

Cracking the Nut – But Which Nutcracker to Use? Diversity in Approaches to Analyzing Collaborative Processes in Technology-Supported Settings

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Abstract: Research on collaborative learning and problem-solving in technology-supported settings increasingly focuses on understanding collaborative processes, not just assessing their outcomes (learning gains or products). Developing such understanding is a prerequisite for promoting collaboration in an informed way. Different methodological approaches have been adopted for analyzing collaborative processes in technology-supported settings. As no single method is sufficient to unravel all aspects of a collaborative process, researchers must choose approaches that allow them to gain data on those aspects that are of focal interest for a given research question. This symposium will highlight aspects of the diversity of methodological approaches. The speakers of the symposium will describe the process analyses conducted as part of their research in different content domains and collaborative settings. They will discuss merits and shortcomings of these methods in revealing particular aspects of the collaborative processes. The discussion will compare and contrast the different methodological approaches, working towards the development of a “methodological toolbox” which could support informed choice of the appropriate methods of analysis.

Panel Overview

In research on technology-supported collaborative problem-solving and learning it is of great importance to understand what makes up good collaboration and to evaluate technologies and instructional measures aimed at supporting such collaboration. There is an amazing diversity in the approaches that have been adopted in trying to crack this nut. The various methodological approaches differ strongly with regard to dimensions like the data sources used, the level or unit of analysis, and the way the analyses are conducted (technology and tools used).

The *methodological approaches* to analyzing collaborative process range from analyses of activity patterns to various types of discourse analysis (e.g. Chinn, O’Donnell & Jinks, 2000), but also to interaction and social network analyses (Reffay & Chanier, 2002) or matrix analysis (Wortham, 1999). Coding schemes have been developed to assess instances of certain types of behaviors or speech acts in a quantitative way (e.g. Pilkington, 1999). Such approaches have sometimes been criticized for focusing merely on the occurrence of behaviors or utterances while disregarding the quality of the process (Rummel & Spada, in press). More qualitative approaches have been taken to analyze the collaborative interactions in more meaningful, contextualized ways (Guribye & Wasson, 2002). In turn, such “holistic” approaches have been criticized for lacking methodological rigor and interpretative strength (Hammersley, 1992).

These methodological approaches have been applied to different *sources of data*. Logfiles can provide information about activities taking place during the collaboration, their authorship, duration and the like. Audio files or transcripts, as well as written dialog from interactions in text-based collaboration settings, make it possible to scrutinize the collaborative dialog on different levels and with different granularity. Video data provides a rich information source with regard to the situational context in which a collaborative interaction is embedded.

Also with regard to the *level and unit of analysis* there is great diversity, ranging from analyzing turns, speech acts or time units of various length, to analyzing bigger chunks of the interaction, like scenes. Analytic approaches may further differ in which aspects of the interaction they include in their analysis (verbal behavior and non-verbal aspects of the behavior, like gesture, posture, facial expression, voice modulation; Whittaker & O’Conaill, 1997).

In this symposium we want to highlight aspects of the multi-faceted diversity of approaches to analyzing collaborative processes. We plan to discuss approaches to analyzing collaborative processes in a variety of technology-supported collaborative settings. The individual contributions will characterize the analyses conducted as part of their research on the dimensions introduced above. They will discuss the merits and shortcomings of these methods of analysis in revealing aspects of the collaborative process relevant to their research questions. An overall discussion will have the goal to compare and contrast the individual approaches. The overarching goal of the symposium is to motivate scientific discourse about the diversity of approaches taken to analyze collaborative processes. No single method is sufficient to unravel all aspects of a collaborative process. Qualitative and quantitative methods, as well as theory-based and data-driven approaches need to complement one another to help reveal the richness of information contained in a collaborative interaction. Yet there is always the necessity to make a choice; to choose methodological approaches that allow one to gain data on those aspects of the collaborative process that are of focal interest for a given research question. It would be very desirable to have a “methodological toolbox” at hand, which could support an informed choice of the appropriate methods of analysis. It is our goal to work towards the development of such a toolbox.

Individual Contributions

An Emergent Methodology for Examining “Collaborative Space” in Educational Technology Environments

Cynthia Carter Ching (University of Illinois at Urbana-Champaign; USA)
& X. Christine Wang (SUNY Buffalo, USA)

Conventional methods of studying collaboration at computers often focus on learning gains or surface indicators of equal access as measures of “effectiveness.” This kind of methodology fails to capture the richness and meanings of children’s collaboration, particularly when children are involved in spontaneous or seemingly unstructured computer activities. To help address this problem we are developing a qualitative methodology for studying children’s face-to-face computer collaboration. Our work examines student interactions within configurations of physical and social spaces surrounding educational technology – both conscripted spaces as mandated by authority figures and emergent spaces as negotiated by students (Ching, Kafai, & Marshall, 2000; Wang & Ching, 2003; Wang, 2003). Built on existing methods of interaction analysis (Jordan & Henderson, 1995) and grounded theory (Strauss & Corbin, 1998), theories of space (Soja, 1996) and emergent goals (Saxe, 1991), and other studies using “space” to describe collaborative activities in classrooms (Gutierrez, Baquedano-Lopez, & Tejada, 1999), this method is ethnographic in nature and uses videos as a vital means to examine social-spatial-cognitive collaborative processes and to identify affordances and constraints thereof. Our goal is to view children’s collaborations from their own perspectives and establish multiple indicators of effectiveness.

Employing Quantitative and Qualitative Methods to Analyze Collaborative Process in a Computer-Mediated Setting at Three Levels

Hans Spada & Nikol Rummel (University of Freiburg, Germany)

In our assessment of collaborative process we distinguish between three levels of analysis: (1) a *macro* level, assessing the coordination of joint work, (2) a *micro* level, assessing the communication, and (3) the *domain-related* content and quality of the collaboration. To gain information about the collaborative process at these levels, we have taken three approaches: First, on the basis of log-files the *activity patterns* of the collaboration were analyzed. This analysis provided information about the pattern of individual and joint phases of work. Secondly, video recordings and transcripts allowed an analysis of the *dialogs* at all three levels. For the analyses of the macro and micro aspects of the dialogs, we developed a system of criteria drawing on empirical findings of what aspects characterize good collaboration. The units of analysis were minutes (macro) and turns (micro). The focus of the domain-related analysis was on “topics” arising within the dialog and their attributes (relevance, depth of discussion etc.). A promising third approach has been taken by performing a multi-step analytic procedure which combines a more holistic qualitative approach (Mayring, 2003) with quantitative elements. By means of this analysis, process *dimensions* relevant for a *successful collaboration* were identified. The various methods to analyze collaborative process were applied and evaluated in a study in which we investigated the effects of instructional support measures to improve computer-mediated collaboration on a

sample of 36 dyads collaborating for several hours (Rummel & Spada, submitted). We discuss gains and problems of the different approaches.

From Coding and Counting to Exploring and Understanding: Methodological Experiences in Analyzing Collaborative Interactions with Shared Representations

Dan Suthers (University of Hawai'i at Manoa, USA)

My research is generally concerned with understanding how people collaborate with shared representations. In a recent study, I wanted to see whether differences in features of representation of evidential reasoning used by collaborators would influence their interactions. I predicted ways in which the representations prompt consideration of evidential relations, and how the salience of represented ideas facilitates subsequent reference to the ideas. Given these predictions, the most straightforward methodology was to code the talk and actions of the participants, count up occurrences of each code, and compare means through statistical techniques (Suthers & Hundhausen, 2003). Subsequently my colleagues and I used similar methods to compare the use of shared representations in face-to-face and online modes of interaction (Suthers, Girardeau, & Hundhausen, 2003). The quantitative methodology was valuable for establishing the presence of predicted phenomena, but did not facilitate an understanding of how shared representations are used to mediate collaboration. For that question, a data-driven qualitative methodology is more appropriate, as the objective is to identify and understand what is there rather than to test a theoretically derived hypothesis. We are presently engaged in a micro-level analysis of individual collaboration episodes to understand how online participants collaborate through their manipulations of a graphical evidence map and distribute their collaboration across graphical and linguistic representations ("chat"). In the panel presentation, I will summarize how the different kinds of research questions led to choice of methodologies, and will elaborate on our use of visualizations of transactions in the latter analysis.

Assessing Quality Features of Online Contributions: Bringing Microanalysis of Written Texts Together With Participants' Subjective Perceptions.

Rainer Bromme, Regina Jucks, & Anne Runde (University of Münster, Germany)

Research on text-based computer mediated communication and cooperation mainly treats participants' contributions as utterances or speech acts, using theoretical frameworks of research on verbal interaction. In contrast we will argue that this kind of communication produces *written artifacts*. We start with a discussion of methodological implications of these different perspectives emphasizing the blind spots and the focus of both views. To regard contributions in a text-based scenario both as text as well as utterances, is all the more important when communicating partners differ tremendously with regard to their knowledge background. This will be exemplified by data collected in a research project on expert-layperson interactions in medical advice scenarios. Using methods that have been developed in educational psychology to assess the quality of instructional materials we analyzed experts' written explanations. In addition to identifying text features that indicate text quality, this research tradition has invented readability scores and comprehensibility ratings, mostly based on theoretical assumptions about the impact of 'objective' text features on learning and understanding. We have developed methods that focus on readers' subjective perceptions of texts and their assumptions about authors' intention. Based on these kinds of data, predictions can be made regarding the impact of specific text characteristics on recipients' perception of text features in computer mediated settings.

It is More Than Just One Nut to Crack: A Multidimensional Approach to Analyzing Collaborative Knowledge Construction in Computer-Supported Learning Environments

Frank Fischer, Armin Weinberger (University of Tübingen, Germany)
& Heinz Mandl (University of Munich, Germany)

Recent studies on technology-supported collaborative knowledge construction have underlined that we face a multi-faceted methodological problem in this area of research. In a series of experimental studies, we addressed this problem using a multi-dimensional approach to analyzing the written argumentative discourse of groups with different cooperation scripts. In analyzing argumentation we were concerned with the structure of single arguments as well as the dynamics of discussions (e.g., argument-counterargument-reply). Moreover, we analyzed the social modes of co-construction, i.e., the extent to which these argumentative activities are conducted in a transactive way, in which learning partners mutually refer to the others contribution (as opposed to a less transactive mode where learners rather work individually while being in a group setting). As units of analysis for

the coding we used segments gained in a propositional analysis. The qualitative data were quantified to serve as basis of comparison between the different experimental conditions. Moreover, qualitative graphical discourse analyses were conducted leading to case studies to better understand the argumentative dynamics of the online discussions. The measures proved both, reliable with respect to inter-rater agreement as well as sensitive to the different kinds of support for collaborative knowledge construction realized in the experimental settings. However, like in other studies of collaborative knowledge construction, the relation of process indicators to collaborative outcomes is high but their relations to individual learning outcomes are relatively modest. We discuss methodological and theoretical explanations of the results as well as their consequences for the analysis of collaborative knowledge construction.

Discussant

Pierre Dillenbourg (École Polytechnique Fédéral de Lausanne, Switzerland)

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