Seven Challenges in CSCL

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Abstract: This paper identifies and discusses seven challenges in the current state-of-the-art in Computer Supported Collaborative Learning (CSCL): (1) tensions between the dominant theoretical approaches and the lack of "native" theories, (2) development of CSCL systems that are pedagogically innovative as well as aesthetically pleasant, (3) designing collaborative learning interventions, (4) diffusion, adoption, and acceptance of CSCL technologies, (5) lack of comparative studies, (6) the gulf of relevance between CSCL research and practice, and (7) the gulf of rigor between CSCL insights and policy prescriptions.

Introduction

The purpose of this paper is to identify and discuss critical contemporary challenges in CSCL. The paper has two objectives. First, to collect and crystalize several diverse and disparate strands of on-going discussions within CSCL on theories, methods, technologies and so on. Second and last, to facilitate an artifact-centered debate and discussion of the key challenges identified to further both the intellectual rigor and societal relevance of CSCL studies and findings. The seven challenges are: (1) tensions between the dominant theoretical approaches and the lack of "native" theories, (2) development of CSCL systems that are pedagogically innovative as well as aesthetically pleasant, (3) designing collaborative learning interventions, (4) diffusion, adoption, and acceptance of CSCL technologies, (5) lack of comparative studies, (6) the gulf of relevance between CSCL research and practice, and (7) the gulf of rigor between CSCL insights and policy prescriptions. The remainder of the paper is organized as follows. In the next seven sections, each of these seven challenges are first presented and then discussed. Limitations of the paper are discussed towards the end.

Challenge #1: Resolving Theoretical Tensions: "Native Theories"

According to Suthers (2006), CSCL predominantly employs an intersubjective epistemology. As argued by Koschmann (2002), CSCL is centrally concerned with designing artifacts for and understanding practices of joint meaning-making in learning contexts. Theoretical approaches in CSCL are from a variety of disciplines and span socio-cognitive, socio-cultural, micro-sociological and structuralist paradigms. The nature of explanations range from demonstrating the pedagogical effectiveness of a technological design artifact, to improving collaborative learning outcomes by dialogue systems, and to uncovering interactional accomplishments in CSCL settings.

Currently, there is heavy theoretical borrowing in CSCL from reference disciplines such as developmental psychology (e.g., Piaget, Vygotsky) and sociology (Marxist dialectical materialism, Garfinkel's ethnomethodology). That is, theories from reference disciplines are transported, translated and transplanted into CSCL. This creates a sense of theoretical diversity for the CSCL field as a whole and a sensibility of theoretical coherence for an individual research project. However, key theoretical concepts undergo "conceptual stretching" (Collier & Mahon Jr, 1993; Sartori, 1970) when decontextualized from the analytical contexts of reference disciplines. A prime example of this is the adoption of the notion of "affordance" from ecological psychology. The term was coined by J.J.Gibson (1979) and introduced to human-computer interaction by Norman(1990). Subsequent uptake in CSCL (Bonderup Dohn, 2009; Kreijns & Kirschner, 2001; Suthers, 2006) has paid little attention to the theoretical developments beyond Gibson's seminal contribution and Norman's original adaptation (cf. Vatrapu, 2010). As such, affordances by and large are understood to be features, widgets and tools instead of relational properties. Additionally, there exist unresolved tensions even in a seemingly coherent approach such as the socio-cultural tradition between process realism and inseparability of the individual and the social formation (Sawyer, 2002).

Issues in and aspects of CSCL crisscross the *psychological* (cognitive, cultural, ecological, cultural), *sociological* (micro, macro), *technological* (design, development, deployment, adoption, evaluation), *interactional* (appropriation, enactment), and *pedagogical* (knowledge, skills, aptitudes, outcomes). As such, CSCL needs a "theoretical object" that can help researchers develop a descriptive vocabulary and an interpretive framework for CSCL phenomena. To address this challenge, "native" theories are needed. Native theories are first-order theories that conceptualize, describe, analyze, interpret, explain (and possibly predict) phenomena in CSCL with regard to intertwining of collaborative actors, technological artifacts, joint meaning-making practices, pedagogical processes and products. Notable attempts include but are not limited to group cognition (Stahl, 2006), theory of socio-technical interactions (Vatrapu, 2009), and learning as participation in autocatakinetic systems (Barab et al., 1999). We need more empirically informed first-order native theories and "native" theory-informed empirical studies to advance the field of CSCL.

Challenge #2: Systems Development: "Broccoli vs. Ice-cream"

The second challenge refers broadly to the role of computational support in CSCL systems. From a HCI standpoint, usability, sociability and learnability are three interdependent design dimensions for CSCL systems (Vatrapu, Suthers, & Medina, 2008). Given the central role that motivation plays in learning (Cordova & Lepper, 1996; Eales, Hall, & Bannon, 2002), it is critical that CSCL systems go beyond being functional research prototypes and become professional-grade applications that provide rich and engaging user experiences from an aesthetic, social phenomenological and critical design perspectives. In addition to traditional CSCL technology design concerns of enhancing learning, improving group awareness and such, the design challenge is to incorporate hedonic usability (Hassenzahl, 2004). One consequence of not adopting a holistic design approach might be the prevalence of "performance vs. preference paradox" (Vatrapu, et al., 2008). The "preference vs. performance paradox" points to the fact that high levels of user performance with and/or technical performance of a system can in some instances be accompanied by low user satisfaction scores. If CSCL systems design only incorporate instrumental aspects and but not the hedonic aspects of design, there might be high performance gains on short-term studies (in lab settings or in-situ DBR settings) but negative preference attitudes and low long-term adoption of CSCL systems. To put it differently, there is the danger of the "broccoli vs. ice-cream effect" with instrumentally rich but experientially poor CSCL systems. Just because the new generations of learners are increasingly growing up with pervasive and ubiquitous information and communication technologies (ICTs), it doesn't mean that they will automatically and universally prefer CSCL systems. One of the prime arguments for technology enhanced learning has been that in a world of constant connectivity and near ubiquity of ICTs, technologies must be leveraged pedagogically. But the HCI design challenge here is that the ICTs that students are immersed in and engaged with in their daily lives outside the formal learning settings are aesthetically rich, multi-textured and for a lack of better words, *cool and sweet* (like ice-cream). This is in contrast to the current situation, where many and not all, CSCL systems are functionalistic but not aesthetically rich from a user experience perspective and as such might be perceived as dull, boring, and uncool (like broccoli). That is, just because students are growing up with digital technologies; it doesn't necessarily follow that they will like *learning* technologies (just like their love for eating ice-cream doesn't guarantee a concomitant love for eating broccoli).

Challenge #3: Orchestrating Collaborative Learning: Re-centering Teachers

Given CSCL's foundational emphasis on shared conception of the problem and joint meaning-making, orchestrating collaborative learning is a core issue. As an instructional technology paradigm, CSCL displaces the teacher from the core of the learning activity and instead locates the center with the collaborative group with near-symmetrical socio-cognitive configurations, equitable division of labor, shared conception of the problem, and distributed task goals. Scripting has been an influential, productive and effective strategy to orchestrate collaborative learning (Weinberger, Ertl, Fischer, & Mandl, 2005). Scripting has been supported from both Vygotsky's (1930/1980, 1962) concept of the "Zone of Proximal Development" as well as Bruner's (1978)concept of "Scaffolding". However, as pointed by many researchers, the notion of "Zone of Proximal Development" is an asymmetrical social configuration between a more capable adult-teacher and the child-student (Fernandez, Wegerif, Mercer, & Rojas-Drummond, 2002; Garrison, Anderson, & Archer, 2000). Near-symmetrical socio-cognitive configurations of collaborative groups are therefore a conceptual challenge within CSCL. Orchestrating CSCL by re-centering teachers within the classroom practice could be a step towards addressing this challenge.

Challenge #4: Diffusion, Adoption and Acceptance of CSCL Technologies

With respect to existing work in CSCL, we can make there characterizations. First, most, if not all, of CSCL research is focused on the primary and secondary school settings with relatively fewer higher education applications (e.g., Strijbos, Kirschner, & Martens, 2004). Second, a majority of CSCL research is in the STEM disciplines (Science, Technology, Engineering, and Math). Third and last, there is little cross-fertilizations of ideas between related fields of in human-computer interaction (HCI), computer supported cooperative work (CSCW), designing interactive systems (DIS) and CSCL. While there has been considerable systems development research in CSCL (for example, see the argumentation systems reviewed by Scheuer, Loll, Pinkwart, & McLaren, 2010), there is little attention paid to the diffusion (Rogers, 1995), adoption (Katz & Shapiro, 1986) and acceptance (Venkatesh, Morris, & Davis, 2003) of CSCL technologies. In my opinion, CSCL faces diffusion, adoption and acceptance challenges both horizontally (across the STEM disciplines and with other academic fields such as HCI and CSCW) and vertically (from secondary to tertiary education). At present, CSCL is relatively poor at diffusing ideas and tools to related fields such as organizational learning.

Challenge #5: Comparative Studies

Given that culture, language, cognition, and action are intricately intertwined (Vatrapu, 2010), in a technology driven multi-cultural and multi-lingual world, we need to empirically examine the design assumptions in CSCL. Learning sciences researchers have begun to critically engage with these issues by employing a rich mix of theories and methods across a diverse range of informal and formal learning settings (Rose et al., 2010). For instance, emerging results in CSCL empirically document cross-cultural variation in tool appropriation and social relationships in CSCL systems (Vatrapu, 2008; Weinberger & Nistor, 2010). One productive avenue for CSCL could be to employ the comparative method to study phenomena across a wide variety of cultures, languages, contexts, countries and settings. "Multiple conjectural causation" is at the heart of the comparative method and posits a combinatorial relationship between causes and effects-multiple causes interact in different combinations to produce effects (Ragin, 1987).

Challenge #6: Practice Implications: Gulf of Relevance

The practice challenge in CSCL relates to bridging the gulf of relevance between CSCL research and teachers' professional practice in schools. Generating implications for the professional practice of teachers has long been a topic of interest within CSCL (e.g., Lockhorst, Admiraal, Pilot, & Veen, 2002; Lund & Baker, 1999; Resta, Christal, Ferneding, & Puthoff, 1999). As mentioned earlier, in CSCL, one side effect of the near-symmetrical socio-technical configurations of students, equitable division of labor, shared conception of the problem, and shared task goals is the displacement of the teacher from the analytical center and a delimitation of the teacher's role to that of a facilitator of discourse and a designer/architect of content. In order to bridge the gulf of relevance between research and practice, CSCL insights needs to be relevant across the broad spectrum of context-dependent, situation-specific, and institutionally-relative teaching practices. Both student-teacher and student-teacher interaction as well as "outeraction" (Nardi, Whittaker, & Bradner, 2000) need to be addressed. Further, CSCL research needs to address the challenges that teachers face in the context of the high-performance/high-density/date-rich 21st century classrooms with 1:1 computing, ubiquitous, pervasive, and mobile computing, diversified info information ecologies, and diverse learning trajectories of individual students (Crawford, Schlager, Penuel, & Toyama, 2008). As such, I think that CSCL research needs to focus on providing both computational and methodological support for teachers in *real-time* and *in-situ* classroom settings to bridge the gulf of relevance (see NEXT-TELL project website (www.next-tell.eu) for a description for the demands of teaching in the classrooms of the 21st century).

Challenge #7: Policy Prescriptions: Gulf of Rigor

Engagement with policy-makers is gaining increasing attention with CSCL (Vosniadou & Dirckinck-Holmfeld, 2009) and the wider learning science community in general (the recent ISLS members listserv discussion on policy). However, we need to recognize that (1) *policy-making/policy-formulating* and *policy-informing* are two different endeavors requiring different competencies and that (2) *educational-policy*, *pedagogical-policy*, and *learning-policy* are at different levels. *Policy-informing* requires translating and advocating the CSCL insights gained from systematic research into meaningful and actionable empirical facts for the perusal of decision-makers in the different communities of policy practice (from the classroom and the school to the school board and the national government). As such, *informing-policy* is a translation and advocacy task that requires policy-informers to have CSCL domain competencies, community credibility, and advocacy skills. In contrast, *policy-making/policy-formulating* requires and demands expertise beyond the CSCL disciplinary domain (such as public administration, educational policy, educational philosophy). With regard to the distinction between the different levels of *educational-policy*, *pedagogical-policy*, and *learning-policy*, a key policy challenge for CSCL is its conception of students and teachers. As mentioned earlier, CSCL as an instructional paradigm can decenter the teacher. Moreover, the collaborative learning setting itself needs to be critically examined for policy-informing implications. How should we reconcile the small-group oriented design and analysis of CSCL with the legally mandated assessment and certification of individual students rather than collaborative learning groups? Educational effectiveness and educational efficiency have long been the buzzwords in educational reform. However, as Ericson and Ellett (2002) argued, "students are as causally central as educators in bringing about higher educational achievement" (p.1). In order to consider *educational-policy* implications of CSCL, we need to situate students within the macro-sociological process (see Figure 1).

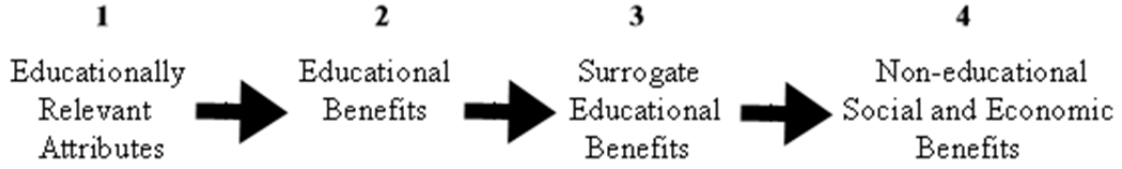

Figure 1. Macro-Sociological Process View of the Educational System (taken from Ericson & Ellett, 2002).

The "Surrogate Educational Benefits" [Figure 1, index 3] of certifications, diplomas, transcripts, grades and standardized testing scores function to position students in the market place of jobs and their associated benefits, perks along with the social status and wealth. Only "Educational Benefits" [Figure 1, index 2] and "Surrogate Educational Benefits" [Figure 1, index 3] of the schematic above are within the control of CSCL researchers and educators. The partial control over the macro-sociological process of education should be taken into account when thinking about educational-policy from a CSCL perspective. In order to inform educational-policy we need to recognize the centrality of student agency and in the noble enterprise of education. As Ericson and Ellett (2002) say:

> Yet, as we shall argue, it is students—their goals, motivations, and conceptions of the good life—that may well prove to be the undoing of the educational reform movement. In other words, we might well improve the quality of teachers, legislate higher content and performance standards and academic requirements, and reform teacher education to the educational reform movement's content, and still totally fail in achieving anything close to educational excellence in our schools. (Ericson & Ellett, 2002)

Conclusion

The list of seven challenges is not exhaustive. Other CSCL researchers and practitioners may identify other challenges. The purpose of the paper is to jumpstart a discussion on the grand challenges in CSCL. No concrete solutions are offered and it might very be the case that some, if not all, of these challenges remain intractable and insurmountable. But an empirically informed discussion of CSCL challenges could provide opportunities to take stock of the accumulated body of knowledge and look into the future.

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