

Computer-Supported Collaborative Learning

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INTRODUCTION

In computer-supported collaborative learning (CSCL), information and communication technologies are used to promote connections between one learner and other learners, between learners and tutors, and between a learning community and its learning resources. CSCL is a coordinated, synchronous activity of a group of learners resulting from their continued attempt to construct and maintain a shared conception of a problem (Roschelle & Teasley, 1995).

CSCL systems offer software replicas of many of the classic classroom resources and activities (Soller, 2001). For example, such systems may provide electronic shared workspaces, on-line presentations, lecture notes, reference material, quizzes, student evaluation scores, and facilities for chat or online discussions. This closely reflects a typical collaborative learning situation in the classroom, where the learners participating to learning groups encourage each other to ask questions, explain and justify their opinions, articulate their reasoning, and elaborate and reflect upon their knowledge, thereby motivating and improving learning.

These observations stipulate both the *social context* and the *social processes* as an integral part of collaborative learning activities. In other words, CSCL is a natural process of *social interaction* and *communication* among the learners in a group while they are learning by solving common problems.

BACKGROUND

Theory

Collaborative learning is studied in many learning theories, such as Vygotsky's socio-cultural theory—zone of proximal development (Vygotsky, 1978), in constructivism, self-regulated learning, situated cog-

nition, cognitive apprenticeship, cognitive flexibility theory, observational learning, distributed cognition, and many more (see Andriessen, Baker, & Suthers, 2003; Dillenbourg, Baker, Blaye, & O'Malley, 1996; Roschelle & Teasley, 1995; TIP, 2004, for a more comprehensive insight). A number of researchers have shown that effective collaboration with peers is a successful and powerful learning method—see, for example Brown and Palincsar (1989), Doise, Mugny, and Perret-Clermont (1975), Dillenbourg et al. (1996), and Soller (2001). However, there is an important prerequisite for collaborative learning to result in improved learning efficiency and bring other learning benefits—the group of learners must be active and well-functioning. Just forming a group and placing the students in it does not guarantee success. The individual learners' behaviour and active participation is important, and so are their roles in the group, their motivation, their interaction, and coordination. Soller (2001) makes an important observation that “while some peer groups seem to interact naturally, others struggle to maintain a balance of participation, leadership, understanding, and encouragement.”

One should differentiate between cooperative and collaborative learning. In cooperative learning, the learning task is split in advance into sub-tasks that the partners solve independently. The learning is more directive and closely controlled by the teacher. On the other hand, collaborative learning is based on the idea of building a consensus through cooperation among the group members; it is more student-centered than cooperative learning.

The Goals of CSCL

The goals of CSCL are three-fold:

- **Personal:** By participating in collaborative learning, the learner attains elimination of misconceptions, more in-depth understanding of

the learning domain, and development of self-regulation skills (i.e., metacognitive skills that let the learner observe and diagnose his/her self-thinking process and self-ability to regulate or control self-activity);

- **Support Interaction:** Maintaining interaction with the other learners, in order to attain the personal goal associated with the interaction; this leads to learning by self-expression (learning by expressing self-thinking process, such as self-explanation and presentation), and learning by participation (learning by participating as an apprentice in a group of more advanced learners);
- **Social:** The goals of the learning group as a whole are setting up the situation for peer tutoring (the situation to teach each other), as well as setting up the situation for sharing cognitive or metacognitive functions with other learners (enabling the learners to express their thinking/cognitive process to other learners, to get advice from other learners, discuss the problem and the solution with the peers, and the like).

Web-Based Education

Web-based education has become a very important branch of educational technology. For learners, it provides access to information and knowledge sources that are practically unlimited, enabling a number of opportunities for personalized learning, tele-learning, distance-learning, and collaboration, with clear advantages of classroom independence and platform independence. On the other hand, teachers and authors of educational material can use numerous possibilities for Web-based course offering and teleteaching, availability of authoring tools for developing Web-based courseware, and cheap and efficient storage and distribution of course materials, hyperlinks to suggested readings, digital libraries, and other sources of references relevant for the course.

Adaptivity and Intelligence

Typically, an adaptive educational system on the Web collects some data about the learner working

with the system and creates the learner model (Brusilovsky, 1999). Further levels of adaptivity are achieved by using the learner model to adapt the presentation of the course material, navigation through it, its sequencing, and its annotation, to the learner. Furthermore, collaborative Web-based educational systems use models of different learners to form a matching group of learners for different kinds of collaboration. This kind of adaptivity is called *adaptive collaboration support*. Alternatively, such systems can use intelligent class monitoring to compare different learner models in order to find significant mismatches, for example, to identify the learners who have learning records essentially different from those of their peers. These learners need special attention from the teacher and from the system, because their records may indicate that they are progressing too slow, or too fast, or have read much more or much less material than the others, or need additional explanations.

Intelligence in a Web-based educational system nowadays usually means that the system is capable of demonstrating some form of knowledge-based reasoning in curriculum sequencing, in analysis of the learner's solutions, and in providing interactive problem-solving support (possibly example-based) to the learner. Most of these intelligent capabilities exist in traditional intelligent tutoring systems as well, and were simply adopted in intelligent Web-based educational applications and adapted to the Web technology.

CSCL Model

CSCL technology is not a panacea. Learners who use it need guidance and support online, just as students learning in the classroom need support from their instructor. Hence, developers of CSCL tools must ensure that collaborative learning environments support active online participation by remote teachers, as well as a variety of means for the learners to deploy their social interaction skills to collaborate effectively.

In order for each CSCL system to be effective, it must be based on a certain model, such as the one suggested by Soller (2001) that integrates the following four important issues:

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