Rethinking Analysis of Progressive Discourse in Online Learning: An Activity Theory Perspective

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Abstract: This paper describes an innovative approach to analyze the progression of dialogue in asynchronous online forums. Although schemes analyzing the content of individual messages exist, they fail to capture the subtle relationships between messages that constitute progressive discourse for knowledge building. We present a group-level discourse analysis based on cultural-historical activity theory that characterizes the unfolding collaborative learning and knowledge construction processes in context. The application of the mixed-method approach is illustrated in the context of two online graduate courses. The analysis highlights connected sequences of discursive actions that multiple students make to advance shared understanding. The mechanics of the approach offered in this paper can be used as an analytic and transformative tool for enhancing online learning, research, and instruction.

Objectives

Historically, researchers analyzing online discourse to improve the depth of learning that occurs in these computer-supported collaborative learning (CSCL) environments have focused on the content of individual contributions. Existing content analysis schemes (e.g. Garrison, Anderson, & Archer, 2001; Gunawardena, Lowe, & Anderson, 1997; Henri, 1992) thus tend to classify the content of individual student's notes into hierarchical categories of interaction and phases of knowledge construction or inquiry. From sociocultural perspectives, however, knowledge is constructed through social interactions among individuals mediated by tools (Vygotsky, 1978). It is critical for research in CSCL to understand the collaborative process of knowledge construction that occur as students try to learn and the role that tools may play in mediating their learning (Hmelo-Silver, 2003). Different analysis approaches than reductive content analysis are needed to understand how assessments of individual engagement in the discourse relate to assessments of group cognition and knowledge building, where the holistic outcome exceeds the sum of its parts (Bereiter, 2002; Stahl, 2003). As Lee, Chan & van Aalst (2006) observed, assessing and fostering the complex interactions between individual and group understanding remains a challenge for learning scientists.

In the present paper, we rethink the analysis of student discourse aimed at deep learning and knowledge building based on an cultural-historical activity theory (Engeström, 1987, 1993) framework to highlight the importance of cultural context in which this activity takes place. Knowledge building is defined as "the production and continual improvement of ideas of value to a community" (Scardamalia & Bereiter, 2003, p. 1370). Knowledge building pedagogy thus emphasizes constructivist learning for deep understanding. A focal activity in knowledge building communities is to engage in progressive discourse through which participants develop "a new understanding that everyone involved agrees is superior to their own previous understanding" (Bereiter, 1994, p. 6). Bereiter (1994) presents a set of quasi-moral commitments that distinguish progressive discourse from other kinds of discourse and that amount to devotion to advancing knowledge and deepening understanding over time: 1) work toward common understanding satisfactory to all; 2) frame questions and propositions in ways that enable evidence to be brought to bear on them; 2) expand the body of collectively valid propositions; and 4) allow any belief to be subjected to criticism if it will advance the discourse. In short, progressive discourse represents what it means for students to engage in knowledge-building discourse (Bereiter, 2002).

While central to knowledge building theory and pedagogy, the characteristics of progressive discourse as an activity integral to and constitutive of knowledge building is not yet well understood. Progressive discourse in the online learning context is a complex process distributed across individuals, the course environment, and the discussion activity. Activity theory, increasingly being used as an analytical and transformative construct to explain social and distributed cognition in higher education and workplace settings, may shed light on how instantiations of progressive discourse may unfold online in real online courses. Therefore, we begin by introducing the activity theory framework informing the group-level analysis of discourse. Thereafter, the mechanics of the method will be outlined, and illustrative examples of emergent connected sequences of progressive discourse will be considered in the cases of two online graduate courses or "activity systems." The main assumptions in this paper concern the necessity of analyzing progressive discourse for knowledge building using a group unit of analysis, and the complexity of the systemic tensions that opportunistically drive discourse towards knowledge building, or alternatively, present a barrier to knowledge building.

Theoretical Framework

Activity theory is an interdisciplinary theory initiated by the founders of the cultural-historical school of Russian psychology—Lev Vygotsky, A.N. Leont'ev, and A.R. Luria—in the 1920s and 1930s. The approach has since been expanded by a large number of contemporary scholars in both in the former socialist countries and in the West (Engeström, 2001; Engeström, Miettinen, & Punamäki, 1999). In contrast to the standard cognitive perspective that identifies individual mental structures as the context of learning, the activity theory perspective takes the entire group or activity system as the unit of analysis, including the societal and cultural aspects in its notion of context. Activity theory thus offers a naturalistic framework for characterizing human activity and provides a set of perspectives on practice that bridges the individual and social levels (Barab, Barnett, Yamagata-Lynch, Squire, & Keating, 2002). Yrjö Engeström's (1987; 1993) activity theory framework guiding this study graphically represents the expansion of Vygotsky's (1978) tri-partite model of mediated action in Leont'ev's (1981) three-level model of collective object-oriented activity, conscious individual or group goal-oriented action, and unconscious operation (see Figure 1):

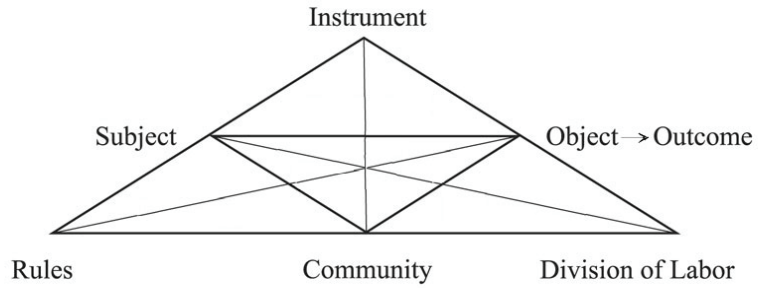

Figure 1. The structure of a human activity system (Engeström 1987, p. 78). The points of each triangle in the model above indicate the components of the activity system:

> *Subject* refers to the individual or subgroup whose agency is chosen as the point of view in the analysis. The *object* refers to the "raw material" or "problem space" at which the activity is directed and which is molded or transformed into *outcomes* with the help of physical and symbolic, external and internal tools (mediating instruments and signs). The *community* comprises multiple individuals and/or subgroups who share the same general object. The *division of labor* refers to both the horizontal division of tasks between members of the community and vertical division of power and status. Finally the *rules* refer to the explicit and implicit regulations, norms, and conventions that constrain actions and interactions within the activity system. (Engeström 1993, p. 67)

Engeström's framework also allows us to examine the secondary contradictions that exist between the components. The contradictions may be considered as systemic tensions that drive and sustain innovation in these systems (Barab et al. 2002). Elsewhere this framework has been employed to identify activity structure through analysis of discourse (Bracewell & Witte, 2003; Sicilia, Bracewell, Park, & Tung, 2007), and to investigate knowledge building community dynamics in elementary classrooms (Hewitt, 2004; van Aalst & Hill, 2006). This paper departs from previous research by using activity theory to characterize, in situ, student discourse that is aimed at the object of engaging in progressive discourse in fully online graduate courses. It also describes in detail the innovative group-level analysis approach used. As online learning opportunities proliferate, it becomes increasingly important to be able to analyze discourse to improve collaborative learning and knowledge construction processes in these contexts given the affordances and constraints of the computer-mediated communication medium.

Methods

This design-based research study (Brown, 1992; Collins, 1992) made continual changes to instructional scaffolding within and across two thirteen-week online graduate educational technology courses delivered using Web-Knowledge Forum (Fujita & Brett, 2007). We roughly followed Chi's (1997) set of functional steps in our mixed-method approach to analyzing our online discourse data. First, we reduced the number of notes to code. Two weekly discussion "views," folders that contain student postings for a particular week, from each of the two courses were selected as representative of the students' discourse from the beginning and end of the two courses. Next, each note was read several times in the context of the thread in which the student posted the note.

Using constant comparison (Merriam, 1998; Strauss & Corbin, 1998), we qualitatively coded the content of each note to topic, or what we refer to as the "problem". This clustered notes referring to a common problem of understanding together. We historically ordered these notes to create sequences of connected notes. Implicit in clustering and chronological ordering notes thus is the assumption that knowledge building will emerge from sustained discussion on a common problem.

Second, we segmented notes into theme units, "a single thought unit or idea unit that conveys a single item of information extracted from a segment of content" (Budd, Thorp, & Donohew, 1969, p. 34). Because researchers have expressed concern about the subjective nature of theme units (e.g. Rourke, Anderson, Garrison, & Archer, 2001) we calculated inter-rater reliability for segmentation as well as coding described below following Strijbos, Martens, Prins, & Jochems (2006).

Third, we adapted a coding scheme developed by Zhang, Scardamalia, Lamon, Messina, & Reeve (2007) to code each theme unit segment. These schemes embody knowledge building and progressive inquiry frameworks consistent with our study. Adaptations addressed complex knowledge and reflective practice at the graduate level. We removed the "correctness of ideas" category, a four-point scale for measuring misconceptions in Zhang et al. more suited for studying elementary school science; we added the "metacognitive comments" category following Muukkonen, Lakkala, and Hakkarainen (2005), as research suggests that graduate students employ metacognitive control and learning strategies for progressive discourse (Oshima & Oshima, 1999). From the data, we also added the emergent categories "socio-affective connection" and "technical issues."

Fourth, we operationalized this coding scheme. Using coded theme units, we mapped sequences of actions multiple students made to transform the subjects' shared understanding of a particular problem. Importantly, we considered such a mapping over two or more notes a minimal unit of analysis. We also situated these actions in the context of the secondary tensions that drive activity in the system.

Finally, we sought patterns in the mapped results within episodes of progressive discourse, concentrating on the patterns of interconnections between multiple students' notes. We interpreted the interactions to understand characteristics of progressive discourse. This highlights the interaction between individual and collaborative processes between multiple student notes that together work towards the collective outcome of shared conceptual understanding. From such qualitative assessments of knowledge building discourse, quantification of the relationships can be developed in future research. Doing so will make the labor-intensive assessment method described in this paper more useable in practice.

Data Sources

Four types of data were collected: student discourse, pre and post assignments, learning journals and online questionnaires. Participants were 33 students enrolled in two online graduate courses in educational technology at a large, research-intensive, Canadian university. Both courses were delivered using web-based Knowledge Forum (KF) (version 4.5.3). KF differs from typical conferencing systems by having features such as scaffolds, annotations and "rise-above" or summary note capabilities, and allowing lateral linking and references to be created between notes in different topic views. This paper focuses on qualitative analysis of the student discourse.

Results and Conclusions

The central concern of this study was to capture the trajectory of progressive discourse as it unfolded in two semester-long online graduate courses. Instead of classifying the content or product of individual student notes in these courses into categories of interaction or knowledge construction, we characterized interactions between a minimum of two participants that turned out well—episodes of group discourse that seemed progressive. We were not interested in concluding whether knowledge building did or did not occur in these semester-long courses. Rather, we were interested in understanding the process through which students begin to construct deep understanding of key concepts through high-quality online discourse.

Qualitative analysis of the reduced sample of 465 student notes at the note level revealed that students revisited certain topics or "problems" over time. Within and across the two courses, student notes coded to 26 emergent topics or problems of understanding for the students. The largest cluster contained 61 notes from all four selected views and dealt with the problem of understanding the affordances and constraints of different computer-mediated communication (CMC) environments. These notes showed some evidence of progressive discourse. Over time, students changed from writing short, superficial notes sharing personal opinions or listing attributes of CMC environments to contributing longer, reflective notes using KF scaffolds to build on to peers' ideas respectfully and to remain open to considering different perspectives.

The theme unit codes included categories and subcategories adapted from Zhang et al. (2007) and Muukkonen et al. (2005), with additional categories added as they emerged from the data (1). Inter-rater reliability on segmentation (88%) and coding (83%) for were achieved on 10% of the data by two independent raters. Overall, the theme-unit analysis showed that students identified slightly fewer problems of understanding

towards the end of both courses, but proportionally more of these problems were posed as questions to peers. For example, in *Course 1, Educational Applications of CMC,* students identified 18 problems in week 3 compared to 15 problems in week 10. Similarly, in *Course 2, Constructivist Theory and Design of Online Learning Environments*, students identified 23 problems in week 3 compared to 19 problems in week 10. A possible explanation for the reduced number of problems may be that students were investigating fewer problems, but were discussing them in more depth. Instead of relying on the instructor or weekly student discussion leaders, students shouldered more responsibility for generating questions within their role as discussion participants. This suggests that students increasingly demonstrated more epistemic agency (Scardamalia, 2002; Scardamalia & Bereiter, 1991) for sustaining progressive discourse online. In so doing, they posed "wonderment questions" to explore ideas and negotiated a fit between personal ideas with those of others. As well, analysis of the theme units revealed that students referenced their peers' ideas more often at the end of the course in both courses. For instance, students in Course 1 referenced their peers 26 times in week 3 compared to 50 times in week 10. Likewise, students in Course 2 referenced their peers 21 times in week 3 compared to 24 times in week 10. In KF, students may insert live hyperlinks to another note, view, or website URL. When referencing peers, students can link to another student's note in the same view or a different view. This allows students to create a "richly connected hypertext document" in which students cite others' ideas rather than copying and claiming them as their own (Scardamalia, 2002).

Using activity theory, we methodically examined sequences of actions that multiple students made to transform the group's understanding of a particular problem. By "actions," we refer to the level associated with individual knowledge and skills as conditioned by the larger cultural scope of the higher level of activity and supported by the lower level of automatic operations (Leont'ev, 1981; Kuutti, 1996; Barab, Evans, & Baek, 2004). We were interested in tracing the actions that multiple students made while engaging in the activity of progressive discourse. To do so, we traced actions over a group of notes using the theme unit codes.

To illustrate, we present two examples of episodes of what we consider progressive discourse from the data, wherein groups of students carry out interdependent actions to achieve shared understanding. Both episodes are brief excerpts selected from longer threads of discussion involving the whole course community. Note that in the transcripts below, the segments in which students quoted or referenced their peers were omitted to avoid repetition. Knowledge Forum's scaffold supports are indicated with italics, and abbreviated theme unit coding is shown in uppercase letters within brackets (1).

The first episode portrays multiple nested actions spread over four days in Course 1, week 3. This week's student discussion leaders, Laurel and Dylan, asked the course community to discuss "What value do asynchronous and synchronous tools have in augmenting collaboration and communication." The subject is a group of students within the course community who were interested discussing in how different kinds of CMC environments can mediate learning and knowledge creation. The instrument includes asynchronous discussion (KF) and synchronous chat (FirstClass) environments, and other course materials. The object is to engage in progressive discourse. An advanced M.A. student, Adam, initiates the discussion by questioning the capability of synchronous chat tools for supporting idea improvement and knowledge building. Adam's action challenges the discussion leaders' responsibilities and creates a disturbance by taking on the epistemic agency for asking questions (Scardamalia, 2002; Scardamalia & Bereiter, 1991). This is an underlying cause of the secondary tension in this activity system between the synchronous instrument and the object to engage in progressive discourse.

> Day 1
> Adam: *Different opinion* I would like to share my concern about the possibility of idea improvement and advancement (a.k.a. knowledge building) in synchronous environments like chat or instant messaging. (OU)
> *Reason* I believe idea improvement takes certain time—to reflect, to revise, improve, and generalize—that is hardly available in synchronous online communication tools. (OU)
> *I need to understand* if anybody can think of a specific case of idea improvement (as opposed to idea sharing) during a chat session (PE)
>
> Belinda (building on to Adam's *I need to understand*): *I need to understand* how you define idea improvement? Before I can answer your question, I would need to know what constitutes and improvement (PE)
>
> Day 2
> Paul: (building on to Adam's *I need to understand*) I understand that some synchronous environments allow you to copy a transcript of your chat session and paste it into a word processor. Couldn't knowledge building be promoted by reflecting on the ideas captured in the transcript and discussing those reflections in future sessions? (RP, OE, PE)

Day 4
Adam (responding to Belinda's I need to understand; accepting Paul's suggestion by citing a chat transcript with Chloe, Yvonne, and Sharon):
Adam: If an idea has certain application like explaining the world around us or generalizing experience or being a mental model, an improved idea does the same thing but—BETTER…
Chloe: ok, so idea improvement addresses the exceptions and counterexamples
Adam: it is *necessitated* by counterexamples…or perceived imperfections…counterexamples to an effective theory/good conceptual artifact (RP, RS)

In the transcript above, a group of three students contribute to developing a robust understanding of "idea improvement" and how synchronous tools can mediate this process. They honor the progressive discourse commitment to work toward mutual understanding. Initially, Adam's action is to challenge Laurel and Dylan's statement by asking an explanatory problem (PE). Belinda's action is in response to Adam's own unelaborated idea (OU) of idea improvement, in which she asks for a definition to transform her understanding of this term. Belinda thus poses an explanatory problem (PE). Paul's action is reframing the discussion to transform his understanding of how synchronous tools can support idea improvement. Finally, Adam's action is taking responsibility for fulfilling Belinda's request for a definition and accepting Paul's suggestion to use chat transcripts in asynchronous discussion. Adam thus quotes an excerpt from a chat in which one object of the chat was to transform Chloe's understanding of idea improvement. This chat transcript that Adam quotes serves as a tool to mediate this group's understanding of the relationship between synchronous and asynchronous tools to support idea improvement and knowledge building. We argue that the understanding of the role of synchronous tools in supporting knowledge building has deepened for all participants as a result of these embedded interactions, where students acknowledge the contribution of others through of referencing peers (RP) and progressive problem solving. Students consistently inserted direct quotes in the body of their build-on note or used KF's hyperlinked referencing feature to work on the problem. The individual actions are nested together and result in progressive discourse, and the collective object of this group to engage in progressive discourse for knowledge building is attained through the interdependence of these multiple actions. The episode ends as the collective object is attained.

The second episode displays multiple actions by different students taking place over two days in Course 2, week 3. The subject, a group of students in the course community, is responding to student discussion leaders Paul and Brian's question, "What opportunities do online environments present for coordinating experiences into *representations* and *mappings* and then *systems* as learners work toward understanding?" The instruments include KF and course materials. The object is to engage in progressive discourse on the concept of building versus borrowing (Schwartz & Fischer, 2003). The secondary tension shown in this episode is between the rules and the object. The rules include course requirements for participation and individual student learning goals, in this case Dana's goal to learn HTML tags to format a note composed in KF. The dialogue below opens as a M.Ed. student, Chloe, agrees with another M.Ed. student, Dana, that asynchronous CMC environments can facilitate "building an understanding of a concept." In addition, Chloe suggests that synchronous tools were even more helpful in deepening her understanding in Course 1:

Day 1
Chloe: (building on to Dana's note) *Opinion* From my prior experiences in on-line courses I find this statement to be true. I have been able to eventually use other students' knowledge to help me better understand concepts. However, it is the very act of "bouncing back and forth" that sometimes throws me off course, i.e., I want the answer now not when someone else takes the time to read my note and reply. Where I have had better success is when I have had synchronous chats using tools such as MSN messenger. (OE)
Reason In synchronous chats I can ask a question of another student and get an immediate response if, of course, they know the answer. I feel more comfortable asking for clarification and examples about a topic. I don't worry as much about wording or grammar and therefore I find it to be more similar to having a f2f chat. (OE)
Example If Dana and I had chatted I could have told her in less than a minute that you need to use the HTML and surrounding the word you wanted bolded (OU)
How idea is useful If others also have this same opinion then perhaps we should think of incorporating both methods (synchronized and asynchronized chats) into all online courses as we are doing in this week's discussion. (OU)
Problem/limitation It requires two or more people to be in front of their computers at the same time, which takes away from the benefits of asynchronous forms such as Knowledge Forum that doesn't require that. Does anyone else have any further thoughts? i.e. benefits/weaknesses

of my idea? (PE)

Day 2
April: Chloe, you provided a great response to Dana's posted message. It is true that synchronous features such as chat would help you resolve any questions that you have. In thinking about the process of asking questions and reflecting this to my own personal classroom experiences, I must agree with Schwartz and Fischer who state that teachers should stop answering some questions or providing quick answers. (SAC, MC; rest of note omitted)

Chloe: (annotation on April's note) Very true, it never occurred to me to think of it that way. Lately I have been so busy with school, work, and the kids that I tend to look for the quickest solution, rather than appreciating the journey I just want to get to the destination. (MC, SAC)
Drew (building on to Chloe's *Problem/limitation* from day 1): I think there is a tradeoff in this respect. What we gain in immediate response time when having a chat or face-to-face conversation, we lose in terms of a variety of viewpoints and consideration time. While postings are not so direct and immediate, they allow time for a number of people to respond to a question. They also allow people to consider the question in depth and formulate considered responses. This is of benefit to complex questions, but I agree that a more immediate form of contact is better for questions of clarification or simple content. (OE)
I wonder if the immediate response would be borrowing and the considered response would be a better attempt at building. And yet, maybe the considered response is just a more complex form of borrowing. Need to think about this more… (SE, MC)

Sue: Perhaps the question is not whether one is better than another but rather, "*What role do synchronous/asynchronous learning environments play in a particular course?"* For example, if you are taking a course which requires students to grasp concepts at key stages of a course before moving onto other concepts—you may find that synchronous chats are beneficial. Students would have the opportunity to ask questions, clarify concepts and you would have a feel for whether the majority of students were able to build onto the concept or move onto another subject area. This could occur in a relatively short chat period vs. a longer chat period using an asynchronous forum. (OE)

In the transcript above, a group of four students engage in progressive discourse on the concept of building versus borrowing—the challenge of actively constructing ideas. Chloe, April, Drew, and Sue are honoring the progressive discourse commitment to work toward mutual understanding. The systemic tension is between the collective object to engage in progressive discourse on building versus borrowing and the rules, the attempt by some students to learn, concurrently, the course technology. In this episode, the KF version that the students were using required knowledge of HTML tags in order to format notes (bolding, inserting tables, etc.).

Chloe's main action is to propose that all online environments incorporate both synchronous and asynchronous communication. Chloe explains that synchronous chats were particularly helpful to deepen her personal understanding in Course 1. Having prior knowledge of HTML, Chloe states that she could have taught Dana how to use the HTML tags in "less than a minute" during a synchronous chat. Fortunately, Chloe remains open to having her belief about quick answers to be subjected to criticism to serve the collective object of progressive discourse. April's action is to politely and indirectly challenge Chloe's focus on obtaining quick answers via synchronous chat. April elaborates source-based ideas (SE) from Schwartz and Fischer (2003) and integrates these with her own classroom teaching experiences in her note. April emphasizes that students need to coordinate experiences on their own to create representations and that instructors should stop answering some questions to bring this about. April's action mediates growth in Chloe's conceptual understanding that active construction of ideas is not about borrowing quick answers. Chloe's annotation on April's note suggests that some shift in Chloe's thinking took place. Drew's action is to accept responsibility for further exploring problems and limitations of synchronous tools in response to Chloe's request. Drew integrates his own ideas (OE) and source-based ideas (SE) from course readings to do so. Sue's action is to build onto Drew's note and reframe the discussion polarizing synchronous and asynchronous learning environments into a more useful one for practice that emphasizes the different roles that each can play in the design of a particular course. Later, in week 10, these Course 2 students discuss the role that synchronous and asynchronous tools play in the design of online courses in different content areas, referencing successful programs in subjects like music and drama that some students initially did not believe would be suitable for the online learning.

In both episodes individual actions by themselves do not achieve the collective object to engage in progressive discourse. Rather, the actions are interdependent. Progress is made when students are committed to remain open to examining their beliefs, critique their peers constructively, accept responsibility for sustaining

the discourse, and reframe the discussion in ways that will enable evidence to be brought to bear on ideas. This exchange suggests an "exploratory talk" pattern more accurately described as Initiation, Discussion, Response, Feedback (IDRF) (Wegerif, 1996) than the more typical Initiation, Response, Feedback (IRF) pattern of pedagogical interaction (Sinclair & Coulthard, 1975). Patterns of actions that emerged through mapping sequences of progressive discourse in the data include a student finding a problem, requesting explanation from peers with a question (PE), followed by their peers referencing the theme unit segment containing the question (RP), proposing an explanation integrating own ideas (OE) with ideas from the course readings (SE). When students contributed unelaborated ideas of their own not supported by evidence (OU), this led their peers to reference this segment, then ask a question of clarification or express disagreement, which in turn sparked a knowledge building turn.

Analyses from an activity theory perspective showcase the inseparability of individual actions from the community context in which they are enacted. Identifying secondary tensions between components in the asynchronous online forums helps us understand what drives innovation or presents barriers in these online course activity systems. In the example episodes, the secondary tension between the object to engage in progressive discourse and other components of the system, namely the instrument in episode 1 and the rules in episode 2, was productive. Other systemic tensions were less auspicious for knowledge building. For instance, students balanced learning how to use the scaffold support tools in KF with the collective object of progressive discourse. Students also contended with rules, like expectations to meet their own goals and the instructor's course participation grade, the object of engaging in progressive discourse, and the outcome of deeper shared understanding. Common practices that students carry out online can efficiently process voluminous notes in forums, but can contribute to thread death and a new culture of conferencing that focuses attention on progressive problem solving is needed (Hewitt, 2005). Despite explicitly fostering cultural norms conducive to progressive discourse in this study, the systemic tension between various components in the activity systems, especially between individual and collaborative aspects, remained unresolved.

Given the small sample size and the exploratory nature of this study, we do not claim to generalize the findings reported here, but the approach we explored provided a promising avenue for analyzing complex group discourse activity. Activity theory provided a cultural-historical grounding for the individual actions we mapped over time. In future research, it may be fruitful to compare this qualitative analysis of progressive discourse with more quantitative analyses of the ties that students formed with each other in each course to highlight the interdependent nature of the actions directed at the progressive discourse activity. Our analysis inspired by activity theory revealed contradictions in the course activity systems, which has important implications for instruction. For example, a common secondary tension that existed in the data was between the object, to engage in progressive discourse, versus the design of the technological tool used to deliver the course, Knowledge Forum. Instructionally, it was important to give students time and opportunity to learn features of the technology in parallel with learning the course concepts, especially since the design of sophisticated CSCL environments like Knowledge Forum feature socio-cognitive tools that embody many design principles for discussion-based learning.

Endnotes

(1) Theme unit codes were abbreviated as follows: problem of explanation (PE), problem of fact (PF), referencing instructor (RI), referencing peers (RP), referencing self (RS), own ideas elaborated (OE), own ideas unelaborated (OU), source-based ideas elaborated (SE), source-based ideas unelaborated (SU), metacognitive comment (MC), socio-affective connection (SAC), technical issues (TI).

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