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Computer support for knowledge construction in collaborative learning environments

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Abstract

Organisations increasingly use multidisciplinary teams to construct solutions for complex problems. Research has shown that multidisciplinary teams do not guarantee good problem solutions. Common ground is seen as vital to team performance. In this paper an ICT-tool to support complex problem solving is studied. A framework for knowledge construction inspired the design of computer support for knowledge construction. The basic support principle consisted of making individual perspectives explicit, which serves as a basis for negotiating common ground. This principle was embedded in a collaborative learning environment in three ways, which differed from each other in the extent to which users were coerced to adhere to the embedded support principles. Coercion, as expected, was correlated with negotiation of common ground; the more coercion, the more participants would negotiate the meaning of contributions to the ICT-tool, and the more common ground they would have. Self-report data suggested that Intermediate coercion resulted in the least common ground. This may have been caused by some disruption of group processes.

Keywords: Negotiation; Common ground; ICT-tools; Knowledge construction; Coercion

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1. Computer support for knowledge construction in collaborative learning environments

Multidisciplinary teams are used in industry, government and education (Derry, Adams DuRussel, & O'Donnell, 1998) because they are regarded as a sine qua non for solving complex problems (Vennix, 1996). The main advantage of multidisciplinary teams is that the team members can bring different perspectives to bear on a problem. Multiple perspectives are expected, for example, to allow for rich problem analyses and solutions (see Lomi, Larsen, & Ginsberg, 1997). Courtney (2001) argues that business organisations need to integrate different perspectives to ensure organisational sustainability. Hasan and Gould (2001) showed that ignoring certain perspectives on a complex problem can lead to unexpected adverse effects of the ultimate problem solution. And finally, Vennix (1996) notes that, "differences of viewpoint can be very productive" (p. 1). However, multidisciplinarity is not always an advantage. Sometimes individuals outperform multidisciplinary teams, even when it concerns the task of complex problem solving (Barron, 2003). The question is thus: What makes a multidisciplinary team successful?

Recent research by Barron (2003) in the domain of education empirically confirms the need for cognitive frames of reference. She showed that team performance is related to team interaction. She noted that the willingness to construct a shared problem space seemed to be essential for engaging multiple perspectives. High performing teams engaged solution proposals through discussion and acceptance, whereas low performing teams ignored and rejected proposals. According to Johnson and Johnson (1994), synthesis of multiple perspectives might result in better decisions and solutions to complex problems. Bromme (2000) argues that a team needs some *common ground*, a shared cognitive frame of reference, before it can attempt to synthesise perspectives. It seems that members of multidisciplinary teams need to find some kind of commonality between their different perspectives in order to benefit from them.

Many researchers have used ICT-tools to facilitate complex problem solving in teams. These tools use *formalisms,* which are constraints that structure conversation and discourse among collaborators with the aim to guide the exchange of knowledge and information. ICT-tools have been used to support complex reasoning, task-oriented activities, and collaborative knowledge building (Lipponen, Rahikainen, Lallimo, & Hakkarainen, 2003). Specific formalisms are tailored to facilitate specific aspects complex problem solving, and ICT-tools *coerce* [1] (Dillenbourg, 2002) people to follow the rules of such formalisms. To give some examples, ICT-tools used specific formalism to facilitate teams in diverse fields and topics as design activities (Buckingham Shum, MacLean, Bellotti, & Hammond, 1997), scientific reasoning (Suthers, 2001), and argumentation (Van Bruggen, 2003). Such tools have attained good results on cognitive aspects of group learning by focussing on task aspects. However, they have not explicitly addressed the problem of common ground in multidisciplinary teams.

[1] Some dictionary definitions (Webster's student Dictionary, 1996) of coercion hold that to coerce involves 'to constrain or force to do something'. We wish to stress that this paper uses to coerce in the sense of constraint, not force.