

# E-Collaborative Knowledge Construction

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## INTRODUCTION

Knowledge has become an important factor in the success of organizations. Several authors reflect this in their use of terms such as *knowledge society* (e.g., Nonaka, 1994) or *knowledge age* (e.g., Bereiter, 2002). The role of knowledge has changed fundamentally with the development of a knowledge society. Knowledge is still an indispensable resource for the individual as well as for an organization, but the emphasis lies on the creation of new knowledge (see Nonaka, 1994). This change also has consequences for the individual acquisition of knowledge and, in turn, for learning. In traditional learning scenarios, knowledge was seen as a commodity that could be transferred directly from one brain to another. This resulted in an interaction between teacher and learner, in which the teacher had an active role and presented parts of his knowledge to the learners, who passively received and memorized them (see Ertl, Winkler, & Mandl, 2007). However, studies have shown that whilst learning by such presentations of explicit knowledge enabled learners to reproduce it in tests, they failed to transfer it to new situations and often failed to apply it in the creation of new knowledge—the knowledge learners acquired remained inert (Renkl, Mandl, & Gruber, 1996).

## BACKGROUND

Innovative approaches to teaching and learning no longer only focus on the transfer of explicit knowledge, but pay more attention to tacit knowledge (Nonaka, 1994). Tacit knowledge is often not conscious and therefore almost impossible to teach explicitly. It may comprise of situational, conceptual, procedural and strategic skills (see De Jong & Fergusson-Hessler, 1996; Nonaka, 1995). It is an important key for the application of existing knowledge and the creation of new knowledge. Constructivist approaches postulate that each learner has to construct new knowledge actively to appreciate the applicability of knowledge.

Approaches such as the *cognitive apprenticeship* (Collins, Brown, & Newman, 1989) or *situated learning* (Lave & Wenger, 1991) place learners in a collaborative scenario that enables them to construct knowledge actively in collaboration with learning partners. Four different processes can be seen as particularly beneficial for collaborative knowledge construction (see Fischer, Bruhn, Gräsel, & Mandl, 2002): Learners' *externalization* and *elicitation* of knowledge, their *conflict-oriented negotiation*, and their *consensus-oriented integration*. Learners' externalization requires them to elaborate knowledge comprehensibly to their learning partners. This challenges them to actively use their knowledge. Elicitation describes a request for new knowledge to the learning partners. Learning partners are required to externalize their knowledge and the learner himself has the chance to fill gaps in his knowledge based on these externalizations. Conflict-oriented negotiation describes learners' discussion of divergent perspectives on the content, whereby consensus-oriented integration comprises of learners' efforts to find a synthesis of their different viewpoints. Consequently, the processes of externalization and elicitation primarily facilitate the acquisition and application of knowledge while negotiation and integration focus more on the creation of new knowledge. To sum up, collaborative knowledge construction is attributed with many benefits for learners (see, e.g., Cohen & Lotan, 1995; Ertl, Fischer & Mandl, 2006; Lou, Abrami & d'Apollonia, 2001; Roschelle & Teasley, 1995).

E-collaborative knowledge construction shifts these processes to scenarios of computer mediated communication. However, the term "e-collaboration" is associated with several different meanings or styles of collaboration and it is necessary to distinguish between them for conceptual clarity (see Dillenbourg, 1999; Gräsel, Fußangel & Pröbstel, 2006). One facet of e-collaboration can be described as the *exchange* of information and working material (see Gräsel et al., 2006). This style of collaboration takes place in a more casual manner and has mutual benefit from the material of the respective collaboration partners as its main goal. Another aspect concerns a professional division of work.

Dillenbourg (1999) also calls this quality *cooperation*. Collaboration partners share a goal and have a joint plan for reaching it. In order to do this, they split the work into different steps and work individually within each step. Collaborating partners' interaction relates in this case to the planning and division of work rather than to collaboration on the content. However, e-collaborative knowledge construction requires *collaboration* in a style in which collaboration partners interact frequently with *content-specific* activities. This means that they work together at the same (virtual) place to construct one joint product or mental artifact (see Bereiter, 2002). Such collaboration does not necessarily have to happen synchronously—however, the collaboration partners' timing and their commitment has to be solid enough for the processes of collaborative knowledge construction to take place.

## ENVIRONMENTS FOR E-COLLABORATIVE KNOWLEDGE CONSTRUCTION

Environments for e-collaborative knowledge construction rely on the computer, which features collaboration partners' communication; for example, by the provision of newsgroups, chats, or audio-visual communication. Furthermore, the computer screen has to provide the instructional design, e.g. instructional elements and learning material for the learners (see Kirschner, Sweller & Clark, 2006). Learners *share* this computer screen—even if located in different places. They may share the same interface structure and contents but not necessarily see the same picture simultaneously when accessing the learning environment (see Weinberger, 2003). However, in some situations they may also share one application and work simultaneously (*application sharing*). In such cases, they can see the moves of their collaboration partners during collaboration (see Dillenbourg & Traum, 2006; Ertl et al., 2006; Pata, Sarapuu, & Lehtinen, 2005). Environments for e-collaborative knowledge construction do not necessarily require fully synchronous communication, yet they require collaboration partners to be simultaneously on task. In the following, we will show two different environments for e-collaborative knowledge construction: One learning environment using discussion boards and a videoconferencing one.

## An Environment Using Discussion Boards

Environments that use discussion boards, forums or newsgroups are quite common in the domain of virtual seminars in higher education (see Koschman, Suthers, & Chan, 2005; Schnurer, 2005; Weinberger, 2003). This communication is asynchronous, which means that there is no immediate reply to a contribution and collaboration partners have enough time for thoughtful replies to colearners' contributions (see Schnurer, 2005; Weinberger, 2003). Furthermore, many systems allow learners to edit and improve contributions (see Clark & Brennan, 1991; Dennis & Valacich, 1999). However, when applying discussion boards for e-collaborative knowledge construction, the instructional design of the learning environment has to ensure that they have *similar paces* (see Fischer & Waibel, 2002)—their activities have to be synchronized to a certain degree.

Weinberger (2003) describes an example of such an environment. He chose the asynchronous environment because the instructional design of his study focused on elaborate individual case analyses, which develop during the ongoing collaboration. In this environment, three learners deepened their understanding regarding an educational theory. They worked collaboratively on a problem-solving task based on three learning cases. For the collaborative case solutions, the environment provided three discussion boards, one for each case. In collaboration with their teammates and referring to individual resources, learners negotiated to find a suitable solution for each case. They wrote messages about case diagnoses and commented on each other's contributions. This negotiation requested them to externalize and apply their content-specific knowledge as well as case-solving strategies. At the end, one learner prepared synthesis of their perspectives as a final solution for each case. In this scenario, the asynchronous learning platform enabled learners to communicate and to reply to each other's comments with a temporal delay, yet because of the fixed timeframe provided for working in the learning environment, they could correspond timely enough to collaborate in knowledge construction and come to a joint case solution.

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