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Computer Supported Collaborative Learning
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A double issue for CSCL 2007

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The first volume of *ijCSCL* followed upon CSCL 2005 in Taiwan and featured important papers from that conference, expanded into journal presentations. This double issue of volume 2 is timed to coincide with CSCL 2007 in New Brunswick. It introduces sets of papers on two "flash themes" that have flared up within the research field of CSCL between conferences. These papers arose out of research projects and workshops held on topics of abiding interest, as is also reflected in volumes of the CSCL book series (Andriessen et al. 2003; Fischer et al. 2006).

We hope to feature articles based on papers from CSCL 2007 in volume 3 of *ijCSCL*. We are particularly interested in articles that report on a mature research agenda, perhaps covering the work of a research lab or project consortium. A journal article should make a significant innovative contribution to the field. It might propose a new direction for theory, socio-technical design, pedagogical practice or research methodology. Ideally, it should investigate the use of computer support in learning and should feature collaborative interaction as the mode of knowledge building or shared meaning making. While proposals should generally be supported with concrete evidence based on some form of user experience, the evaluation of the evidence can take the form of any rigorous method: for instance, statistical significance of experimental results, ethnographic study, action research, case study. Please see our website at http://ijCSCL.org for details and examples of published papers if you are considering a submission.

In this issue

The paper by *Maarit Arvaja* reflects the Finnish concern with the enacted context in which knowledge-building discourse is situated, and which is constructed through that discourse.

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After reviewing theoretical concerns about the mediating nature of context, the study analyzes the work of two groups in a computer-supported discussion forum. The online discourse is coded and quantitatively compared to highlight different interaction patterns. One group used more co-text and course material in their discussion while the other referred more to personal experiences. Quantifying the data provided a valuable tool to measure and contrast knowledge construction in these groups. Complementing this, a detailed qualitative analysis of the groups' discussions and thick descriptions of the relations between the specific thematic content, communicative functions and contextual resources provided insight into reasons behind the similarities and differences. The paper includes both the coding scheme and extended excerpts from the group postings and their analysis, helping the reader to understand and evaluate the claims made. The combination of quantitative and qualitative analysis illuminates the situated and mediated nature of learning in the case studied. The students' knowledge-construction activity was grounded in the immediate context in the sense that meaning negotiation was shaped by the moment-by-moment interpretation of each others' messages. Also, the students' activity was grounded in their contexts, in that knowledge construction and sharing were based on prior experience and background knowledge that were brought into the discussion. These two aspects of context were illustrated by the work of the two groups, respectively.

The report from New Zealand by *Nilufar Baghaei*, *Antonija Mitrovic* and *Warwick Irwin* discusses an intelligent tutoring system for object-oriented programming skills that also represents collaboration skills using the same user modeling and domain formalism. It is a CSCL environment that supports groups of students as they work and learn together—something unusual for intelligent tutoring systems. The system provides a careful balance of supports for individual and group work, based on the CSCL literature. A pilot study and a controlled experiment in a classroom confirmed the effectiveness of the system in achieving its main goals. Attempts to use artificial intelligence in education have always been an important aspect of CSCL, and this paper represents that tradition with a new innovation. It also bridges the technological and software-oriented concerns of CSCL with its focus on supporting collaborative learning among programming students.

Many CSCL activities involve students or adults searching the Web—either individually or collaboratively—and synthesizing the information that they find on multiple sites. *Marc Stadtler* and *Rainer Bromme* provide an analysis of the metacognitive tasks involved in modeling this flow of information from diverse documents. Metacognitive tasks include, above all, the ability to identify, rate and keep track of information sources—key concerns for CSCL designers who want students to critically assess Web resources and to acknowledge their sources. In the reported laboratory experiment, a web-browser equipped with optional prompts for supporting metacognitive tasks was used in a number of conditions with college students. Quantitative analysis of the results indicated that the integration of source information and content information while dealing with multiple sources on the Internet is not only a desired goal, but a realistic one that can be fostered through the metacognitive strategy of evaluating information.

Scripting in CSCL

The next two papers grew out of a European Research Team on 'Computer-Supported Scripting of Interaction in Collaborative Learning Environments' (CoSSICLE) funded by the 'Kaleidoscope' Network of Excellence. Pierre Dillenbourg and Frank Fisher suggested publishing a set of papers reporting on project findings in *ijCSCL*. Lars Kobbe coordinated

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the expansion of the papers and their submission. Barbara Wasson, Associate Editor of *ijCSCL*, supervised the peer review of these articles. In this issue, we initiate the flash theme of "Scripting in CSCL" with the first two papers that are ready for publication. We welcome submissions on this theme for future issues.

Lars Kobbe, *Armin Weinberger*, *Pierre Dillenbourg*, *Andreas Harrer*, *Raija Hämäläinen*, *Päivi Häkkinen*, and *Frank Fischer* introduce the theme with a review of the current state of the art of scripting and a framework for the specification of scripts, including a proposed standardization of terminology. Collaboration scripts aim to foster collaborative learning in shaping the way in which learners interact with one another. In specifying a sequence of learning activities, together with appropriate roles for the learners, collaboration scripts are designed to trigger engagement in social and cognitive activities that would otherwise occur rarely or not at all. This paper aims to consolidate and expand these approaches in light of recent findings and to propose a generic framework for the specification of collaboration scripts. The framework enables a description of collaboration scripts using a small number of components (participants, activities, roles, resources and groups) and mechanisms (task distribution, group formation and sequencing).

Tammy Schellens, *Hilde Van Keer*, *Bram De Wever* and *Martin Valcke* continue the theme with a relatively large, multilevel analysis of college freshmen discussing topics in online groups of about ten students. Their discussions were scripted by assigning four students in each group to well-defined collaboration roles: "moderator," "theoretician," "summarizer," and "source searcher." By focusing on communication and coordination, the primary targets of the script instructions were interactions within the group rather than cognitive processes of individuals. The authors conclude from their detailed statistical analysis that the use of collaboration roles has the potential for improving knowledge construction. In part of the experiment, an overall positive effect of role assignment was detected. All students in the experimental condition outperformed the students in the control group without role assignment. Nevertheless, the study revealed that not all roles equally promote knowledge construction for the individuals who have to perform that specific role. It appeared that students in some roles were confined by their role and did not participate as well in the ongoing discussion. This points to the danger of over-scripting during collaborative interaction.

Argumentation in CSCL

The following four articles introduce the flash theme "Argumentation in CSCL." An argumentation perspective exposes how learning in group settings can be accomplished by participants' critical analysis of claims and interpretations through dialectic processes. Research on argumentation has an established history in CSCL, particularly in the line of European work reported in the first volume of the CSCL book series (Andriessen et al. 2003). This work has continued in two European projects, SCALE and DUNES, which have studied argument graphs as well as other media for conducting or representing argumentative dialogues. Jerry Andriessen and Michael Baker proposed this theme for *ijCSCL* to present some of the results of these research efforts and related work. Daniel Suthers, Associate Editor of *ijCSCL* supervised the peer review of submissions for this theme and wrote the following overview. The first four papers being published under this theme include two papers from SCALE and two from DUNES, representing a diversity of CSCL argumentation research. Argumentation and technological support for "arguing to

learn" continues to be an active area of research in CSCL; the Journal editors look forward to additional contributions in this area.

Michael Baker, *Jerry Andriessen*, *Kristine Lund*, *Marije van Amelsvoort* and *Matthieu Quignard* introduce Rainbow, a framework for analyzing debates. The analysis method aims primarily to quantify functional categories of interaction so that frequencies of these categories may be correlated with learning outcomes in experimental settings. Drawing upon prior research, seven functional categories are identified, exemplified and discussed in detail. Perhaps the most unique analytic category contributed by this paper identifies moves that *broaden and deepen* learners' understanding of a space of debate. Independently of whether learners are taking positions in a debate or studying others' positions, learners can advance their understanding by exploring a greater diversity of positions and the arguments that bear upon them (broadening), and elaborating on these arguments and the concepts on which they are based (deepening). Applications of Rainbow to other projects in the SCALE community are described, as well as potential extensions to nonverbal interaction media and relevance to other methodological traditions.

The other SCALE paper, by *Kristine Lund*, *Gaëlle Molinari*, *Arnauld Séjourné* and *Michael Baker* also offers an analysis method, ADAM, that is positioned within the experimental paradigm. Here, the emphasis is on analyzing argumentation diagrams as products rather than the process of argumentation that is addressed by Rainbow. ADAM measures the quality of argumentation diagrams according to quantifiable characteristics such as the number and nature of topics, opinions, arguments, relations, and elaborations, along with judgments of correctness of the relations. The primary contribution of this paper is an experimental comparison of two instructional strategies for using argument graphs: as a *means for debate*, in which students interact through both chat and argumentation graph tools, and as a *tool for representing debate*, in which students interacted through chat and then transcribe their discussion to an argumentation graph. In both cases, students created individual argumentation diagrams before and after the debate: these diagrams were analyzed using ADAM to identify differences. Students who used the graphs as a means for debate tended to express more personal opinions, elaborating on argumentation (reasons), while students using the graph to represent debate sought to express the consensus of a "group voice," and elaborated more on causes and consequences. Thus, the paper illustrates the bidirectional influence of tool on argumentation and argumentation on tool.

The concept of a group voice plays an important role in the paper by *Baruch B. Schwarz* and *Reuma De Groot*, which shifts us from experimental to analytic methodologies in design-based research. Observing that the study of argumentation in CSCL is part of a direction in education that values collaboration over individuation and dialogic reasoning over thinking skills, the authors seek to identify evaluation methods that most appropriately reflect these values. This work was undertaken in the context of an evaluation of the Kishurim program, which was designed by the authors to foster argumentation and dialogic thinking skills under the guidance of several principles. Digalo, a software tool for the representation and management of argumentative discussions developed in the DUNES project, supported implementation of this program. Seeking to evaluate whether students improved their thinking on the historical topic studied, the authors first compared pre- and post-session essays on quantitative measures of argument structure, such as the number of claims and reasons given, finding no differences. Recognizing that these structural measures are not criteria for the educational objectives they care about, the authors then analyzed the essays for openness, decisiveness and coherence, finding significant differences. Furthermore, the authors undertook a discursive analysis of students' argumentative dialogues to understand how these improvements came about. Schwarz and De Groot

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conclude that as students sought to find collective truth in a group voice, they became less motivated to produce "more arguments at any price," and hence numeric frequencies of the constituents of arguments fail to capture the educational outcomes that were of greatest importance to both researchers and students. The paper exemplifies the value of being reflective about our methods rather than following disciplinary traditions uncritically.

Nathalie Muller Mirza, *Valérie Tartas*, *Anne-Nelly Perret-Clermont* and *Jean-François De Pietro* also work with Digalo in the context of the DUNES project, and similarly find that analysis of interaction best suits their educational goals. Mizra et al. seek to foster students' understanding of a historical debate about the humanity of the natives of the New World. Students were assigned to three groups in which they role-played three protagonists. This instructional strategy should broaden and deepen the space of debate, because students are not only exposed to diverse frames of reference on the debate, but must understand these frames of reference deeply enough to act as representatives of those positions. Like Schwarz and De Groot, Mirza et al. find that analysis of the structure of arguments would not address their educational goal, which is learning about the debate from argumentation, rather than learning to argue. Instead, they pursue a bi-level approach to analysis, one that traces the development of understanding of the historical topic throughout the dialogue, and another that treats argumentation as a social activity, analyzing triplets of argument–counterargument–reply to identify how challenges to a position are addressed. As a broad picture of the historical event was elaborated, students also developed argumentative strategies. The authors sought to identify Digalo tool affordances that were appropriated in these topic-development and argumentative processes, observing roles of representations consistent with those reported by Suthers and colleagues. As for Lund et al. and Schwarz and De Groot, the emergence of "collective reasoning" afforded by the shared representation was notable.

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