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The learning kit project: Software tools for supporting and researching regulation of collaborative learning

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ABSTRACT

Computer-supported collaborative learning (CSCL) is a dynamic and varied area of research. Ideally, tools for CSCL support and encourage solo and group learning processes and products. However, most CSCL research does not focus on supporting and sustaining the co-construction of knowledge. We identify four reasons for this situation and identify three critical resources every collaborator brings to collaborations that are underutilized in CSCL research: (a) prior knowledge, (b) information not yet transformed into knowledge that is judged relevant to the task(s) addressed in collaboration, and (c) cognitive processes used to construct these informational resources. Finally, we introduce gStudy, a software tool designed to advance research in the learning sciences. gStudy helps learners manage cognitive load so they can re-assign cognitive resources to self-, co-, and shared regulation; and it automatically and unobtrusively traces each user's engagement with content and the means chosen for cognitively processing content, thus generating real-time performance data about processes of collaborative learning.

1. Introduction

Computer-supported collaborative learning (CSCL) is a dynamic area of research involving an assortment of methodologies, various theoretical and operational definitions, and several technological tools for investigating multiple collaborative structures (Gress, Hadwin, Page, & Church, 2010). Overall, CSCL environments aim to advance research on models of collaborative learning and facilitate learners' co-construction of knowledge (Koschmann, 2001; Salovaara & Järvelä, 2003). More specifically, CSCL interactive tools aim to encourage, support, and sustain solo and group regulation of collaboration, learning processes and products by prompting, coaching and providing interactive feedback (Kirschner, 2004).

Collaboration typically is operationalized as student-centered small group activities in which learners are supposed to develop skills for sharing the responsibility to be active, critical, creative co-constructors of learning processes, and products. Conditions that facilitate effective collaborative processes include, for example, positive interdependence, positive social interaction, individual and group accountability, interpersonal and group social skills, and group processing (Johnson & Johnson, 1989; Johnson & Johnson, 1999; Kreijns, Kirschner, & Jochems, 2003). Some CSCL software tools attempt to support these kinds of engagements. Examples are awareness tools designed to support positive social interaction (Carroll, Neale, Isenhour, Rosson, & McCrickard, 2003) and negotiation tools designed to support group social skills and discussions (Beers, Boshuizen, Kirschner, & Gijselaers, 2005). Despite much activity in the CSCL field, there is relatively little research on how types of tools support and sustain productive collaboration (Gress, Hadwin, Page, & Church, 2010; Hadwin, Gress, Page, & Ross, 2005).

We identify four reasons for this situation. First, much research in CSCL focuses on developing and testing technologically-based tools (e.g., text chat tools, conferencing tools, email systems, and so forth) for sharing information (Gress, Fior, Hadwin, & Winne, 2010). These tools provide a means for collaborating online, but facilitating research about how and why collaboration takes the shape(s) it does and has the effect(s) it does is a much less the goal of these projects. Second, a review of the CSCL literature (Gress, Hadwin, Page, & Church, 2010) uncovered multiple "modes" for collaboration. Some describe students working asynchronously on individual contributions towards one document, others portray students working asynchronously on one document and reflecting on their collaborators' contributions, and still others describe students contributing to a shared document in a synchronous environment. It may be that each model of collaboration is best suited to a particular type of task and pedagogical approach, though this is not demonstrated. Notwithstanding, tools for collaborating do (and probably should) differ dramatically depending upon instructional goals, tasks, and tools available to learners. Third, the extensive educational literature on cooperative and

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collaborative leaning (e.g., see Abrami, Lou, Chambers, Poulsen, & Spence, 2000; O'Donnell & King, 1999; Slavin, 1999) is often ignored in designing CSCL environments, tools, and research. As a result, research about CSCL and research about collaboration in general share too little ground, particularly regarding supports or instruction. Fourth, researching how individuals and groups learn to collaborate and support collaborators poses significant challenges for measurement and evaluation (Gress, Fior, Hadwin, & Winne, 2010).

2. Supporting software tools for researching collaborative learning

One goal of the Learning Kit Project is to research how students adopt and adapt strategies for solo and collaborative learning. Our work extends along a continuum from conventional models of self-regulated learning (SRL) as (a) a solo activity to (b) learning in a group to (c) shared-collaboration of learning that emphasizes collective negotiation and regulation of task understanding, goal setting, planning, and enacting strategies.

The bulk of research on collaborative learning in classrooms and as supported by software technologies has appropriately focused on features of collaboration per se; that is, the nature and patterns of exchanges of information among collaborators (see O'Donnell & King, 1999). These efforts have revealed a great deal. Nonetheless, we posit that models of collaboration are misspecified. Specifically, little and sometimes no attention has been focused on three critical resources every collaborator brings to collaborations: (a) prior knowledge, (b) information not yet transformed into knowledge that is judged relevant to the task(s) addressed in collaboration, and (c) cognitive processes used to construct these informational resources. The logic upon which our conjecture rests is as follows.

1. In research on solo learning, measures of prior knowledge are often the most potent variables affecting outcomes. While collaboration may do much to fill gaps in an individual's knowledge and to stimulate recall of an individual's knowledge that otherwise would not be brought to bear, one collaborator's gain in this respect often depends on another's knowledge. That is, collaborators' knowledge as a group is almost certainly greater than any one collaborator's knowledge. Those with less knowledge about a particular sector of the collaborative task benefit from group mates' prior knowledge. That knowledge may be about the task, the content, or the collaborative process itself.
2. Information that a collaborator can access but which is not yet anyone's knowledge—information that can be contributed to the group but is only partly understood by the contributor—may be a powerful resource in collaboration. This is because each member's partial knowledge may, in concert with contributions of such information made by others in the group, generate a synergy that boosts the group's productivity past a critical threshold. Through collaboration, information that is initially no one's knowledge may become knowledge forged within the group.
3. How learners learn—the tactics and strategies learners know and apply to transform information into knowledge—tends to be stable. The simplest demonstration of this is the considerable effort that must be spent to teach learners new tactics and strategies for learning and, once these are learned, the additional effort that must be spent to coax learners to use those newly acquired tactics and strategies. Consequently, the processes that each learner typically uses to learn very likely are carried over to the collaborative setting. Furthermore, there presumably are tactics and strategies that learners collaboratively develop and refine to engage in collaboration itself.

While our first claim is empirically justified, we acknowledge the second and third are speculations, though they have considerable collateral support. What would be required to test these propositions in the context of CSCL and lend empirical address to the possibility that models of collaborative learning are misspecified? In this article, we offer a partial answer by describing an advanced software learning environment, called gStudy, that we and colleagues are developing (see Winne, Hadwin et al., 2006; and also Winne, Nesbit, et al., 2006; http://www.learningkit.sfu.ca). gStudy software harnesses a platform for supporting solo SRL to support collaborative learning. Our explicit goal in designing collaborative tools and structures has been to support students in learning to regulate collaborative learning activities and tasks.

Since this paper overviews and introduces software tools discussed more deeply within other papers in this special issue, we provide illustrations of how each tool can be used to facilitate collaborative activity. In depth discussion of those collaborative enterprises is found in the other papers in the special issue.

3. gStudy

3.1. Overview

gStudy (Winne, Hadwin, et al., 2006) is a state-of-the-art, cross-platform software system that puts into practice proposals Winne (1992) made about using software to substantially extend research in the learning sciences. gStudy is a shell in which a learner or an instructional designer can create or import content about almost any topic. (Topics defined by enacting physical skills, such as playing a piano or dissecting a frog, are excluded.) Information about topics is rendered using the hypertext markup language (HTML) in forms including text, diagrams, photos, charts, tables, audio and video clips—that is, the information formats common to hard-copy library resources and on the Internet. A unified collection of these materials is called a learning kit.

gStudy provides cognitive tools for learners to create, share, and exchange information objects. Every information object is linked to a file, data the learner selects within a file, or data the learner selects within a remote web site outside the learning kit. Each tool has been designed, as much as possible, to instantiate research that demonstrates using the tool will positively influence solo and collaborative learning and problem solving. In this article, we highlight features designed to promote collaborative learning in particular but these features are seamlessly interwoven with features designed to promote solo learning. Hadwin, Oshige, Gress, and Winne (2010) describe some specific models of collaboration that can be supported in the gStudy software, based on three different views of regulation of learning.

Fig. 1 shows one of gStudy's views, the browser view, onto a learning kit. The kit may belong to a learner, to a collection of learners, or to a learner and instructor. In Fig. 1, all of gStudy's panels are exposed to show search, concept maps, the catalog of kits (including the one being viewed), the selected kit's table of contents, and a panel that identifies information objects that are linked to data in the section of the kit that is in view. In practice, it would be rare that a student exposed all of gStudy's panels simultaneously.

3.2. Information objects

In gStudy, each information object is characterized by metadata that specify: author of the object, date created, and date modified. This allows identifying each information object by one or several of these characteristics. It means a student can share objects and