenge is that even when transformative practices successfully emerge, scaling them would require substantial changes throughout the nested levels of the education system (Law, Yuen and Fox, 2011), including technology developers. On the other hand, in spite of the efforts made by the CSCL community, many public-domain digital tools, advertised as supporting collaboration, appear not to be informed by CSCL research, and even fewer actually scaffold and support convergence. In effect, popular social media have redefined the "sharing" of content in a way that excludes core concepts of collaborative learning. The question we would like to explore in this symposium is whether principle-based CSCL practices can be effectively implemented and scaled by commercially available technology tools, or whether the CSCL practices would necessarily be compromised in the name of scalability.

A complex-system view of scalability as proposed by Clarke and Dede (2009) builds on a foundational formulation by Coburn (2003). The five dimensions of the framework—*depth, sustainability, spread, shift and evolution*—point to the need for scalable innovations to be dynamic and responsive. Scale requires the availability of interaction mechanisms to support learning that are aligned with the change direction of the innovation at different levels of the system. A commercial product tends to be more sustainable and more likely to spread compared to a research prototype. On the other hand, can commercial products afford teachers' deepening of the transformative aspects of their collaborative practice? Will teachers and researchers still be able to exercise their agency and ownership to evolve the functionality and/or user interface of the commercial CSCL technology as the practice develops?

Gibson's (1977) concept of affordances may be instrumental here to frame the analysis. "An affordance relates attributes of something in the environment to an interactive activity by an agent who has some ability, and an ability relates attributes of an agent to an interactive activity with something in the environment that has some affordance" Greeno, 1994, p. 338). (See also Kreijns, 2004). More specifically, we refer here to Allaire's (2006) adaptation of Gaver's (1991) conceptual framework that offers a comprehensive approach for setting the problem. First, it is unclear that the designer's intent is influenced by CSCL research. Second, it is doubtful that teachers refer to learning science research when choosing tools for supporting student collaboration. Third, when technology design is principle-based, do teachers notice it? Or does the learning curve (for themselves and their students) in technology adoption keep them from appreciating tools grounded in learning-theory based perspectives (hidden affordances)? Fourth, is there any problem with teachers and students using appropriate social media tools for collaborative learning? Can learning-principle-based CSCL practices be effectively implemented using general communication tools and social media?

From the perspective that the interactions between the designer (technological innovation) and the user (pedagogical innovation), and their relationship are of critical importance as technology-enhanced learning issues, the papers presented in this symposium will explore the tensions and pedagogical interactions reported in the CSCL literature for four key types of CSCL technologies originating from research or as commercial products. These explorations will provide a rich basis for exploring the questions related to the scalability of CSCL pedagogical innovations and CSCL technologies.

Types of technology tools commonly used in CSCL research

It is fair to say that CSCL started in the computer science community to serve that community's need to collaborate in tackling technology development problems using the earliest Internet-based communication tools such as Emails, Listserv, Gophers. These tools were not specifically designed for collaboration, but they played important mediation roles by supporting the communication needs of a self-selected group of researchers to solve cutting edge problems in their fields. Hence, these rudimentary communication tools were appropriated by the respective communities of practice as productive CSCL/CSCW platforms even though these are not underpinned by any collaboration, learning or organizational models. The collaboration models were structured intentionally by the participants themselves.

Reviewing the CSCL technologies found in the literature, we identify four main categories based on their modality of communication: (a) asynchronous communication, (b) synchronous communication, (c) synchronous communication with shared visualization, and (d) social media. Further, we can broadly classify each category of

CSCL technology into three types in terms of their nature and origin: (1) a generic tool originating from research on that specific mode of communication, (2) a tool developed by the CSCL research community based on some well articulated design principle grounded in the learning sciences, and (3) a commercial product, that may or not have taken insight from the previous two types of software tools.

Table 1 provides a list of well known examples of CSCL technology belonging to each of the four categories of communication functions in each of the three origination types. There is a strong similarity in the relationship across the three types of tools represented as one goes across the columns for each of the four functional categories. In most cases, the starting point was a communication product originating from research labs. Later, such tools became appropriated by education technologists for use in teaching and learning situations, and at the same time further evolved into popular commercial products. However, in the case of social media, the sequence is reversed. For example, Edmodo was entirely build on the basis that students and teachers are so used to Facebook (FB) that it imitated FB to serve educational purposes. Also, though it is developed to serve as a learning support platform, it is doubtful that one can call this a principle-based product. Similarly, blogs, which are also used by some teachers to support collaborative learning, were developed as a general purpose tool, and later adopted for educational purposes.

Table 1: Examples of the four categories of CSCL technology belonging to each of the three origination types

Type of tool	From research: generic	From CSCL research: principle-based	Enterprise products (proprietory/open-source)
Asynchronous	• Listserv • Gopher • Email • Electronic forum	• CSILE • Knowledge Forum® • FLE1-2-3 • VGroups (Virtual-U) • ARGUNAUT	• General discussion boards • FirstClass/Blackboard/WebCT • Sakai • Moodle • MOOCs
Synchronous	• Earliest non-commercial text messaging	• MOO • TappedIN • MUVEs	• ICQ • Videoconferencing systems (Skype, Google Hangout, Adobe Connect) • Active World/Second Life • Multiplayer online games
Synchronous with shared visualization	• Shared whiteboards	• CoVIS • Virtual Math Teams (VMT) • Scratch • CoLab: Virtual Laboratory	• GoogleDocs • Collaborative concept mapping tools (Cmap, Bubble.us, Mindmeister)
Asynchronous social media	• Wikipedia • Edmodo	• Wikis & blogs for classroom use	• Blogs • Twitter • Facebook , …

In this symposium, each of the four functional categories of CSCL tools will be introduced by a researcher who has conducted principle-based investigations involving that category of tools. The presentation will focus on what counts as principle-based teaching and learning practices for their work, how far they think the CSCL tools used have to be principle-based as well, and in so doing, present their perspectives on the tension between design affordance and perceived affordance, and how far the realized affordance depends on the intentional characteristics of the learners and teachers vs. the design features of the technology.

Asynchronous CSCL

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Email allows for one-to-one and one-to-many communications while eforum supports many-to-many communications. When integrated into learning environments, forums are meant to support communication and collaboration. They expand opportunities and bring flexibility to teacher-learner, learner-learner and teacher-teacher interactions. These affordances are perceptible by most designers and users of online and blended learning environments. Computer-mediated-communication (CMC) research and CSCL research have been documenting teachers' and students' discourse practices.

Affordances less perceptible by users are those that are the results of research advances. Facing the complexity of collaboration as a process and collective knowledge as a product, CSCL researchers work on identifying online/onsite discourse patterns and principles. Some also contribute as members of technology development communities on CL-informed digital tools and platforms. They identify new tool functionalities meant to assist the teacher in their orchestration, scaffolding and monitoring of the CL process and in the analysis and visualization of the learning outcomes. It is to these researcher-led CSCL tools that I turned for designing, implementing and sustaining blended-learning models empowered by digital technologies. I used Virtual-U VGroups (Harasim, 1999) and, later, Knowledge Forum® (KF) for building a virtual community to support teacher candidates doing field experiences and pratica in a secondary school program on one-to-one laptop classrooms (Laferrière, 2002, 2010). Beginning in 2002, a colleague and I recommended the use of KF for networking small rural schools as the technology platform to implement ways of enriching their learning environment (Scardamalia & Bereiter, 1994). In each case, therefore, the use of an eforum was embedded in a larger socio-technical scheme. There were competing commercial technologies that IT personnel in school districts and others would have preferred over a less known collaborative tool, and to whom the concepts of progressive discourse and emerging knowledge-building community are rather alien and incomprehensible. Over the years, the tension manifested itself in many forms, and needed to be addressed for the government-funded Remote Networked School initiative to sustain and scale (Laferrière, Hamel, & Searson, 2013).

Researchers had a lot of explaining to do regarding the value of KF. Evidence of student learning outcomes has been critical for the model to evolve (2002-2014), and become the main socio-technical design for the Networked School (NS), within which collaborative learning and knowledge building occur in Quebec schools. Today, however, another group of educators is building a network of networked schools, using social media technology (Twitter) as its main networking tool, which is expected to scale rapidly. The possibility that this development will lead to further distinction of the NS model (e.g., KF-supported NS or knowledge-building NS) is slight given the variety of technologies that teachers and students now access for collaborative purposes. The notion that in tomorrow's networked schools different activities will be supported by different technologies seems realistic.

Synchronous Engagement: Context for Content

Linda Polin, Pepperline University, USA

Asynchronous products supposedly offer endurance or persistence, as opposed to the allegedly ephemeral quality of synchronous communications. However, almost every commercial VOIP chat space (*FUZE, Connect, Elluminate, GoToMeeting, Skype*) now offers the ability to record and distribute recordings. In addition, file exchange and sharing are features of every commercial synchronous product listed above. There is, however, a crucial element found in early synchronous communication spaces that should still matter in consideration of synchronous tools for learning: a sense of place. That is, talk arising in a virtual reality, a place.

There are at least two versions of support for learning conversations afforded by a sense of place. In one version, place is valued as it situates knowledge in the context of its use, as exemplified by multiplayer virtual worlds explicitly constructed to support curricular aims. River City, Whyville, and most notably *Quest Atlantis* (atlantisremixed.org) are examples of synchronous spaces as immersive, curricular simulations (Barab et al, 2010; Ketelhut, Nelson, Clarke, & Dede, 2010; Fields and Kafai, 2009). Focused as they are on very specific age levels and curricula, these spaces are not commercially viable/sustainable. More recently, we see practitioner groups harnessing existing commercial, subject-neutral, virtual worlds for curricular aims. *World of Warcraft* (wowinschool.pbworks.com), *Second Life* (Warburton, 2009), and *Minecraft* (minecraftedu.com) have been appropriated from the leisure play arena to support intentional learning across age levels and topics.

In another version, place anchors talk in a social space with all the affordances of third place social spaces (Oldenburg, 1997; Schlager, Fusco, & Schank, 1998). Here, place locates a conversation in a social situation beyond that which the speaker normally occupies "in the real world." This can influence engagement and risk-taking, especially when that influence is subtle and carried by the scene rather than by explicit pedagogical moves (Polin, 2000; Salmon, 2009). In early pre-web synchronous networked communications, talk was constrained to text chat in a constructable microworld, e.g., *LambdaMOO* (Curtis, 1992) and MIT's *MOOSE Crossing* (Bruckman & Resnick, 1995). These spaces provided a world in which members could talk not only to each other, singly or in groups, but could also construct and share objects online in real time.

With the popular adoption of LMS/CMS platforms (Blackboard, Sakai, Moodle, and many more) by educational institutions for e-Learning, synchronous engagement has effectively become re-embedded in a classroom metaphor. VOIP and text chat arise in a space that typically has a "whiteboard," and in which "documents" and "links" can be viewed together. There is nowhere to contextualize conversation beyond that of the occasion, i.e., class. There is no persistent world, and the conversational group is sequestered by "class."

This presentation will focus on the tensions between curriculum, pedagogy, and technology in virtual world settings for "chat," to consider the role and value of place (immersion) for synchronous engagement in schooling, and the design issues that are raised.

Synchronous CSCL with shared working space

Gerry Stahl, Drexel University, USA

CSCL began with the distinction between cooperation, in which tasks are divided up and important work is done individually, versus collaboration, where people work together in small groups, build a "joint problem space," engage in "joint attention," develop "intersubjective meaning" (Stahl, 2015). In the Virtual Math Teams (VMT) Project, we found that collaboration is best supported by synchronous communication around a shared working space in which everyone can interact equally and spontaneously (Stahl, 2009). Collaborative learning of specific domain knowledge, such as school geometry, benefits from a specialized environment with custom components (see, e.g., http://ggbtu.be/b154045) to support individual, small-group and classroom efforts (Stahl, 2013).

Initially, we considered building VMT on top of social media apps and open source components or environments. However, these are all designed to meet corporate or institutional goals, like advertising or tracking students, not collaborating or building knowledge. There is not an educational market to attract corporate developers, except textbook companies, who are adverse to digital competition.

Of course, it pays to build as much as possible on existing platforms to facilitate updates to technology, but turning over control to commercial entities has rarely paid off for educational applications, as the businesses quickly lose interest and profit motives. Funding agencies should consider supporting sustainable non-profit solutions, as such innovation developments are generally publicly funded and educational applications serve a broad public need, potentially reducing costs of other resources. The Math Forum and GeoGebra have sustained themselves for years, in the tension between research funding and income generation.

Social media have become commercially successful because they are technically simple and trivial to use. They do not require training, practice or skills in collaboration. They are also generic, so they can be offered to a global market. Success in using them consists in just posting anything: a "like," a raw emotion, a cat video. Social media are generally asynchronous, allowing simple, independent actions of posting, viewing and responding—not interacting. Attempts to use social media in education must overcome the habits of users to post trivialities and obscenities. Education is complex and learning is difficult.

The increasing technical opportunities offered by social media are offset by their continuing tendency to reduce users to isolated consumers of information and individualized expressers of personal opinion. The exciting promise of globally networked computers has been consistently diverted away from collaboration in networked groups toward cooperation of individuals.

Social Media--a creative commons for learning scientists

Rick Alterman, Brandeis University, USA

During the last few decades a tremendous amount of general-purpose collaborative technology has been produced. Each collaborative platform commits to an arrangement of features and methods, ways to communicate, coordinate, create and share artifacts, participate, and engage in a virtual social situation. Within and outside the learning sciences, empirical studies on social media like Wikipedia have reported important general findings about social technology and their use (e.g., Oeberst et al 2014; Viegas 2007). There is a gap, however, between what the general purpose technology can do and what is required in a specific learning situation. There are many situational factors that need to be accounted for in order to make the technology work effectively as a support for learning. What is the subject? Is the learning intentional, incidental, classroom-oriented, and/or lifelong? What are the learning goals, objectives, and activities? Is the technology for the classroom, or for doing homework? Is the course blended, flipped, or completely online?

The gap between what the technology can do in general and the requirements of the learning situation is the *middle zone* in which the learning scientist operates. She must create a learning environment that serves to present and support the learning situation and as the mediating technology. The learning environment that is constructed is a result of principled learning-science-based design work: it accommodates the requirements of the learning situation by customizing, reconfiguring, and making additions to the base technology. For example, where the use of a general purpose blog in the classroom generates less interaction than is ideal (Deng & Yuen 2011), enabling students to share drafts of their posts greatly increases interaction and peer collaboration amongst the students (Alterman and Gunnarsson 2013). Without this reworking of the basic platform, without the adjustments and additions, the technology is less effective or just plain fails.

By sharing extendable collaborative platforms, this middle zone can become a *creative commons* (Lessig 2002) for learning scientists where they perform research studies, better understand the utility and functionality of the technology in different kinds of learning situations, and develop design rules-of-thumb. Some examples of rules-of-thumb for blogging might be: students receive more peer feedback in smaller blogging groups, or sharing drafts of blogs increases collaboration and interaction amongst the students. If the community establishes code repositories it becomes possible to create libraries of plug-ins and software packages. Examples of code that potentially could be shared are methods for visualization (Larusson and Alterman 2009) and assessment (Gunnarsson and Alterman 2014), and alternate approaches to drafting blog posts. Thus, over time, the creative commons becomes a significant resource for the rapid construction of learning environments and research progress.

Challenges to the adoption of principled-based CSCL technology

To gain a more comprehensive overview of the extent to which research and development involving CSCL implementations in various learning contexts are using collaboration technology generated from academic research labs or commercial products, we conducted a quick review of the proceedings of past CSCL conference proceedings. The review found that only a few of the technologies used in the reported studies were developed by CSCL tool development communities. Further, the technologies originating from CSCL research labs generally do not sustain nor scale at a level comparable to those of public domain tools that have been integrated into the classroom. Among the most used and/or researched, we find Knowledge Forum, TappedIN, Scratch, and Virtual Math Teams. This apparently runs counter to what one may expect from the four researchers' viewpoints expressed in this symposium—that there is a gap between the commercially available tools and the pedagogical functions desired from the CSCL technology, irrespective of the form of technology-mediated CL under consideration. Does this relatively low adoption of principle-based digital tools by CSCL researchers indicate significant adoption hurdles that they cannot afford to confront? Or does it indicate that as long as they can provide a strong pedagogical focus on principle-based CSCL practices, the designed affordance of the technology is not that important?

The literature on ICT-enabled pedagogical innovations may shed light on the challenges faced by researchers conducting design-based CSCL research in authentic school environments. Assuming that the primary interest of the CSCL researcher is to facilitate pedagogical innovation in real life classrooms with all its myriad complexities, the challenge is multidimensional and multiscale (Law, Yuen and Fox, 2011; Kampylis, Law and Punie, 2013), and the use of specific software is only one part of the ICT infrastructure that needs to be catered for within the eight key dimensions of innovative classrooms (Bocconi, Kampylis and Punie, 2013). Leveraging technology tools that are already familiar to teachers and learners lowers the innovation threshold they need to overcome in the process of innovation adoption. On the other hand, the use of general, public-domain software limits the extent to which principle-based CSCL practices can be implemented, as argued by the four presentations in this symposium. (See also Brown and Campione's (1996) notion of lethal mutation, that is, a re-interpretation that no longer captures the pedagogical essence of the innovation.) Is there a possibility to bridge this chasm between implementing and exploring learning-theory-based CSCL practices and scaling such practices widely in the community?

Can there be a socio-entrepreneurial design for scalable, twinned innovations in principle-based CSCL technology cum pedagogy

In recent years, research on reform and innovations have increasingly drawn insight from literature on complex adaptive systems (CAS) (Lemke and Sabelli, 2008; Kampylis, Law and Punie, 2013). There is wide recognition that sustainable and scalable change of CAS is a progressive incremental process requiring many different agents to self-organize and co-evolve in tandem, and that impacts from change implementation take years before they can be observed at the system level, after cycles of iteration and improvement. There have been studies that identified social designs to connect different actors at teacher, school leadership and district levels, referred to as architectures for learning, that will contribute to the success and scalability of reforms and innovations (e.g. Stein and Coburn, 2008). However, there it little in the literature that explores the social architecture for technology developers to effectively engage in mutually beneficial interactions and collaborative co-evolution of CSCL pedagogy and technology for both to achieve sustainability and scalability. Such social architectures have to serve the entrepreneurial development needs of the technology developers as well as the pedagogical and learning science aspirations of practitioners and researchers, and probably require the support and involvement of relevant policy makers. It is hoped that this symposium will stimulate conversations and explorations in this direction.

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