Towards a Promising Technology for Online Collaborative Learning: Wiki + Threaded Discussion

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Abstract: Despite the well-established benefits of collaborative learning, successfully implementing group activities in online environments is often a challenge for online instructors. Web 2.0 technologies provide opportunities for the implementation of more effective computer-supported collaborative learning environments for online learning. Yet, the affordances of such technologies are currently under-researched. We present a case study investigating the affordances of wikis to support online collaborative learning, compared to asynchronous threaded discussion tools. This case study focuses on two selected groups (four students each) collaborating on the analysis of a case scenario, first using wiki (vs. threaded discussion), then using threaded discussion (vs. wiki). Our initial analysis showed that groups demonstrated different patterns of collaboration in each technology. Complete results, discussion, and implications of this work for future research and practice in online education will be included in the final presentation.

Purpose of the Study

As our society becomes increasingly complex and technologically advanced, the ability to collaborate in online settings is becoming an essential skill for professional success. What is more, collaborative learning as an instructional method has been found to result in deeper levels of learning and critical thinking, more frequent generation of new ideas and solutions, and greater transfer from one situation to another, among other benefits (Johnson & Johnson, 1999; Johnson, Johnson, & Holubec, 1998). Yet, successfully implementing collaborative learning in online environments is often a challenge for online instructors (e.g., Reeves, Herrington & Oliver, 2004; Roberts, 2004; Stahl, 2006).

Asynchronous threaded discussion tools (threaded discussion) have been already quite extensively adopted, embedded into current computer-supported collaborative learning (CSCL) environments, and researched as for their affordances to support collaborative learning. Typically within a course management system (i.e., WebCT), threaded discussion is used as a common online meeting place where students and instructor can dialogue and work together asynchronously. While threaded discussion is often seen as an effective means for promoting participation, interaction, and group learning, a considerable number of studies continue to report disappointing results related to engaging students in online collaborative learning using this technology (i.e., dePaula, 1998; Stahl, 2001; Suthers, 2001). Briefly, threaded discussion can suffer from incoherence (i.e., Herring, 1999; Reyes & Tchounikine, 2003), and lack of convergence (i.e., synthesizing and summarizing) which might prevent students from having a strong perception of the global discussion (Hewitt, 2001, 2003; Suthers, Vatrapu, Medina, Joseph, & Dwyer, 2008). Moreover, the representation of a topic in threaded discussion is based on the historical development of the discussion more than its conceptual content (Turoff, Hiltz, Bieber, Fjermestad, & Rana, 1999), which makes it difficult to place contributions in context and to assess the outcome of the discussion (Turoff et al., 1999; Suthers, 2001). On another note, Suthers (2001) discussed that, for collaboration to occur, online discussion environments should allow the inclusion of visual artifacts (i.e., solutions under construction, graphs, knowledge maps, videos), but these artifacts should exist outside of individual messages in the discussion - and not as attachments - so that collaborators can change these artifacts. Similarly, Stahl (2006) suggested that developers of collaborative learning technologies should distinguish those features designed to support discussion from those designed to support collaborative knowledge construction, such as discussed ideas can be integrated into knowledge construction processes.

Other Web 2.0 tools, such as wikis, remain under-researched despite their potential to foster group learning and collaborative construction of knowledge (Rick & Guzdial, 2006). Wiki websites allow every visitor to become an editor of a given topic at any time and from any location given the availability of a web browser. Once a wiki page is edited, it is instantly visible to other users. Wikis aim to provide an accessible way to publish, collaborate, and exchange ideas over the web (Dalke, Cassidy, Grobstein, & Blank, 2007). The largest and perhaps most well-known wiki is Wikipedia. In education, a notable example of using a wiki for collaborative learning is the CoWeb

wiki at the Georgia Institute of Technology. Since 1998, CoWeb has been shown to successfully support collaborative learning in several classes (Rick & Guzdial, 2006). The interactions made possible in wiki environments – such as quick and easy editing and linking of shared pages, personal and public talk, and history documentation - might be vital mechanisms that can improve online collaborative learning. Nevertheless, empirical evidence to support or refute this argument is currently lacking.

A number of researchers agree that different computer tools or interfaces afford different opportunities for learning (e.g., Hmelo-Silver, Chernobilsky, & Nagarajan, in press; Kozma, 1994; Stahl, 2006; Suthers et al, 2008); for instance, tools may scaffold students' online individual and group work (Hmelo-Silver & Chernobilsky, 2004). As such, investigating the affordances of different technologies to support online collaborative learning has implications for future research and practice in online education.

This case study seeks to investigate three research questions:

- RQ1: What are the differences in collaborative learning interactions evident in a wiki compared to a threaded discussion tool?
- RQ2: What are the differences in individual participation levels evident in a wiki compared to a threaded discussion tool?
- RQ3: How do collaborative discourse and use of technology relate, as students collaborate in wiki versus threaded discussion to produce an artifact?

Definitions and Conceptual Framework

Despite the many years of work in this area, researchers have yet to converge on a shared definition and understanding of 'learning together'. The discussion mostly focuses on the differences between 'cooperative' and 'collaborative' learning. For example, Roschelle and Teasley (1995) explained that: ''Cooperative work is accomplished by the division of labour among participants, as an activity where each person is responsible for a portion of the problem solving...", whereas collaboration involves the "... mutual engagement of participants in a coordinated effort to solve the problem together." (p. 70, emphasis added). According to these definitions, "collaborative learning" is what we seek as we group students to work on a problem together during this case study.

The proposed study draws on sociocultural perspectives (Brown & Campione 1994; Rogoff, 1994; Vygotsky, 1978; Wertsch, 1994). From a sociocultural perspective, social interaction is a powerful force in the learning process, as it supports thinking and knowledge construction (Wertsch, 1994). In this sense, knowledge emerges from active dialogue and interaction among those who seek to understand, before it is internalized as individual knowledge (Brown & Campione 1994; Brown & Palincsar, 1989; Scardamalia & Bereiter, 1996; Vygotsky, 1978; Wertsch, 1994). Moreover, from a sociocultural perspective, human thought and behavior is mediated by physical artifacts and symbolic artifacts (psychological tools and signs), the most important of which is language Wertsch (1991). Drawing upon this idea, technologies that support social interaction, mediation by artifacts (physical or digital, and symbolic), and artifact construction, might then mediate and scaffold subsequent knowledge construction (Stahl, 2006).

Methodology

We employed a mixed-method research design that incorporated both qualitative and quantitative data collection and analysis. As Hmelo-Silver et al. (in press) explained, mixed-method methodologies allow researchers to obtain an understanding of collaborative learning as a multifaceted and complex phenomenon.

Participants

A total of 20 students (five groups of four students each) participated in this investigation as part of their Learning Theories graduate-level course, taught fully online during fall 2008 at a large public university in the northeastern U.S. Participants were graduate students in the field of Educational Technology. The sample included 90% women with a mean age of roughly 30 years old. This case study focuses on two selected groups only (see selection criteria in the results section).

Technologies

The first technology was the threaded discussion board within WebCT. The second technology was a wiki was built in MediaWiki -- the open-source platform originally written for Wikipedia. This wiki allows editing,

formatting, and linking of shared wiki pages, asynchronous personal and public talk via regular wiki pages, notifications for changes in the environment (known as RSS), and access to history documentation for each page. Before coming into this course, all students had experience with WebCT threaded discussion. None had used MediaWiki before, but some students had experience with other wiki tools.

Procedures

The investigation was completed in four weeks (two week for each case scenario), during which students interacted and collaborated using their assigned technology. Student activities and data collection procedures for the four weeks are described below:

- Weeks 1-9 (before the investigation). Students engaged in online, class-wide discussions and other activities using threaded discussion and wiki interchangeably. Right before week 10, students were randomly assigned to groups of four students for weeks 10-13 (see Stahl 2006 about small group size selection).
- Weeks 10-11. For weeks 10 and 11, students in their groups worked on Case A. Students were asked (a) to apply concepts learned in the course, as well as their personal experiences, to analyze the case; then (b) to collaboratively produce a 2-3 page plan to solve the problem embedded in the case. For the purpose of this investigation, three groups used wiki for collaboration on Case A, while the other two groups used threaded discussion.
- Weeks 12-13. The same groups from weeks 10-11 were asked to work collaboratively on Case B (evaluated by three experts as equivalent to Case A). But, this time the technologies facilitating students' collaboration were reversed.

Data Sources and Analytical Methods

Data sources included: 1) Logs of groups' online discourse archived in wiki discussion pages and threaded discussion board (i.e., day/time stamp, collaborator's name, collaborator's contribution), 2) Groups' final responses as they developed in wiki article-pages and Word documents attached back and forth in the threaded discussion area.

For all groups, online discourse was analyzed using a coding-and-counting approach to computer-mediated-discourse analysis (CMDA) as described in Herring (2004). Then, participation analysis (also described in Herring, 2004) was used to examine whether individuals' participation within groups was evenly distributed. Subsequently, for two selected groups, we used the Chronologically-oriented Representations of Discourse and Tool-related Activity (CORDTRA) illustrative technique described in Hmelo-Silver & Chernobilsky (2004; Hmelo-Silver et al. in press). The CORDTRA technique goes beyond coding-and-counting to allow us to carefully examine groups' collaborative discourse, their essay construction, and their use of technology to support this process.

Analysis and Results

Firstly, the online discourse of each group was coded for student collaboration, statement complexity, monitoring, and other content (analysis at the group level), following Herring's (2004) CMDA with coding-and-counting. These categories were broken into more detailed subcategories. Our coding scheme was slightly modified from Hmelo-Silver and Chernobilsky (2004) who studied student collaborative learning processes during problem-based activities in the STEP online environment. The operationalization of the coding scheme was refined by the author and a second expert, using approximately 10% of the discourse. The unit of analysis (segment) was decided to be a consistent 'unit of meaning'. The author coded the whole discourse. A second coder also coded the whole discourse, independently, after being trained by the author. The inter-rater agreement was satisfactory – 81% for segmentation into units and 83% for coding of the units. Disagreements were resolved by discussion between the coders, until 98% agreement was achieved for segmentation and coding; 2% of the discourse remained un-coded. Then, for each group, we counted the number of codes within each coding category, not including facilitators' contributions.

Secondly, the notion of participation analysis described in CMDA as described in Herring (2004) was adopted to determine how equally or unequally group-members contributed to the discussion of the case scenario and construction of the group essay. For each individual group-member the total *number of postings* and *average length* of a posting (in words) contributed to the discussion of the case scenario was computed. Then, the total number of contributions made to the group essay (i.e., append, delete, content-editing, formatting & spelling) was counted. In this case, accurately counting the length of individual contributions to the group essay was not trivial since students often made several changes to the essay in one round of edits.

Based on the results from CMDA and participation analysis (tables to appear in final presentation), two groups were selected: (a) the most successful group in the wiki, and (b) the most successful group in the threaded discussion. Success was defined by the quality of discourse (i.e., more task-oriented, rather than not-task-oriented interactions, i.e., Veerman & Veldhuis-Diermanse, 2001), and equal participation by all group members (Johnson & Johnson, 1999).

The analysis for RQs 1-3 is currently being conducted. Complete results, discussion, and implications of this work for future research and practice in online education will be included in the final presentation. Below, I discuss the analytical procedures I will follow to investigate each research question.

RQ1. To investigate the differences in collaborative learning interactions evident in the wiki compared to threaded discussion, I will run four chi-square tests (one for each coding category). Specifically, for each selected group, I will examine whether there were significantly more or fewer *collaboration, statement complexity, monitoring & planning,* and *other content* codes in their wiki compared to their threaded discussion discourse.

RQ2. To investigate the differences in the differences in individual participation levels evident in the wiki compared to threaded discussion, I will carefully inspect the results of the participation analysis. These results will reveal the following: a) whether students posted more or less frequently in wiki compared to threaded discussion, b) whether postings in the wiki discussion page were, on average, longer or shorter than those of threaded discussion, c) whether group members participated more or less equally in the discussion of the case and construction of their group essay depending on the technology used.

RQ3. To investigate how collaborative discourse and use of technology relate, as students collaborate in wiki versus threaded discussion to produce an artifact, we will construct CORDTRA diagrams for each of our four selected groups. To do so, we need the group's coded discourse and information recorded in the wiki (history) pages and threaded discussion board (i.e., day/time stamp, collaborator's name, collaborator's contribution and attached documents). Time of contribution runs at the top of the CORDTRA in chronological order. Discourse categories and participants (group members and facilitator) are listed on the right of the diagram. The tool used (i.e., wiki article page or wiki discussion page, versus threaded discussion board or MS Word document), and action taken (expansion, deletion, content-editing, and formatting/spelling) are also listed on the right of the diagram. Thus, each time point on the CORDTRA represents one or more discourse categories (depending on what kinds of contributions the student offered), the corresponding tool that the specific student is using, and the type of action taken. We should note here that wiki tools, such as history documentation and personal talk pages, will be excluded from the CORDTRA because they were not used by any students. Only wiki article pages and wiki (public) discussion pages were utilized, even though the facilitators modeled and encouraged the use of all wiki tools/features. On a CORDTRA, one explores collaborative learning by going back and forth between the CORDTRA and the coded discourse. To explore group differences, the CORDTRA diagrams of the groups are compared amongst them; large differences in the collaboration patterns become obvious visually. Then, the researcher can zoom in on the areas of the diagram where differences exist to explore the phenomenon deeper, often going back and forth between the CORDTRA diagrams and the discourse messages (Hmelo-Silver et. al, in press). For RQ3, four CORDTRA for the selected groups (in wiki and threaded discussion) will be constructed, before any comparisons and conclusions can be made.

Conclusion

Promoting collaborative learning in online environments is an important and growing need in education and business. Web 2.0 applications such as wikis have promise, but are currently under-researched. In this case study, we present a 4-week investigation of the affordances of wikis to support online collaborative learning, compared to threaded discussion technology. I conducted preliminary analysis of collaborative learning discourse of students who used both wiki and threaded discussion technologies to collaborate on authentic case scenarios. This initial analysis (particularly focused on two selected groups) showed that groups demonstrated different patterns of collaboration in each technology. I am working on further analysis as well as construction and examination of CORDTRA diagrams. The final presentation will include:

- A detailed description and screenshots of the wiki and threaded discussion technologies and activities.
- Detailed results from CMDA and participation analysis (i.e., tables of frequency counts for codes etc.).
- CORDTRAs for two selected groups and discussion about the inferences we can make from the diagrams.
- Discussion of findings with reference to the current literature on Web 2.0 technologies and their affordances to support online collaborative learning.
- Limitations of the study and future directions.

Acknowledgments

This research is supported by the Cyprus Research Promotion Foundation's grant (ΠΕΝΕΚ/ ΕΝΙΣΧ/ 0308/ 53) and the European Regional Development Fund (ERDF).

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