COMPUTER-SUPPORTED COLLABORATIVE LEARNING

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Synonyms

Computer supported cooperative learning

Definition

Computer Supported Collaborative Learning (CSCL) refers to the activity of peers interacting with each other for the purpose of learning and with the support of information and communication technologies (ICT). CSCL also refers to the learning that results from such activity, and to the research field that studies such activity. We examine the components of "learning," "collaborative," "computer," and "supported" in turn, before commenting briefly on the scope of the research field.

Learning generally involves changes in behavior of some agent as a result of experience, but CSCL includes various conceptions of learning that differ on (for example) what is taken to be the agent of learning. These differences are consequential for CSCL, so are summarized in the theoretical discussion of the next section.

Collaborative activity is most strictly defined as tightly coordinated activity in which participants seek to maintain a joint conception of a problem and its solution. Collaboration is sometimes contrasted with cooperation, in which learners divide up work to be done in parallel, occasionally coordinating their activity (Stahl, Koschmann & Suthers, 2006). However, in practice, CSCL researchers and practitioners study both collaboration and cooperation, and even competitive structures that motivate students' efforts.

The term *computer* in CSCL is now understood broadly to include all ICTs, such as the Web, mobile phones, and ubiquitous and embedded computing, as well as desktop and laptop computers. Some of CSCL's results and insights can apply to other technologies, including those predating the information revolution, to the extent that they are designed and applied in ways that support and guide interaction among peers leading to learning.

CSCL may take place in face-to-face settings in which students interact directly with each other. In such settings the ICT may *support* collaborative learning by serving as a resource or guide that improves the learning interaction, for example, with representational tools for organizing students ideas, agents that make suggestions, or scripts that structure student interaction. The ICT may also itself be the object of study. CSCL may also take place in in online settings where ICT plays the additional role of the medium through which participants interact. In the online case, CSCL may be synchronous (interacting at the same time), or asynchronous (interacting by leaving messages or other artifacts accessed by others at different times).

The research field of Computer Supported Collaborative Learning is supported by its own conference series by the same name, by the International Journal of Computer Supported Collaborative Learning, and the Springer (formerly Kluwer) Computer-Supported Collaborative Learning book series, among other venues. The research field has been characterized by one if its founders, Tim Koschmann, as "a field centrally concerned with meaning and practices of meaning-making in the context of joint activity and the ways in which these practices are mediated through designed artifacts" (Stahl, Koschmann & Suthers, 2006). Understood in this way, CSCL is not merely a specialization of collaborative learning within educational psychology, but rather is relevant to any field of inquiry concerned with intersubjective meaning-making (Suthers, 2006).

Theoretical and Methodological Traditions

Work undertaken in CSCL is based on several alternative theoretical views of how social settings bear upon learning (Suthers, 2006). Some theories treat the individual as the locus of learning. Research under a *knowledge-communication* epistemology examines how to more effectively present knowledge in some medium, or how to otherwise communicate in ways that cause or support learners' acquisition of the desired knowledge. CSCL has moved decidedly away from views of learning as transfer of knowledge, and towards more constructivist and interactional views. *Constructivist* epistemologies emphasize the agency of the learner in constructing knowledge based on her efforts to make sense of her experiences. These may include social experiences in which new ideas are encountered, some of which may conflict with one's own ideas, and the expectation to defend one's own ideas. Some *interactionalist* epistemologies emphasize learners' efforts to find "common ground" and share information with others. Other interactional epistemologies, such as *group cognition*, treat learning as a process in which new ideas are jointly created through interaction. Here the agent of learning is the group rather than the individual, and learning itself is not just a product of interaction but actually consists of interaction. *Participatory* epistemologies bring the agency of learning to the community level: becoming a member of a community of practice is not merely a matter of an individual internalizing the knowledge and practices of that community, but also a process of the community's own self-replication and growth as it takes on new members.

Four major empirical strands can be discerned as influential in CSCL. The *experimental* paradigm, which typically compares an intervention to a control condition by carefully manipulating variables, has a dominant position in CSCL due to its roots in cognitive and educational psychology. Experimentalism has been critiqued for failing to examine learning in specific cases of interaction (most analyses aggregate the behavior of multiple individuals), and for weak ecological validity due to the contrived situations needed to control variables. The *iterative design* tradition continuously improves artifacts intended to mediate learning and collaboration, with changes at each iteration driven by theory, observation, and engagement of stakeholders. This tradition derives from CSCL's roots in computer science and human-computer interaction. Traditions of *interaction analysis* in CSCL are influenced by conversation analysis and ethnomethodology, and examine how learning is accomplished in practice. These traditions privilege participants' own behavior and accounts rather than prior theoretical accounts, and typically focus on short episodes of interaction (Stahl et al., 2006). Such methods are well suited to existentially quantified claims, yet are less developed for making predictive generalizations. Finally, *socio-cultural analysis* examines how institutional, cultural and historical processes, structures and tools bear upon learning, identifying how infrastructures produced at meso- and macro-scales influence learning in specific settings (Jones et al., 2006).

Important Scientific Research and Open Questions

Some relevant findings in CSCL derive from or overlap with the field of cooperative learning in Education, which has studied the conditions that affect whether groups are beneficial for learning (for example, group composition, reward structures, task characteristics, role specialization, various forms process guidance, etc.). Due to space limitations, this article provides a sampling of important trends within the field of CSCL itself and associated open questions. See Stahl, Koschmann & Suthers (2006) for a brief history of CSCL and pertinent references. A sampling of earlier research in CSCL may be found in Koschmann, Hall and Miyake (2001).

A common strategy in CSCL is to identify interactions that lead to learning and then try to get students to engage in these kinds of interactions. Based on socio-cognitive conflict theory and research showing the beneficial effects of attempting to articulate and justify one's own ideas, a major thrust of work in CSCL has sought to engage learners in *argumentation* with each other (Andriessen, Baker & Suthers, 2003). Here, "argumentation" is not used as synonymous with verbal conflict, but rather to include cooperative interactions in which participants take a critical stance to ideas and their justifications, exposing them to tests and comparing alternative points of view in an effort to reach greater understanding. Interventions explored include ICT-supported role-playing; sentence-opener prompts that make different argumentative moves explicit; and representational notations and tools that support argumentation by making ideas and their interrelations and evidence visible. The effectiveness of different computer-mediated communication tools for supporting argumentation has also been studied. Argumentation scripts lead us to the next major area of research in CSCL.

Learners do not spontaneously engage in practices that lead to effective collaborative learning, such as coordinating their joint efforts, referencing each others' contributions, and building and evaluating grounded arguments. Furthermore, they may be detracted from such practices when attention must be allocated to managing the ICT and their group processes. For these reasons, *collaboration scripts* are studied as ways to make learners' interactions more productive for learning (see Fischer, Kollar, Mandl, and Haake, 2007, on which this paragraph is based). Scripts are understood in psychology to refer to memory structures that guide people in understanding and participating in social action sequences; in computer science as formal structures that may be visualized or used to drive computational processes; and in education as practical means for organizing learning activities. Scripts may apply at a "macro" level in advance of a session by organizing who is collaborating on what task in what roles; and at a "micro" level, by specifying the processes by which learners conduct their activities. Research examines issues such as the most effective ways to structure interaction (e.g., scripting collaboration versus scripting reasoning); the conditions under which collaboration scripts are internalized so that external support can be removed; the use of scripts to bridge knowledge differences in heterogeneous groups; and how scripts can drive software agents participating in the collaboration. Critical issues include the coerciveness of scripting and the danger of denying participants' agency in learning to direct their own learning.

Technology-centric work in CSCL is in a delicate position, requiring an understanding of the concept of *affordances*. Affordances are relationships between agents and their environments, relationships that offer potentials for action. Because human beings are cultural agents, our use of technologies is not determined by their properties. Affordances are enacted (come into being) through the meaning-making activities of learners. Yet affordances are not purely socially constructed or entirely relativistic: the properties of technologies make some kinds of practices more available than others. Consequently, designers of

technologies for CSCL cannot treat their designs as directly controlling or determining learning. Rather, an indirect approach is called for in which designers offer potentials for desirable practices and examine how these potentials are actually taken up (Jones et al., 2006). Open questions lie in the design and study of fundamentally social technologies that are informed by the affordances and limitations of those technologies for mediating intersubjective meaning-making (Suthers, 2006).

An advantage of studying learning in small groups is that participants will display their understanding to other participants in ways that are also accessible to educators and researchers (Stahl et al., 2006). Small groups are also of interest because they lie at the boundary of and mediate between individuals and a community: the knowledge building that takes place within small groups becomes "internalized by their members as individual learning and externalized in their communities as certifiable knowledge" (Stahl et al., 2006). Yet there has been insufficient research that actually makes connections between these levels of analysis: most work examines either individual learning outcomes or group processes, and does not trace connections between these levels. Also, the ways in which institutions select and implement the infrastructures of CSCL that influence local interaction needs to be made visible (Jones et al., 2006). Hence, some CSCL researchers are examining ways to bridge between levels of analysis.

The development of the Internet and Web into technological infrastructures for networked individualism and sociability has led to new challenges. CSCL research has traditionally focused on strong relationships of cooperation and collaboration, but is now faced with the question of whether to also embrace proliferating "weak ties" of the new networked society, or instead to offer a critical voice in favor of strong relationships (Jones, et al., 2006). At the community level, CSCL has also focused on cohesive groups who share an enterprise and repertoire, raising the question of whether "communities of practice" or "networked learning" based on weak ties is more productive with respect to the learning of the individual participant (Jones et al., 2006). Promising topics for research in the networked society include identifying how the mutability and mobility of digital artifacts can serve to recruit participants in new social arrangements that make new forms of learning possible; the conditions for productive entanglement of multiple individual trajectories of participation; and how the social affordances of technologies operate over larger spans of time and larger collections of actors (Suthers, 2006).

Cross-References

Collaboration scripts Regular Entry 00600 281/281

Collaborative knowledge building Regular Entry 00000 282/282

Collaborative learning Regular Entry 00817 283/283

Collaborative learning and critical thinking Regular Entry 00910 284/284

Collaborative learning strategies Regular Entry 00818 285/285

Collaborative learning supported by digital media Regular Entry 00932 286/286

Collective learning Regular Entry 00136

Communication and learning

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