Relations Matter – CSCL Research Informing and Developing CL Competencies

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It is well known that bringing together a group of learners does not guarantee that they will work and learn properly, either as a group or individually. They must develop a shared mental model specifying how they will communicate and coordinate their actions to share group knowledge effectively (Fransen et al., 2013). In CSCL, students share and construct knowledge with their group members through social interactions in which one might imagine collaboration between diverse types of entities, such as students, actions, and the digital artifacts that the students create (van Aalst, 2009). Interpersonal interactions and relations involving technologies and contextual resources are formalized within and between these entities, and these relations are consequential in influencing CSCL outcomes.

This conceptualization of relations is central in the CSCL literature, and as we have seen in our journal, the field has progressed in asking deeper and more nuanced questions to contribute towards refinement and elaboration of that conceptualization. Relations are enacted through processes, which are studied through collection and analysis of multiple data streams. These data afford the opportunity to implement new analytical approaches to reveal evidence of interactions and relationships at both the social and cognitive levels (Martinez-Maldonado et al., 2019). This edition comprises four papers that illustrate ways of asking and then addressing questions posed to these data, specifically related to multiple notions of relations, both empirically and methodologically. The four papers show that CSCL relations matter in two ways. On the one hand, a substantial part of what is lacking in and for successful collaborative interactions can be supported through interventions designed in light of the knowledge we create from our empirical studies. On the other hand, CSCL environments and the processes housed within them have the ability to foster key competencies among learners.

The papers in this issue add to existing CSCL research and bring novelty in several ways. They report empirical evidence contributing to ongoing investigations that span the gamut from the kind of short-term collaborations that occur in collaborative problem

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solving (CPS) to longer term sustained interaction in teams or even knowledge building communities aiming to elaborate answers to overarching themes. In all this, the question remains: What kind of relations make CSCL successful? The papers discuss action transitions and social and cognitive capacity in between peers, team coordination mechanisms as well as active and cross-community knowledge building processes. The studies also add to the methodological and analytical means to understand these relations, by implementing various analytical approaches, such as social network analysis, epistemic network analysis, collaborative analytics, and deep content analysis.

Action transitions and Team Coordination as Representations of Shared of Decision Making and Conceptualizations

The first two papers of this edition represent a progression of understanding of the processes in collaboration, which may both push the collaboration forward and contribute to the group's shared understanding and learning outcomes.

Shupin Li, Johanna Pöysä-Tarhonen and Päivi Häkkinen study short term collaboration, specifically collaborative problem solving (CPS) in CSCL. They claim that earlier studies have often emphasized the outcomes of CPS, such as problem solving or reflection skills, but less is known about the processes, in particular the mutual influence between peers leading to demonstrable productivity within the CPS. CPS covers many valuable thinking and interaction processes that are especially useful in on-line learning environments, but what specifically makes these interactions useful for productive collaboration, especially when considering what is unique about collaboration between humans rather than between a human and an agent? Li et al. studied action transitions to better understand the relations between the actions in sequences enacted by dyads in an online assessment environment. What they mean by action transitions is those sequential actions that a pair of students enact with the aim of understanding, planning, solving, and revising.

The purpose of their study was to examine the sixth-grade student pairs' (N = 166) patterns of action transitions in an online CPS assessment environment in which the students worked in pairs to solve a problem together. They also studied the relationship between the patterns of action transitions and students' assessed skill levels of CPS, such as social and cognitive skills of CPS. Log file data generated from the assessment environment were collected. Social network analysis was applied to the log file data, and transition networks were created using weighted directed networks. Patterns of action transitions in each transition network were represented by the numbers of nodes, degree centralization, reciprocity and numbers of triadic patterns.

The results showed that pairs with one member with high social and high cognitive CPS skills conducted more actions and demonstrated a higher average frequency of action transitions with more attempts given to different actions, implying that they attempted more paths to solve the problem than the other pairs. Their interpretation is that the pairs with one student with high social and high cognitive CPS skills were able to exhibit more productive CPS than the other pairs. The study shows that investigating the patterns of action transitions of the dyads deepens the understanding of the mutual influence between dyads' actions in CPS. Pedagogical implications are stressed, such as being aware of the students' social and cognitive capacities of CPS when assigning them into pairs for computer-based CPS tasks. The results are contrasted with previous findings from PISA, thus raising the question of whether collaboration skills in the sense that we consider their application in

social interaction within human dyads and groups can really be assessed in an environment that only engages one human.

Maedeh Kazemitabar, Susanne Lajoie and Tianshu Li studied teamwork in a hackathon setting. It is known that teamwork precipitates some types of socio-emotional interactions that may at times pose challenges in teamwork and that may have detrimental effects on the progress of collaboration (Bakhtiar et al., 2017). While earlier studies concentrate on work teams in organizational contexts, this study adds a novel CSCL context, a hackathon that makes particular characteristics of CSCL teamwork salient, for example, time pressure, the effects of team composition, and the integration of technology.

Kazemitabar et al. examined and classified general teamwork challenges in a novel CSCL context to pinpoint which challenges impede the development of key team coordination mechanisms, such as mutual trust and shared mental models. Multiple data were collected during the two days of an international Physics hackathon event among undergraduate and graduate students (N = 48) covering a questionnaire (AIRE), post-competition interview data, and videos of team interactions. Interview data, questionnaire data, and team-interaction discussion data were analyzed using a qualitative theory-driven coding and theme development aiming to analyze mutual trust and shared mental models as well as identify the specific challenges teams faced. Also, descriptive statistics was used to identify the most important challenges.

Their analyses revealed 16 general challenges and seven types of challenges that hamper teamwork in a hackathon. The types of challenges were cognitive, motivational, emotional, and behavioral, cognitive/behavioral, general, and external challenges. They also identified which challenges hindered the development of mutual trust, and which challenges hindered the development of shared mental models. The findings provide insights for educators and mentors in understanding the types of teamwork challenges that may occur in CSCL settings.

CSCL Developing Learner Competences in Knowledge Building Communities

At the same time as research in CSCL has progressed substantially in terms of developing tools and scripts for improving CSCL designs and making them beneficial for different learners and groups (Schaubert & Vogel, 2022), it has also become increasingly important to understand how CSCL can scaffold learners' competencies in collaborative inquiry. The last two full papers in this issue offer solutions to develop knowledge building communities and practices in contexts where students work for several weeks, possibly even in large communities, in which teachers and learners have the opportunity to evolve and grow together in a CSCL classroom.

Yuqin Yang, Gaoxia Zhu, Daner Sun and Carol Chan studied the design and process of collaborative analytics-supported reflective assessment and its effects on promoting pre-service teachers (PST) to develop their competencies in collaborative inquiry and knowledge building. They used a quasi-experimental design that lasted 18 weeks, having experimental (N = 40) and control groups (N = 28). This study used a data driven approach and analytics to develop practical scaffolds for learners. Learners' reflective assessment of their knowledge building inquiry was aided by visualizations and data generated by the Knowledge Building Discourse Explorer (KBDeX), which is a social network analysis tool designed to visualize collaborative ideas and discourse.

They studied characteristics of PSTs' Knowledge Forum discourse moves and whether they reflect competencies in collaborative knowledge building inquiry. Also, they investigated whether PSTs who participated in the knowledge building design enhanced by collaborative analytics-supported reflective assessment perform better than those in the regular knowledge building design.

The primary data source for content analyses examining PSTs' competencies in collaborative knowledge-building inquiry were Knowledge Forum notes from the experimental class and from the comparison class. Epistemic network analysis was used to analyze differences in epistemic network characteristics. Also PSTs' responses in reflective prompt sheets were collected and analyzed. Knowledge Forum discourse analysis showed that collaborative analytics-supported reflective assessment was able to help PSTs develop collaborative inquiry competencies for community knowledge advancement. Implications for designing CSCL collaborative-analytics enriched with reflective assessment and student agency were discussed, while also broadening CSCL and knowledge building approaches to pre-service teacher education as well.

A major advantage of CSCL is to extend local and small-scale collaboration to higher social levels and over longer timescales even enabling cross-boundary interaction. However, empirical investigations in this space are rare. The Guangji Yuan, Jianwei Zhang and Mei-Hwa Chen study deals with collaborative knowledge building among four Grade 5 classroom communities (N=76) that studied human body systems with the support of the Idea Thread Mapper (ITM). While students in each classroom collaborated in their local discourse space to investigate various human body functions, they generated reflective syntheses, so called "super notes", to share knowledge progress and challenges in a cross-community meta-space. As a cross-community collaboration, students from the four classrooms further used the Super Talk feature of ITM to investigate common problems.

The goal of the Yuan et al. study was to investigate how students pursue collaborative knowledge building in an expanded social context that involves cross-classroom collaboration. Data sources included classroom observations and videos, online discourse within each community, students' super notes and records of Super Talk discussion shared across the classrooms, and student interviews. Qualitative content analyses featured prominently in the data analysis. The results showed that the fifth-graders were able to generate high quality super notes to reflect on their inquiry progress for cross-classroom sharing. Detailed analysis of the cross-classroom Super Talk documented that students constructed and displayed a multifaceted understanding of the topic "how people grow". This understanding was built on the diverse ideas from each classroom and then subsequently contributed to enriching student discourse within each individual classroom. Their findings give recommendations as to how to approach cross-community collaboration as an expansive and dynamic context for inquiry and continual knowledge building with technology support.

Reflection

The current edition of the journal can be seen as a continuation of the discussion from the March special issue. As the articles of this June issue reflect, the CSCL field is working towards deeper understanding and also better influence on the way people learn. This is what makes CSCL research so powerful for renewing teaching, learning and education in this unpredictable and changing world. Our recent March 2022 special issue (Schaubert & Vogel, 2022) discussed the integration of three concepts central to the enterprise of

computer-supported collaborative learning: namely, collaboration scripts, self-regulation, and group awareness. In the discussion paper Charles Crook, (2022) pointed to a concept of multilayered "relations" as a lens for understanding how increasing knowledge of the synergy between collaboration scripts, self-regulation, and group awareness can help guide us as we design joint activity and thus increase the success of collaboration during knowledge building encounters. Moreover, designs that reflect this understanding are also conceived as resources that might cultivate collaboration as a general competence as an outcome of the resulting collaborations. This issue adds to the discussion by adding new empirical findings regarding relations in CPS, teamwork and knowledge building communities.

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