Computer-Supported Collaborative Learning (2015)

A decade of CSCL

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This issue of *ijCSCL* completes a decade of publication of CSCL research.

When the field of Computer-Supported Collaborative Learning emerged about a decade prior to the launching of the journal, there was a pervasive sense of a paradigm revolution in learning research (Koschmann 1996). It was time to transcend cognitive science's critique of behaviorism, extending the unit of cognition beyond the boundaries of the individual mind (Stahl 2015c). For instance, new directions in theory surfaced around the influential Institute for Learning Research (Brown, Collins & Duguid 1989; Lave & Wenger 1991; Orr 1990; Suchman 1987; Teasley & Roschelle 1993; Winograd & Flores 1986), as well as in distributed cognition (Hutchins 1996), activity theory (Engeström 1987) and conversation analysis (Goodwin & Duranti 1992). *IjCSCL* has continued and extended this interest in innovative theory, further exploring the centrality to social cognition of physical artifacts and interactional resources (Arnseth & Ludvigsen 2006; Damsa 2014; Jones, Dirckinck-Holmfeld & Lindstrom 2006; Overdijk, van Diggelen, Andriessen & Kirschner 2014; Stahl 2012; 2013a).

Cognitive science argued that human behavior could not be modeled without hypothesizing cognitive structures like mental representations and computations, which mediated responses to the environment, particularly linguistic responses (Chomsky 1959). However, the cognitive approach did not consider structures of interaction at the dialogical, small-group and community level, where language is primarily learned and practiced. Artificial intelligence—which exerted an important influence on CSCL—had already conceptualized cognition as taking place outside the human mind, in software computations and digital representations. The new post-cognitive theories began to postulate structures and practices at the group level, although they did not always clearly distinguish small groups from larger social institutions. Dialogical, interactional and practice-oriented approaches in CSCL have elaborated these conceptions within the context of collaborative learning (Cress & Kimmerle 2008; Ligorio, Loperfido & Sansone 2013; Öner 2013; Stahl, Cress, Ludvigsen & Law 2014).

While the post-cognitive paradigm dominates CSCL *theory* and seems particularly appropriate to a field focused on group collaboration, it has perhaps been less influential in the areas of technology *design* and analysis *methodology*. CSCL research often relies upon technologies designed on a model of individual learning and knowledge transfer, rather than on an understanding of meaning negotiation, collaborative knowledge building or dialogical interaction. For many researchers, it is easier (or more affordable) to use commercial software to support communication than to develop innovative applications that are devised specifically to foster group cognition. Unfortunately, commercial software is designed to enhance personal productivity and to exchange individual opinions, rather than to support collaborative knowledge building.

Analytic methods applied in CSCL studies also frequently assume a cognitive framework, focused on individual student cognition, even in contexts of small-group collaboration or classroom knowledge building. Researchers are primarily trained in techniques and standards based ultimately on positivistic conceptions of rigor. According to recent analyses of the CSCL literature (Jeong, Hmelo-Silver & Yu 2014; Tee & Lee 2013), statistical measures at the individual unit of analysis dominate the field. Many other educational journals reinforce the associated traditions of experimentation and reporting. Academic institutions and funded labs—in which most CSCL researchers work—reward research that conforms to established practice, militating against development and dissemination of innovative methods. Although there have been calls for analysis at the group unit of analysis (Stahl 2015b; Zemel & Koschmann 2013), most publications still rely upon pre/post tests of individuals or coding of individual utterances/postings. While it is possible to adapt data sessions and interaction analysis from conversation analysis to the online educational context, this requires extensive training and adoption of new practices for research teams. It also results in reports that may be harder for reviewers of some educational journals or conferences to assess.

A clear and positive tendency within CSCL during the past decade has been growth in international efforts, as well as an increase in multi-method and design-based research (DBR) approaches. These two trends are critically important for the future of educational research. They are synergetic, because the sort of DBR needed to influence educational policy and practice requires large multi-disciplinary efforts, which individual researchers and even single labs cannot undertake, manage or fund.

While it is now clear that collaborative learning across networked devices can provide an important component of education for the future, CSCL has yet to make a major impact on schooling around the world. Teachers and policy makers do not generally understand the social basis of learning and how small-group collaboration can be effectively orchestrated with classroom instruction, book learning, Internet browsing and individual reflection to form a mutually supportive and flexible learning environment. Given the institutions of schooling we inherited from the industrial age, there is now a need for teacher professional development in guiding and supporting collaboration as well as the development of curriculum aligned with established standards across grades. The curriculum and pedagogy should incorporate a learning-sciences emphasis on student-centered, collaborative, explorative, immersive, problem-solving, computer-supported approaches.

There is no profit motive to encourage companies to tackle these challenges, so the work is left to non-profit consortia. CSCL research has established that the development of teachers who can create collaborative classrooms takes several years and the development of curriculum that works effectively in small-group interaction requires many iterations of trial and redesign. These costly processes require the commitment of national educational institutions and international funding of educational R&D on levels that we have not yet seen. European Networks of Excellence (e.g., Kaleidoscope), the US Science of Learning Collaborative Networks and initiatives in Singapore and Hong Kong (Chan 2011; Looi, So, Toh & Chen 2011) may be seen as tentative steps in this direction.

We would like to see CSCL technologies, pedagogies and curriculum used by students in multiple subjects and across successive grades. The educational programs should be transferable to or accessible by communities in all countries. The CSCL research community cannot accomplish this on its own, but it can take a leadership role in catalyzing it. John Dewey's insistence that a democratic society requires an educated population that can engage in inquiry on open-ended issues seems more trenchant than ever. A collaborative, informed and reflective attitude among the world's population is needed to solve the pressing issues of global peace, sustainable environment and economic justice.

CSCL research reported in *ijCSCL* on simulations, argumentation support and knowledge building often targets these challenging topics. The Executive Editors of *ijCSCL* are each involved in research labs with national and international collaborations, as are many other members of the *ijCSCL* Board of Editors. They are also engaged in policy discussions with their national and regional educational ministries to implement future-oriented innovations. In collaboration with international colleagues, I have published analyses from the Virtual Math Teams Project, illustrating a concrete model of DBR exploring

CSCL technology, pedagogy, curriculum, methodology and theory within an integrated post-cognitive approach (Stahl 2013b; 2015a) as a path for advancing CSCL research systematically.

In the coming decade, *ijCSCL* will continue to feature visionary investigations that suggest broad impacts as well as publishing traditional studies that contribute incrementally to the CSCL scientific literature. In its first decade, the journal helped to establish the potential centrality of CSCL to education for the future; in its next decade, the journal will suggest and support efforts to implement urgently needed educational transformations on a global scale, based on peer-reviewed analysis of international design-based research and other knowledge-building advancements.

Advancing knowledge-building discourse

The most extensive and influential example of an effort to impact schooling with a CSCL approach has been the Knowledge Forum project, directed for many years by Marlene Scardamalia and Carl Bereiter at OISE in Toronto. Based on theories of the role of reading and writing in learning, they proposed that students should have media and practices through which they could communicate and build textual knowledge together on the model of academic communities. Just as journal articles and conference papers allow scholars to articulate their ideas, discuss them and revise them in a community context, so students should be able to propose theories, react to the theories of others, share pro and con evidence and collectively refine the theories. The project developed many iterations of software to support this process, involved researchers from around the world and mentored teachers for years. The project experimented with curricular topics from various academic fields and published analyses of classroom experiences. This continuing project has produced many researchers and teachers oriented to CSCL. It has also developed the central theory of knowledge building, in which ideas are refined through computer-supported classroom discourse.

In this issue, *Bodong Chen, Marlene Scardamalia and Carl Bereiter* propose a new feature for their software, support for promising ideas. The ability to recognize and focus on promising ideas is an important skill for knowledge building. For instance, Ph.D. students must propose a promising idea for their dissertation topic in order to succeed and researchers must argue for a promising idea in order to be awarded a grant. In this article, the authors describe a promising idea for software support of knowledge building: a promising-ideas tool. They show that even young children (about 8 years old) can identify, communicate, respond to and build upon promising ideas in their knowledge-building discussions, mediated by this tool. By making the identification of promising ideas explicit within the classroom discourse practices, the tool instills in the students the important skill of making judgments of what is likely to become an important idea in their community discourse. This tool is just one new refinement to the software and classroom practices of the authors' DBR process of iteratively testing new features, just like last issue's formative-feedback tool (Resendes et al. 2015).

Argumentation style

Another dominant research effort within CSCL has been the exploration of support for argumentation. It seems reasonable that this would be a promising idea in CSCL since argumentation is a way of conceptualizing the negotiation of meaning and the building of knowledge through community discourse. Aristotle began the formalization of rational discourse as logic and Toulmin (1958) proposed a rubric for scientific arguments. Toulmin's logical model has been influential in CSCL research, despite the fact that student discussions of topics generally follow very different patterns. For recent *ijCSCL* articles on argumentation, see (Alagoz 2013; Asterhan & Schwarz 2010; Scheuer, Loll, Pinkwart & McLaren 2010; Schwarz, Schur, Pensso & Tayer 2011).

The Irish authors of our second paper—*Owen M. Harney, Michael J. Hogan, Benjamin Broome, Tony Hall and Cormac Ryan*—explore the effects on argumentation style of various task-level and process-level prompts. These experimentally manipulated features of the support software mediate the student argumentation. This alters the group discourse practice and, potentially, the individual students' style of argument (including their silent mental thinking).

Cohesion and dialogism

The field of CSCL emerged from an interest in taking advantage of artificial intelligence in education and in educational research. One perennial goal has been to automate the analysis of student discourse using AI techniques. Meanwhile—with the use of CSCL technologies like social media, discussion environments and MOOCs—the need for using computer processing of discourse has grown tremendously in order to bring pivotal interchanges to the attention of teachers and others (Law & Laferrière 2013). *IjCSCL* has periodically reported on such efforts (Erkens & Janssen 2008; Gweon et al. 2013; Mu et al. 2012; Rose et al. 2008).

For a number of years, a lab in Romania has been developing procedures to capture the "polyphonic" nature of knowledge-building discourse, in which multiple voices interact in vertical simultaneity and the ideas expressed are repeated and refined in horizontal sequentiality (Trausan-Matu, Dascalu & Rebedea 2014). In an extension to this work, reported by *Mihai Dascalu, Stefan Trausan-Matu, Danielle S. McNamara and Philippe Dessus* in this issue, methods of automatically capturing thematic cohesion are integrated as part of the horizontal progression of ideas. By incorporating McNamara's linguistic theory of topic cohesion, the analysis of knowledge building over time in student discussion is significantly enriched.

Live learning analytics

Live feedback to students about their behavior can be effective in many ways (Enyedy, Danish, Delacruz & Kumar 2012; Schneider & Pea 2013). However, the promise of robust and useful automated discourse analysis—especially in real time—has been largely elusive until now. Statistical AI approaches require large amounts of data, which were hard to collect quickly in the past. With the proliferation of online education—especially using MOOCs—techniques developed for "big data" are now becoming applicable. In the final article of the 2015 volume of *ijCSCL*, *Matthew Berland, Don Davis and Carmen Petrick Smith* provide an example of identifying specific discourse features relevant to collaborative learning and displaying representations of the behavior of these features in the interaction of student groups. These displays are made available to the teacher in real time to inform the process of matching students into collaborating pairs.

While the idea of displaying learning analytics to teachers and students in a live setting has been frequently proposed, the evidence that the analytics proposed by researchers and programmers are understandable and helpful for classroom teachers and their students is far less common. The AMOEBA system reported on here analyzes the software programming work of students and makes recommendations based on its analysis of which students might most effectively collaborate with each other. The study concludes that these automated recommendations did in fact lead to improved learning and more sophisticated programming by the students.

The next decade of CSCL

The four articles collected here are suggestive of future advances in CSCL. Computer science continues to play a central role in implementing new features to support student collaboration, new techniques for aiding analysis of group-level processes, new methods for assessing collaborative learning and new theories, such as promissingness, polyphony or learning analytics. It is important that innovation in our field continue to blossom in a diversity of directions, including both incremental refinements or creative variations and fresh breakthroughs or radical departures. However, it will also be imperative to consolidate the many isolated advances into larger efforts that can effect a fundamental transformation of how the world thinks about education. We need to flesh out models of collaborative learning that are not only demonstrably effective under a range of settings, but are packaged to be used in practice by teachers everywhere. This will necessarily involve new kinds of research networks. Only this way will computer-supported collaborative learning become widely recognized as a fundamental form of learning and be adopted as a prevalent approach.

Ideas want to be free

When *ijCSCL* started, an innovative agreement was negotiated, where the journal could maintain a free and open website with pre-publication versions of all *ijCSCL* published articles (http://ijcscl.org/?go=contents). For the second decade, the agreement has been extended to provide free access for all ISLS members to all the final versions through the members-only page of the ISLS website (https://www.isls.org). By the time you read this, the new benefit should be accessible. So be sure to maintain your ISLS membership and you will have a free online subscription to *ijCSCL* and *JLS*.

Reviewers are the foundation of the journal

We gratefully acknowledge the researchers who have established the high standards of publication in *ijCSCL* by rigorously reviewing submissions and guiding authors to improve their presentations. Most of the *ijCSCL* Board of Editors and reviewers will be continuing in the coming years. The following people submitted reviews during the past decade:

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