Social Annotating in the Online Margins: (Re)designing an Annotation Tool Drawing on Unintended Ways University Students and Faculty Chose to Use It

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Abstract: This study explores a feature that allows one to highlight parts of online messages and comment in the margins. Data comes from 12 university-level courses in 3 universities, n=198 students and n=5 instructors. A videotaped group discussion, a survey, and annotation usage were analyzed. The tool was designed to facilitate retrieval and reviewing. Students actually used the tool more collaboratively, akin to a Web 2.0 tool. Students perceived seven benefits (in decreasing frequency): insight into thoughts of others, instructor feedback, critical understanding, text-review, group processes, emphasizing relevance, and insight into others' thoughts about one's message. Fourteen uses within four categories were identified: retrieval only (i.e. using keywords); reflection (i.e. elaborating on a point); replying (i.e. directly responding to author of message or of an annotation), and instructor feedback. Replying and instructor feedback were unanticipated. We made the default for annotations public and increased annotations' word-limit to address emergent uses.

Objectives

Research evidence from many learning and epistemological perspectives suggests the efficacy of learning through dialogue, from Socrates to Vygotsky. In online dialogue students and teachers are able to leave and re-read electronic messages for each other at any time, sustaining ideally more reflective dialogue than possible face-to-face as participants can think about their contributions and those of others with more care. Despite potential benefits of learning online, online dialogue (much like face-to-face conversations) can engage students in surface learning. This study explores an annotation feature embedded into software to support users' cognitive processes. In face-to-face discussions furniture is arranged in various ways to induce dialogue; an empty room with no furniture would not seem likely to promote a good discussion. Similarly, features embedded into software (such as highlighting, annotating and labelling) may promote better discussions.

Literature Review

Human interaction through text based discussion forums is widely employed in online education today. Over the past two decades, many researchers have written about the pedagogical potential of forums for reflection, critical thinking, and collaborative learning. Many hoped that the additional time to peruse online messages would promote critical thinking (cf. Scardamalia & Bereiter, 1994), yet critical thinking is not always evident in online dialogue and sustaining meaningful dialogue is challenging. A number of recent studies have found that there is a lack of deep engagement, and that students do not view forums as a space for critical discourse (Friesen, 2009; Garrison, Anderson, & Archer, 2000; Lee & Jeong, 2009; Osman & Duffy, 2009; Rourke & Kanuka, 2007; Wise, Duffy, & Padmanabhan, 2008). Online, the very wait-time between writing, reading, and responding which allows for deeper thinking also poses challenges. The sheer number of messages, in addition to the various message branches, can overwhelm the learner (Hewitt, Brett & Peters, 2007), who cannot discern what to read and in what order, much less where to post or what to post about (Rohfeld & Hiemstra, 1995; Wise, Duffy, & Padmanabhan, 2008).

To support learning, online discussion environments must structure interactions to encourage productive collaboration (Dillenbourg, 2002; Suthers, 2007). Some have argued that web forums support divergent thinking, and hence convergent thinking needs to be supported by the moderator, the assignments, and/or the interface itself (i.e. Harasim, 1993). Software should be mindfully developed to support healthy online behaviors that initiate, sustain, and advance dialogue (Xin & Feenberg, 2006). Unfortunately, widely-used forums, such as those in course management systems like WebCT, Blackboard, and Moodle, are little different from those used in the early days of web-based course management systems. Indeed, apart from cosmetic changes, most current forum interfaces are quite similar to the original newsgroup programs from which they descend. Some pedagogically advanced systems have been developed, such as Knowedge Forum (Scardamalia & Bereiter, 1993), and TextWeaver (Feenberg & Xin, 2003), but thus far they have not succeeded in entering the mainstream. One approach is to develop open-source extensions to open-source web-based softwares such as Moodle in order to put clothes on them, to allow the pedagogical dressing of them.

Marginalia was developed (Marginalia, 2009) as an open source extension to Moodle. It adds several

key features to help structure dialogue and encourage healthy online behaviors. The core functionality is an annotation feature: the capability to highlight passages of text in forum posts and write short notes in the margin next to them, just as the reader of a book might underline passages and scribble notes in the margin. A number of studies have found annotation helpful for online learning (Bateman, Brooks, Mccalla & Brusilovsky, 2007; Farzan & Brusilovsky, 2008; Huang, Huang & Hsieh, 2008; Kaplan & Chisik, 2005; Lee & Calandra, 2004). This research involves reiteratively designing the tool to match users' needs.

Research Questions

This paper focuses on the design and analysis stage of the research. The key questions are:

1) What benefits of the annotation tool do students perceive?
2) In what ways (intended and unintended) do students use the annotation tool?
3) Based on the actual uses of the annotation tool, what changes to the tool should be made?

Research Methods

The approach falls within the design experiment literature (cf. Brown, A., 1992; Reeves, Herrington, & Oliver, 2005). The tool is designed concomitantly to research being conducted. This study involves formatively evaluating and (re)designing the annotation feature. Open-ended coding procedures are used to categorize perceived student benefits and actual uses of the tool.

The participants come from 12 intact classes, 5 from a small rural Quebec undergraduate university, 5 from a large Western University, and 2 from a small rural Western university, n=198. Five instructors are involved. In 9 of the courses the feature was introduced during an online activity of a minimum of 2 weeks duration and students were able to use it as they chose; in 3 cases the use of the feature was a single class-time (n=68).

Data sources include a video-taped group discussion, a survey with open-ended questions about the benefits and uses of the tool, and annotations.

The feature allows one to highlight parts of messages and append margin notes. One can see one's own annotations, public annotations made by other people, and a summary of annotations. See Figure 1.

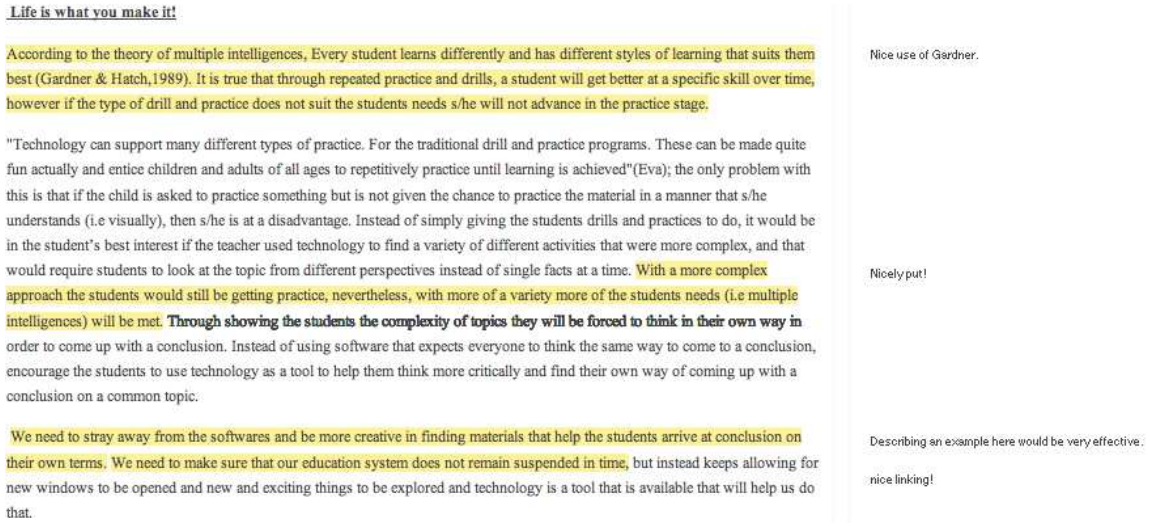

Figure 1. The Highlighting and Annotating Feature.

Results and Discussion

Students' Perceptions of Potential Benefits of Annotation Feature

In the video-footage students from an intact classroom (n=24) discussed the feature's potential following a class activity using it. The key points made by students were summarized by the first author and a research assistant. The students emphasized benefits not originally envisioned such as receiving formative feedback from the teacher and peers, and being able to make side comments about the task. They also saw its utility to further their understanding of course material. Student perceptions of the feature's potential as discussed in the video influenced how the feature was used in future courses especially to comment on students' online dialogues. Overall, students were positive about the annotation tool, despite some technical difficulties.

Students' responses to open-ended items on the survey were coded and categorized using an open-coding procedure to identify seven key benefits in decreasing frequency: insight into thoughts of others, instructor feedback, critical understanding, review text, supporting group processes, emphasizing relevance, and

insight into what others think of what one writes. See Table 1. Originally conceived as a tool to help students review and re-read online dialogue, it was essentially a review tool. Perusing Table 1 demonstrates a different potential that emerged through its use in a range of pedagogical contexts. Surprisingly, the most frequent benefit that students mentioned is being able to have insight into the thoughts of others by reading their annotations.

Table 1: Student perception of key benefits of highlighting and annotation feature.

Key Benefits	
Insight into thoughts of others	Steve wrote: "I thought was useful for finding out what the teacher and peers thought about a given subject."
Instructor feedback	Formal assessment: The tool makes it easy for the instructor to give feedback to students by highlighting pieces of the text and making comments. "It helped for sure. It was easy to read Eva's comments and easier to understand them. It also look very clean and neat."
Critical understanding	"It made me more aware of different perspectives on using technology as well as different teaching approaches." "When I read online I sometimes don't really read, but by being able to make comments, I actually read well and understand more."
Review text	Students can highlight pieces to put into a portfolio or a final summary. "It helps the students go back and review their work."
Group processes	The feature can be useful to track the group process.
Emphasizing relevance	Some students felt it focused them on the most relevant information. "Cool to use with a group to get the most information (relevant)."
Insight into what others think of what one writes	Students reported liking to read what others think about what they have written; some were especially interested in the instructor's perceptions.

How Students and Instructors Used the Feature

Looking at the actual usage of the tool demonstrates more unanticipated potential. Students used Marginalia in 12 courses. N=198 students contributed 2067 messages and 1605 highlights/annotations, M=10.44 and 8.11 respectively. Fifty-one percent of students used the feature. We summarized four distinct functions of the tool: retrieval only; reflection; reply; and instructor feedback (see Table 2). Retrieval only annotations include highlights without any annotations and keywords, which make it easy to return to those passages. Reflection annotations also facilitate retrieval, but they add to the highlighted passage by summarizing what was said or by making connections to other ideas. The third function was replying. Unexpectedly, students actually created dialogues on the side of messages where they responded to each other's annotations. See Figure 2. This use of annotations or meta-narrative shows the students responding to each other's annotations! The fourth function was that instructors provided summative and formative feedback.

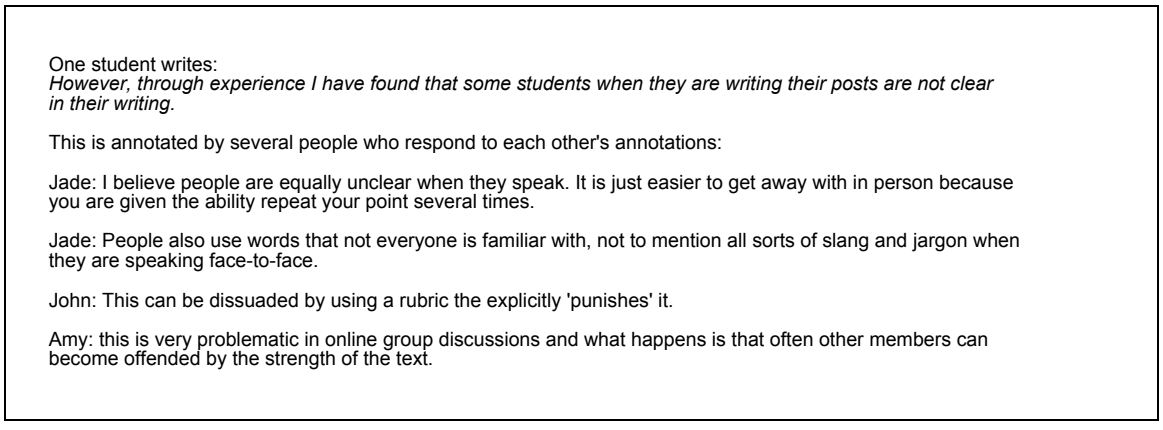

Figure 2. Example of Using Annotation Feature to Hold a Dialogue in the Margins.

Iterative open-coding of the annotations was conducted. Twelve student uses and two instructor uses of the feature were identified within the categorization of four broad functions. See Table 2.

Table 2: Four functions of the annotation feature.

Function	Description	Examples Found
Retrieval Only	• These annotations facilitate easily retrieval, signifying information or ideas that are worth following up on later	keywords; highlighting only
Reflection	• Similar to retrieval only, these annotations will facilitate retrieval of significant information. But in addition students using these annotations appear to be deepening their understanding.	critical understanding; reinforcing understanding; synthesizing; questioning
Reply	• These annotations directly communicate a message, such as a question, an agreement or disagreement, or a short answer to a question, to the author of the original message or of another annotation referring to the message.	encouraging; agreeing; motivating help progress through task content dialogue in margins; questioning directly
Instructor feedback	These annotations are provided by instructor and depend in part on the type of activity.	Informal feedback Formal feedback at end

Summary of Changes Made to the Annotation Tool Reflecting Emergent Uses

Reflecting the uses we witnessed students and instructors make of the annotation tool, some adjustments were made. Given the type of enthusiasm we saw generated around reading other people's annotations, the default of the annotations was made public rather than private. Other major decisions revolved around the way students used the annotations to hold dialogues in the margins. A button was added to allow the user to comment on an annotation, which would then post a new message. This was an important controversial design decision, with some members of the team thinking it was beneficial to group processes that students were using the feature to hold a dialogue in the margins, and others pointing out the negatives especially possible cognitive overload as learners wonder where to read. The 'reply to this annotation' button was a compromise. We also increased the length of annotations to 250 words. Competing visions of what Marginalia should be emerged; originally marginal notes were not intended to create a separate channel of dialogue but instead were designed to support the private enterprise of reviewing messages. If the conversation in the margins becomes the main conversation this could make it hard to find the key relevance, undermining the main goals of the tool. Still, the way the tool was actually used was far beyond the original design of privately reviewing messages; students were able to share their annotations with potential learning benefits and made it primarily a social enterprise, akin to a Web 2.0 tool. Should we then limit their use of annotations as a separate channel of communication?

Issues are still being resolved. The limit of 250 words was problematic for students and instructors. The 'reply to annotation' button returning students to the main dialogue to reply to an annotation is frequently ignored and it might be better to keep a thread running in the margins in some circumstances such as when the instructor is providing feedback or students are engaging in a meta-cognitive discussion about the task.

Conclusions

Students used the annotation tool in a range of ways, from reviewing messages for later (which was very much in keeping with the design), to keeping track of the class task (who is doing what) and even to emotively (or otherwise) respond to one another without actually replying to the message as a whole. Students emphasized the benefit of seeing the annotations of their instructors and peers. The range of uses was well beyond what was originally envisioned in the design, and we have made alterations to sustain students' wishes for the tool within reason, making a review tool into a collaborative tool. Still, some design decisions controversially constrain the use of annotations to make it difficult to create a separate dialogue in the margins.

The enthusiasm shown for the feature was astonishing especially when compared to the lack of enthusiasm for other knowledge tools to scaffold online learning (Bures, Abrami & Schmid, 2010). On the other hand, although students reported appreciating the annotations of others, many students never used the feature. Guided, focused and purposeful interaction goes beyond whether opportunities for interaction exist to consider especially why and how interaction occurs. Several evidence-based approaches may be useful in the next generation of Marginalia to facilitate more purposeful interaction drawing on theories of self-regulation, multimedia learning, motivation, and collaborative learning (Abrami, Bernard, Bures, Borokhovski, & Tamim, 2011). As these features become increasingly common, it becomes increasingly important to design them to support students' learning and dialogue and avoid unnecessarily adding cognitive load (Dillenbourg, 2002; Stahl, 2006).

References

Abrami, P. C., Bernard, R. M., Bures, E. M., Borokhovski, E. & Tamim, R. (in press). Interaction in distance education and online learning: Using evidence and theory to improve practice. *Journal of Computing in Higher Education* (special issue).

Bateman, S., Brooks, C., Mccalla, G., and Brusilovsky, P. (2007). Applying collaborative tagging to e-learning. In Proceedings of the 16th International World Wide Web Conference (WWW2007).

Brown, A. (1992). Design experiments: Theoretical and methodological challenges in creating complex interventions in classroom settings. *The Journal of the Learning Sciences, 2*(2), 141-178.

Bures, E. M., Abrami, P. C., & Schmid, R. F. (2010). Exploring whether students' use of labelling depends upon the type of online activity. *International Journal of Computer-Supported Collaborative Learning, 5*(1), 103-116.

Dillenbourg, P. (2002). Over-scripting CSCL: The risks of blending collaborative learning with instructional design. In P.A. Kirschner (Ed.), *Three worlds of CSCL: Can we support CSCL?* (pp. 61-91). Heerlen: Open Universiteit Nederland.

Farzan, R. and Brusilovsky, P. (2008). Annotated: A social navigation and annotation service for web-based educational resources. New Rev. Hypermedia Multimedia, 14(1), 3-32.

Feenberg, A. & Xin. M. C. (2003). Facilitation. In A. DiStefano, K. E. Rudestarn, & R. Silverman (Eds.), Encyclopedia of Distributed Learning, Sage Publications, London, pp. 163-166.

Friesen, N. (2009). Genre and CSCL: The Form and Rhetoric of the Online Posting. International Journal of Computer Supported Collaborative Learning. 2(4), 171-185.

Garrison, D. R., Anderson, T., & Archer, W. (2000). Critical thinking in a text-based environment: Computer conferencing in higher education. Internet and Higher Education, 11(2), 1-14.

Harasim, L. (1993). Collaborating in cyberspace: Using computer conferences as a group learning environment. Interactive Learning Environments, 3(2), 119-130.

Hewitt, J., Brett, C., & Peters, V. (2007). Scan Rate: A new metric for the analysis of reading behaviours in asynchronous computer conferencing environments. American Journal of Distance Education, 21(4), 215-231.

Huang, Y-M., Huang, T-C., Hsieh, M-Y. (2008). Using Annotation Services in a Ubiquitous Jigsaw Cooperative Learning Environment. Educational Technology & Society, 11(2), 3-15.

Lee, J. K., & Calandra, B. (2004). Can embedded annotations help high school students perform problem solving tasks using a Web-based historical document? Journal of Research on Technology in Education, 36(4), 65-84.

Lee, J. M. & Jeong, A. (2009). The effects of argument mapping on critical thinking process in computer-supported collaborative argumentation. Paper presented at the American Educational Research Association Annual Conference, San Diego, April 13-17.

Osman, G. & Duffy, T. (2009). Scaffolding critical discourse in online problem-based scenarios: The role of articulation and evaluative feedback. Paper presented at the American Educational Research Association Annual Conference, San Diego, April 13-17.

Reeves, T. C., Herrington, J., & Oliver, R. (2005). Design research: A socially responsible approach to instructional technology research in higher education. Journal of Computing in Higher Education, 16(2), 97-116.

Rohfeld, R.W. & Hiemstra, R. (1995). Moderating discussions in the electronic classroom. In Z.L Berge & M.P. Collins (Eds.), Computer-mediated communication and the on-line classroom in distance education. Volume III, Chapter 5. Cresskill, NJ: Hampton Press.

Rourke, L. & Kanuka, H. (2007). Barriers to online critical discourse. International Journal of Computer-Supported Collaborative Learning, 2(1), 105-126.

Scardamalia, M. & Bereiter, C. (1994). Computer support for knowledge building communities. Learning Sciences, 3(3), 265-283.

Stahl, G. (2006). Group Cognition: Computer Support for Collaborative Knowledge Building. Cambridge, MA: MIT Press.

Suthers, D. D. (2007). Roles of computational scripts. In F. Fischer, I. Kollar, H. Mandl, & J. M. Haake (Eds.), Scripting computer-supported collaborative learning: Cognitive, computational and educational perspectives (pp. 177-190). NYC: Springer.

Wise, A.F., Duffy, T.M. & Padmanabhan, P. (2008). Deepening online conversation: How and why to use a common referent to connect learners with diverse local practices. Educational Technology, 48(4), 3-11.

Xin, C. & Feenberg, A. (2006). Pedagogy in Cyberspace: The Dynamics of Online Discussion. Journal of Distance Education 21(2), 1-25.