

Analyzing and Conceptualizing Collaborative Learning with Digital Knowledge Objects

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Abstract: With the surge of data analytics and data mining techniques, automated analysis of interaction data has also advanced greatly. While multimodal data analytics are gaining terrain, little research in the field of learning sciences and CSCL has analyzed collaboration through (automatically) tracing the evolution of digital objects, often used or developed by learners individually or in collaboration, e.g., collaborative essays, research reports, prototypes, digital tools. This workshop aims to create opportunities for researchers, designers and practitioners to share their research questions and challenges, and discuss theoretical and methodological approaches to examining collaborative learning with digital objects. Workshop participants will work together on exploring and elaborating new analytical approaches and theoretical notions informing empirical research. The workshop will contribute to convening notions, frameworks and methods instrumental for empirical and methodological work and to building a forward-looking research agenda on digital tracing and analysis of collaborative learning with digital objects.

Keywords: collaborative learning; digital objects; digital traces; automated analysis

Theme and aims of the workshop

The need for collaboration, and for knowing how to collaborate is no longer debated, as research and practice have shown that individual knowledge and skills are not sufficient to address open-ended, ill-structured problems. In education, collaborative learning and group-based activities are considered strategies that provide learners with the opportunities to work with complex knowledge contents and advance their collaborative competence (Damşa & Muukkonen, 2020). In examining collaboration and group interactions, research has generally focused on the nature and quality of interaction, showing that these are predictive for CL effectiveness and for learning (Mercer, Wegerif & Major, 2020), where digital technologies support interaction and coordination (Matuk, Tissenbaum & Schneider, 2019). For this reason, discursive interaction has been studied and theorized extensively, with a focus on discursive processes or dialogue. Some studies in the learning sciences recognize that complex, ill-structured problems are better addressed when collaborative work revolves around shared objects, usually in digital form (e.g., collaborative essays, research reports, prototypes) that drive and make tangible the collaborative efforts. Yet, objects and their role have received little attention in empirical, conceptual and methodological work focusing on collaborative learning. Qualitative research that highlights collaboration around knowledge objects and the role of objects in collaboration has been published in dispersed outlets, but has limited potential to reach the broader learning sciences, learning analytics and human computer interaction communities, to which this topic is highly relevant.

The workshop ‘Collaborative Learning with Digital knowledge Objects’ (CLeDO) is the successor of a series of activities and workshops organized in previous years. The primary goal of this workshop is to generate common understandings of the, sometimes, divergent perspectives of different research areas on the phenomenon of collaborative learning with digital objects and how it is examined/analyzed. The workshop aims to create

foundations for the synthesis of existing research work and setting up an agenda for continuing this work in the learning sciences and CSCL. The objectives of the workshop are to:

1. Enhance understanding of *current* conceptualizations and methodological approaches to studying collaborative learning with digital objects;
2. Explore and expand ways for conceptualizing and researching collaborative learning with collaborative learning with digital objects;
3. Articulate common themes and issues relevant for researchers, designers and practitioners;
4. Outline an integrative agenda for future collaboration;
5. Expand a network of (especially) LS and CSCL scholars contributing to research and development of collaborative learning with digital objects.

Theoretical background

In the available literature in the field of learning sciences and CSCL, there are crudely two ways of looking at objects and their role in collaborative learning. In the field of learning analytics, objects can take the form of artifacts *used* for various purposes (such as shared workspaces or tools) within a group's collaborative environment. Examples are representational tools or visualizations of a group's joint work (Janssen & Bodemer, 2013; Martinez-Maldonado, 2019). Also, digital objects can be represented by the particular artifacts a group is *working on* collaboratively, for example collaborative essays, reports, and prototypes (Muukkonen & Lakkala, 2009; Riikonen et al., 2020). This variation in types of objects adds a further dimension to collaboration: the objects can support group work by providing structure or information, can be a topic of conversation, or can be manipulated and lead to subsequent (learning) activities. In the latter case, there is thus a bidirectional relationship, where the groups edit the object and the object is input to the collaboration (Damsa, 2014).

We identify two main challenges around the role of digital objects in collaborative learning. A first one is to generate an *articulated overview of conceptualizations* of collaborative learning where digital objects and their role are explained and accounted for. Such an overview may build on different premises underlying socioconstructivist, sociocultural and sociocognitive tenets, wherein artifacts are envisioned as products of collaborative inquiry, or as shared creations (Hakkariainen et al., 2013); or sociotechnical and sociomaterial notions, which conceive of objects as tools embedded in and which facilitate collaboration (Säljö, 2010). A second challenge is of *methodological* nature. With the surge of data analytics and data mining techniques, automated analysis of interaction data has also advanced greatly (Gašević et al., 2019). Yet, while multimodal data analytics are gaining terrain, there is limited literature in the field of learning sciences and CSCL that takes an explicit focus on analyzing collaboration through (automatically) tracing the evolution of digital knowledge objects and the epistemic value they carry throughout the process. Tracing the evolution of digital objects through the engagement of actors in editing, commenting and revising the objects requires sophisticated analytical approaches. Such approaches have thus far mainly been carried out by hand and by a combination of various analytical heavy, time-consuming, qualitative techniques not yet suitable for large-scale implementation (e.g., Damsa, 2014; Damsa & Muukkonen, 2020). Advances in automated analytic methods and tools provide novel opportunities explored in the workshop.

This workshop will facilitate sharing approaches and methods for conceptualizing and studying collaborative learning with digital objects, and building integrated lines of work for addressing these conceptual and methodological challenges. It will create opportunities for the researchers, designers and practitioners interested in collaborative learning with digital objects to share their research questions and challenges, and expand their theoretical and methodological approaches.

Workshop activities

The workshop draws upon and extends work started by the organizing team through a network project. Conceptual explorations, through reading and discussion of theoretical and empirical articles, have highlighted concepts and approaches instrumental to generate a more integrative conceptualization of collaborative learning with digital objects. In addition, work conducted by the organizers' local teams provide various methodological approaches to analyzing the digital traces of the collaborative processes and the objects and artifacts developing through these processes. This workshop offers the chance to outline a baseline for further investigations and scholarly collaboration, whereby other scholars can bring in the outcome of their exploration, whether conceptual, empirical or methodological. In this context, the workshop will, therefore: a) convene a set of notions, frameworks and methods instrumental for conceptual, empirical and methodological work on collaborative learning with digital objects, b) create an overview of research, interests and orientations pertinent to this topic, c) build a forward

looking research agenda and consortium investing in this research topic and suitable methods, and d) set the basis for a shared agenda for subsequent conceptual and methodological explorations.

Extending previous work, we intend to structure the ICLS2021 workshop into two themes: 1) Concepts and theories and 2) Research methods. To structure the workshop activities, we will use methods developed in the learning sciences for design-based research and model-based reasoning (see Pennington et al., 2016; Sandoval, 2013). The workshop will include a combination of activities in small groups for a more in-depth exploration of particular questions, and plenary activities for sharing of ideas across the groups. The final part of the workshop will be allocated to discussing future steps. The following concrete activities will help advance the planned agenda:

- Clarifying and reframing the purpose and joint activities during the workshop,
- Sharing, through participant presentations of their work & interests (Pecha Kucha),
- Exploring, through group activities structured around the themes using a progressive brainstorming technique, aiming to identify connections among participants' presentations,
- Sharing the main outcomes in the whole-group plenary discussion,
- Extending, through facilitated focused group activities to explore shared outcomes and synthesis of outcomes in whole-group interactive session,
- Framing plans for collaboration, joint activities at the next annual meeting, and possible ideas for joint publications

The intended audience of this workshop are researchers and practitioners (e.g. teachers, designers), who study or support collaborative learning where objects function as products or tools. The workshop is intended for both new attendees and for experienced scholars, who have been joining earlier workshops on collaborative learning at CSCL2017, CSCL2019 conferences and at ICLS2018, ICLS2020. Different types of contributions are welcome, ranging from initial ideas, to work in progress, to mature or finished projects, which can be situated within and across diverse disciplinary perspectives (e.g. learning sciences, CSCL, cognitive science, computer and data science, learning design).

Expected outcomes and contributions

This workshop's outcomes will generate benefits ranging from immediate to longer-term:

- Immediate: A repertoire of notions, frameworks and methods instrumental to continuing conceptual, empirical and methodological work on collaborative learning with artifacts;
- Short-term: An overview of research, interests and orientations relevant to this topic;
- Medium-term: A plan and set of ideas for selected contributions to be further developed with the prospect of submitting a special issue proposal and an edited volume proposal organized by the organizers.
- Long-term: A research agenda and a consortium concerned with themes and studies that aims to account collaborative learning with digital objects.

Link to conference theme and organizers

The organizers conduct research in the field of learning sciences and CSCL and bridge learning research communities across three continents. The organizing team has considerable experience in organizing workshops on collaborative learning, and theoretical and methodological approaches in learning research at international conferences related to learning sciences, collaborative learning and learning analytics. The workshop addresses the theme of the conference by examining a topic that has been explored previously, but has been only to a limited extent visible in the learning sciences research. This workshop builds on and extends work conducted at CSCL2019 and ICLS2020 workshops, wherein the members of the organizing theme have been contributing and participating in various capacities. Examples are the co-organizing of the workshops 'Emergent Practices and Material Conditions in Tablet-mediated Collaborative Learning and Teaching' (Ceratto Pargman et al., 2017) and 'Synthesizing CSCL perspectives on the theory, methods, design, and implementation of future learning spaces' (Hod et al., 2017) at CSCL2017, or contributing the workshop 'Rethinking Intelligent Support for Learning in Groups' at ICLS2018. The main organizers participated and organized various events (symposiums, papers) at ISCL and CSCL conferences on the topic of collaborative learning with knowledge objects and collaborative productive disciplinary engagement during the past ten years. All organizers are members of a network project that has been engaging in conceptual and methodological explorations on analysis of collaborative learning and development of digital objects (<https://www.earli.org/ECER>). This workshop will further elaborate on these explorations, and invites other researchers from the ISLS community to join, expand and continue this work.

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