

## **From Active Reading to Active Dialogue: An Investigation of Annotation-Enhanced Online Discussion Forums**

Cindy Xin, Geoffrey Glass, Andrew Feenberg  
Simon Fraser University, Canada

Eva Bures  
Bishops University, Canada

Phil Abrami  
Concordia University, Canada

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### **ABSTRACT**

Our research aims to improve online discussion forums. We identify typical problems in online discussion that create difficulties for learners and describe a pedagogical approach emphasizing the importance of moderating in dealing with these problems. The usual design of discussion forums in learning management systems is not helpful but can be improved by specific add-ons. We describe a software add-on to the Moodle discussion forum called Marginalia that was designed to implement our preferred pedagogy. We focus on annotation, aiding the retrieval of archived material, helping participants build upon one another's ideas, and encouraging participants to write "weaving" messages that connect ideas and summarize the discourse. Preliminary studies of this software found a number of uses, some of them unexpected. The article concludes with an analysis of two trial classes employing Marginalia.

### **INTRODUCTION**

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. But 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 (Fahy, 2005; Friesen, 2009; Gao & Wong, 2008; Garrison, Anderson, & Archer, 2000; Lee & Jeong, 2009; Osman & Duffy, 2009; Rourke & Kanuka, 2007; Shea & Bidjerano, 2009).

Why is this the case? Are forums essentially useless, or can they be improved to promote active and critical engagement? In our previous research we have argued that leadership or moderating is one of the key factors determining the quality of learning in online forums (Feenberg, 1989; Feenberg & Xin, 2003; Xin & Feenberg, 2007). This claim is supported by a number of studies (Celentin, 2007; Meyer, 2003; Garrison, 2001; Luebeck & Bice, 2005). We proposed a set of moderating functions that are fulfilled primarily by the teacher but that can be more or less distributed among the members of the class. These functions bear both social and intellectual content. They include many activities we associate with leadership of discussion in a face-to-face context, such as recognizing participants' contributions and summarizing discussion at key points. The effective performance of these functions

initiates, sustains, and advances dialogue online as well as in the classroom.

Unfortunately the technical environment in typical web forums does not facilitate moderating. The lack of adequate moderating may explain the failure of many forums to add much value to online courses. Widely used forums, such as those in popular 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 Knowledge Forum (Bereiter & Scardamalia, 2003; Scardamalia, 2004), and TextWeaver (Xin & Feenberg, 2002), but thus far they have not succeeded in entering the mainstream.

Knowledge Forum, for example, is based on the theory of “knowledge building” through “scaffolding” user contributions with tags that signify their function in the discourse. It has a rather complex interface and requires a difficult apprenticeship. As a result, it has not achieved widespread adoption despite being well regarded by many educational technologists. Our TextWeaver software was a user-friendly education specific program designed to support a pedagogy emphasizing moderating. In theory such a pedagogy should lead to more and better interaction and intelligent reuse of the forum posts. But TextWeaver was conceived as an application program just before such programs were supplanted by learning management systems running on the web. It too failed to reach a wide audience.

In an attempt to address both the pedagogical limitations of existing forums and the problem of adoption, we have developed Marginalia as a web based descendent of TextWeaver (Marginalia, 2009; Xin & Glass, 2005). Marginalia is an open source extension to Moodle that adds annotation and several other features useful for enhancing online discussion. Annotation has gained a certain popularity on the Web. A number of studies have found it helpful for online learning (Bateman, Brooks, Mccalla & Brusilovsky, 2007; Carusi, 2003; Farzan & Brusilovsky, 2008; Huang, Huang & Hsieh, 2008; Kaplan & Chisik, 2005; Lee & Calandra, 2004; Nokelainen, Miettinen, Kurhila, Floréen & Tirri, 2005). By leveraging the popularity of Moodle, we are able to introduce many people to our software and the pedagogy it supports. In any case, the availability of many Moodle sites will enable us to make a thorough test of the hypothesis that annotation and effective moderating can improve educational forums.

This paper begins with a discussion of the theoretical grounding of our Marginalia software. This is followed by a discussion of the problems we have identified in existing online forums. We then present its design and explain how Marginalia attempts to address the problems we have identified. Next we share our initial observations on Marginalia’s trial use in online classrooms. The paper ends with a summary and a discussion of future research directions.

## **THE DYNAMICS OF ONLINE DISCUSSION**

Online web forums generate a “rolling present,” an extended period in which relevance is determined by previous comments. This enables participants to check the appropriateness of their own contributions. But this unique temporal experience has a serious flaw from the standpoint of educational work: the rolling present seems to authorize forgetfulness of the virtual past. Forum design tends to hinder easy movement between the current activity in the discussion and older

material, between what is read and what is written, between a given piece of text and other text to which it refers.

This is not simply a matter of static relationships between pieces of text or ideas, but traces the movement and activity of participants. These relationships are essential to a cumulative discussion in which knowledge is gradually gained and deepened. The movement of knowledge acquisition in the forum is cyclical, but it is not repetitive; it is recursive, a spiral rather than a circle. Each time we write or recall, we propel ourselves and the discussion forward. In our earlier research we developed a model of engaged collaborative discourse that describes this cyclical phenomenon (Xin & Feenberg, 2007).

Our model identifies two basic processes in online educational contexts, “intellectual engagement” and “communication.” Intellectual engagement is the focus of the collaborative activities. The teacher or a student introduces a theme of discussion and the participants contribute ideas and comment on each other’s contributions. In a well-designed course, intellectual engagement is structured by a purposeful agenda related to a disciplinary tradition. If successful, it leads to conceptual change for individuals and gradual convergence for the group. Convergence need not mean agreement but may also take the form of mutual understanding around explicitly developed themes of discussion. We call intellectual engagement, so understood, the foreground process.

This foreground process is constantly supported by the background communication process. “Communication” signifies all the actions and interactions that maintain the flow of messages. Communication has familiar social and psychological aspects that are always involved in human interaction, but we focus also on a cognitive aspect that is particularly significant for the intellectual engagement in which education online consists. This cognitive aspect is the sharing of meanings and assumptions, without which discussion collapses into misunderstanding and confusion. Studies in conversation analysis call this the development of a tacit “common ground” underlying the explicit surface phenomena of the discussion. When interlocutors indicate mutual understanding, for example by tacit signs such as nodding, they implicitly enlarge the common ground of meanings and assumptions on the basis of which their remarks are constructed. Participants in educational forums also test their understanding of the new concepts and theories under discussion in each message they write. The explicit theme of discussion serves as a basis of the test which remains in the background as an implicit question addressed to the group. But unlike in everyday conversation, confirmation online must take an explicit written form since no non-verbal cues are available. When a message is well received, its author can be confident of having mastered the concepts deployed in writing it. The background and foreground processes feed each other, creating the circular motion that advances the discussion as a whole. These two processes are in fact combined in every message in the seamless flow of online talk.

The imbrication of intellectual and communication processes is typical of human communication in general. It is rare that communicative acts have a single well-defined function. Normally, when we speak or write, we do several things at the same time. The resulting complexity of communication is so familiar it is easily overlooked. When we ask if it is time to eat, we may be taken to mean that we are hungry. When we reply to a remark by nodding or saying “yes,” we implicitly urge our interlocutor to continue. When we use a certain slang expression we signify our membership in the group that uses that expression. And so on. Though this observation is obvious, its consequences are often overlooked in the course of research, for example, in studies that identify specific utterances with single functions.

The multiplicity of functions and meanings attached to communicative acts proves to be particularly important for understanding online leadership. Most observers agree that online discussions in educational contexts do not flow seamlessly all by themselves. Without maintenance and cultivation, they often stumble (Berge, 1995; Anderson, Rourke, Garrison, Archer, 2001). As a consequence the participants either do not engage at all or do not engage critically. A good discussion requires strong but not overbearing leadership through complex interventions combining substantive contributions to the discourse with facilitation of the communication process. In online education leadership is usually exercised by the teacher, but leadership functions are often performed by students as well. In fact, we argue that discussions tend to be more successful when this responsibility is shared among the participants.

We summarize leadership activities in ten moderating functions under three categories (Feenberg, 1989; Xin & Feenberg, 2007):

*Contextualizing functions:* These functions provide a shared framework of rules, roles and expectations for the group and include such performances as stating the theme of the discussion and establishing a communication model (opening discussions), suggesting rules of procedure for the discussion (setting the norms), managing the forum overtime (setting the agenda), and referring to online and offline materials (referring).

*Monitoring functions.* These functions help participants know if they have successfully obeyed the groups' norms and fulfilled the expectations laid down for them. They include such activities as referring explicitly to participants' comments to acknowledge their contributions (recognition), soliciting comments from individuals or the group (prompting), and assessing or providing feedback on participant accomplishment (assessing).

*Meta functions.* These functions have to do with the management of process and content and include such activities as repairing communication links (meta comments), summarizing the results of intellectual engagements (weaving), and assigning specific roles to participants (delegating).

Table 1. Summary of Moderating Functions

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<b>Contextualizing functions</b>
1. <b>Opening Discussions.</b> The moderator must provide an opening comment that states the theme of the discussion and establishes a communication model. The moderator may periodically contribute "topic raisers" or "prompts" that open further discussions within the framework of the forum's general theme.
2. <b>Setting the norms.</b> The moderator suggests rules of procedure for the discussion. Some norms are modeled by the form and style of the moderator's opening comments. Others are explicitly formulated in comments that set the stage for the discussion.
3. <b>Setting the agenda.</b> The moderator manages the forum over time and selects a flow of themes and topics of discussion. The moderator generally shares part or all of the agenda with participants at the outset.
4. <b>Referring.</b> The conference may be contextualized by referring to materials available on the Internet, for example, by hyperlinking, or offline materials such as textbooks.

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<b>Monitoring functions</b>
5. <b>Recognition.</b> The moderator refers explicitly to participants' comments to assure them that their contribution is valued and welcome, or to correct misapprehensions about the context of the discussion.
6. <b>Prompting.</b> The moderator addresses requests for comments to individuals or the group. Prompting

includes asking questions and may be formalized as assignments or tasks. It may be carried out by private messages or through public requests in the forum.

7. **Assessing.** Participant accomplishment may be assessed by tests, review sessions, or other formal procedures.

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#### Meta functions

8. **Meta-commenting.** Meta-comments include remarks directed at such things as the context, norms or agenda of the forum; or at solving problems such as lack of clarity, irrelevance, and information overload. Meta-comments play an important role in maintaining the conditions of successful communication.

9. **Weaving.** The moderator summarizes the state of the discussion and finds threads of unity in the comments of participants. Weaving recognizes the authors of the comments it weaves together, and often implicitly prompts them to continue along lines that advance the conference agenda.

10. **Delegating.** Certain moderating functions such as weaving can be assigned to individual participants to perform for a shorter or longer period.

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Moderating functions mediate between the two basic processes of intellectual engagement and communication so that the discussion as a whole is maintained and advanced. In all these activities the two-sidedness of moderating – social and intellectual – is the key to online pedagogy. Here are some examples:

- The course agenda, implemented in periodic topic raisers, gives a loose academic structure to a discussion that might otherwise lack focus and wander off into multiple monologues or trivialities. Without an agenda participants may become discouraged and fail to see the relevance of the discussion to the course.
- Gaining active participation does not go without saying but requires attention from the teacher. In the absence of tacit signs such as looks and nods explicit recognition of contributions is essential to assuring participants that they are on the right track. When students use new concepts in ways that show a lack of understanding, the teacher's recognition can take the form of interventions that help to build a correct and shared understanding.
- Perhaps the most important moderating function from a pedagogical standpoint is summarizing the discussion. In face-to-face settings, the fast pace of discussion and problems of time sharing constitute major obstacles to mutual understanding. We cherish those rare individuals who can sum up what has been said so far and point out the similarities and differences between the various ideas that have been brought up. Such interventions put participants in touch with each other's ideas, recognize their contributions, shape a consensus, and prepare the stage for the next round of discussion. In online discussion forums, this summarizing activity is called "weaving" (Feenberg, 1989; Kaye, 1992; Scardamalia & Breiter, 1991; Sorensen, E. & Takle, 2001). Students can be assigned to write weaving comments as a challenge to their ability to engage with the ideas of others. This is a valuable way to fulfill the dialogic potential of online education but it is made technically difficult by a number of problems with online forums we outline in the next section.

## PROBLEMS OF EXISTING FORUMS

Participants in online discussions encounter a number of problems, some due to technical limitations, others related to the asynchronous nature of the medium. Many of these problems might be ameliorated with better technical design.

1. **Reading and Writing.** Reading and writing are not independent tasks. Critical engagement with a text (so-called "active reading") requires the reader to formulate her reactions by taking notes on posts and writing replies. But writing a note or reply involves alternating writing with reading,

shifting back and forth between the two modes. If this is difficult, reflections are likely to be lost before they can be recorded. In a busy forum many participants may simply choose not to write at all as their memory of the posts that interest them fades amidst the task of reading a large amount of new material.

2. *Visual Disconnection*. Related posts are often not displayed together. In many cases, they are not visible at the same time, or if they are, they are reduced to subject lines which seldom reflect the contents of the message. In many cases, participants reply to a post simply because it is convenient, not because what they want to say bears directly on what they are replying to. This problem of disconnection weakens attribution and pulls attention away from significant posts. It also makes use of the archive difficult since its “threads” may be false leads to relevant content.
3. *Short Attention Span*. People tend to focus on the most recent posts, leaving older posts and ideas behind (Hewitt, 2003). This applies equally to writing and to reading. The visual disconnection mentioned above contributes to this, as does the nonlinear nature of a discussion that breaks into multiple threads. This can derail the discussion, or it can lead to repetition: rather than advancing the discussion, posts are likely to unknowingly repeat ideas that have already been discussed.
4. *Under-used Archive*. One of the key advantages of online discussion over face-to-face conversation is the presence of an archive. Older posts can be revisited and consulted at any time. However, archives are hard to reference and are relatively unstructured; despite their promise they are under-used. This amplifies the problem of the short attention span since not only do posts fall out of memory quickly, but it is difficult to go back and find them later. The contents of many forums could be valuable resources, but end up being lost to view even before the discussion is finished, or never found at all by interested people who were not participants in the discussion but have access to its transcript.
5. *Communication Anxiety*. Phatic expressions such as “Hey, how’s it going?” “Yes, go on” “See you later” are common in face-to-face conversation, and are essential for keeping a conversation going. Non-verbal signs such as looks and facial expressions supply additional tacit cues to assure interlocutors that their remarks are heard or to signal that the communication is threatened and needs repair. The paucity of phatic expressions and the absence of non-verbal signs online amplifies communication anxiety and results in people hesitating to participate. Lurking and low levels of activity are the bane of online forums (Feenberg, 1989). Many standard forums supply emoticons in an attempt to compensate, but this is a feeble solution to a major problem.
6. *Quoting*. Quoting is a common and important part of written dialogue. It recognizes the contributions of others, indicates the lineage of ideas, and promotes interaction. However, many current forums do not provide easy ways for people to quote each other’s remarks. Copying and pasting passages of text from previous posts is cumbersome and time consuming, especially when those texts are difficult to recall and locate. This can lead to lower interactivity, and ultimately affect idea development.
7. *Tagging*. Turoff (1991) notes that effective discussion software should allow individuals to classify their contributions into meaningful categories that reflect their relevance and significance according to the nature of the topic, the objective of the discussion, and the characteristics of the group. While this suggests a rather formalized scheme, such as is discussed in relation to learning objects, a more modest and more easily implemented practice of classification would be helpful. We will call such classifications “tags.” Individualized tagging of forum content enables participants to find for later use items of interest identified in the course of reading. It facilitates recall and supports more targeted searching (Marlow, Naaman, Boyd & Davis, 2006). Standard forums do not provide such capability.
8. *Weaving*. Given the fact that the record of a web based discussion is available for retrieval and study, this activity is much easier than in face-to-face settings. However, it still requires

considerable effort. As a result, weaving messages are rare. We argue that the compound problems of reading and writing, visual disconnection, quoting, and tagging contribute to this rarity. Forums can and should be improved to make weaving easier.

## **MARGINALIA**

Many add-ons have been proposed to overcome the limitations of existing discussion forums. Calvani and his collaborators identify the following essential elements of an improved forum design for the Moodle Learning Management System (Calvani, Fini, Pettenati, & Sarti, 2006). They write from the standpoint of Computer Supported Cooperative Learning (CSCL):

1. basic CSCL functions; more specifically some functions of a traditional discussion forum, with the objective of selecting some essential functions and make them particularly ergonomic and effective
2. some management functions; such as rules to activate specific actions, features for interactions tracking and evaluation of contribution coherence, with the objective of avoiding potential risks (dispersiveness, overload, respect of due dates, etc.) through more structured dialogic activities
3. some functions to support reflection and metacognition, to help the community in the definition of its own path to effective knowledge construction" (Calvani, et al., 2006).

A number of add-ons have been developed for the Moodle web forum which reflect the first of these desiderata by extending the capability of the system for synchronous conferencing (Chadwick; Conroy; Jonnavithula, 2008; Key To School). This capability is enhanced by various programs that enable forum users to deliver visually interesting presentations online. We have developed Marginalia as an extension to the Moodle discussion forum with other aspects of the first and especially the third points in mind. The design is based on the pedagogical approach outlined above and aims specifically to support the moderating functions and improved access to the forum archive. The following is a discussion of Marginalia's design and features.

To overcome the limitations of existing discussion forums and to facilitate the exercise of the moderating functions, we have developed Marginalia as an extension to the Moodle discussion forum. The following is a discussion of its design and features.

*Creating and editing annotations.* The software's core feature is annotation: 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. Annotation mitigates many of the problems with web forums discussed above, and opens up their full potential in education.

An annotation can be edited after creation. Figure 1 illustrates annotated forum posts.

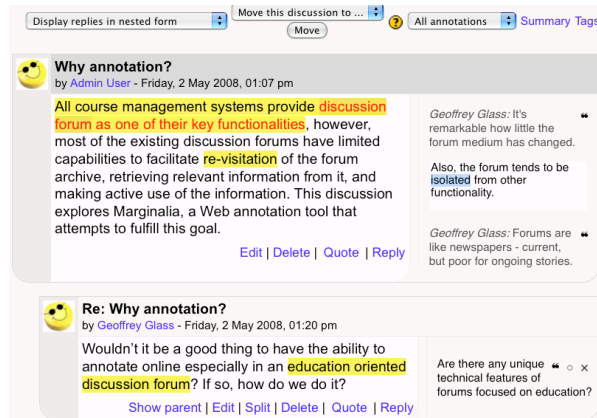


Figure 1: Marginalia annotations in Moodle forum

Annotations allow users to read and write simultaneously and to collect what they find to be the most interesting or important ideas in a discussion for future reference. Marginal notes are not intended to substitute for forum posts; rather they are snapshots of a reader's immediate (and often incomplete) thoughts. Being able to see the marginal notes alongside the posts creates the visual connection between the reader's reactions and the context, a link that is typically missing in standard forums. In addition to this primary function of annotations, they recognize the writer of the comment to which they have been attached.

*Public vs. private annotations.* When a user creates an annotation, she may choose to make it private or public. If it is private, only she can view it. If it is public, it is available for others to read. By default, all annotations are public. We made this design choice hoping that people would share. Indeed, they did, and to our surprise, they used the margin as a second channel of communication, as will be detailed in the results section of this paper.

*Summary of annotations.* To facilitate retrieval and make use of archived materials, annotations are also collected together on a separate summary page, where they are displayed alongside the highlighted excerpt to which they refer. The summary can be searched and filtered. For example, a user might choose to search the summary for annotations containing a particular phrase, or view only annotations by a particular user. The summary page is shown in Figure 2.



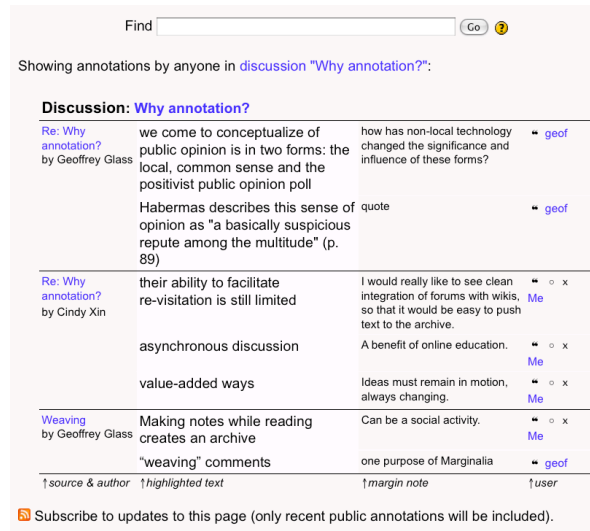


Figure 2: Marginalia summary page

The summary page, along with the quoting feature described next, are designed to support the writing of weaving messages. The writer can use his or her own annotations and tags to identify passages on which to comment in a weaving message.

*Quoting.* We implemented a special quoting feature to make it easier to quote other discussion posts and encourage recognition. To use this feature, a participant highlights a passage of text and then simply click on the quote button. The highlighted text is automatically pasted into the reply window with a hyperlink to its original post. This can be done repeatedly to include multiple quotes in a single reply, as in a weaving comment. A quote button beside margin notes allows them to be quoted in the same fashion. This is particularly useful for writing comments that develop a reaction first expressed in the margin.

*Tagging.* Marginalia makes it easy to establish and use a fixed vocabulary for marginal notes. Marginalia detects when the same note is used more than once and offers to auto-complete subsequent uses. The note is then called a "tag." Standard schemas like this can be pedagogically valuable. For example, a teacher can create a set of pre-defined tags for students to apply when reading each other's posts; this can be used to drive various types of further engagement, such as main points to be summarized, new areas of discussion, questions to be followed up, and so on. In another application, a language or writing teacher can tag errors in order to summarize problems of usage with reference to students' contributions. Alternatively, tagging can be used for content analysis, or to simplify future retrieval of annotations about a particular topic.

In summary, Marginalia is intended to make it easier to read, recall, and write forum posts, to help participants perform the moderating functions, to acknowledge each other's contributions, question and solicit further comments, strengthen communication links, and help teachers provide feedback on students' posts. Marginalia is expected to be especially useful for gathering the ideas and references for writing effective weaving comments.

## METHODOLOGY

### Research questions

Our main research questions are:

1. How is Marginalia used and how do our users perceive its usefulness?
2. What kind of conversations or social interactions, if any, does Marginalia support?
3. In what ways, if any, does Marginalia support revisitation, reflection, and idea development?

### Participants and procedures

Participants were from two mixed-mode classes: an upper undergraduate class in philosophy and a graduate class in e-learning. The undergraduate philosophy class met face-to-face on a weekly basis. Ten students and one instructor (total 8 male, 3 female) participated in the two-week online discussion in the last two weeks of the semester during which the research was implemented. All students were regular full-time undergraduates. The online discussion topic was the public sphere. The students were told at the outset that one of them would be asked to write a weaving message at the end of the discussion. Indeed, one male student was asked and he wrote a weaving message.

The graduate e-learning class met face-to-face on a bi-weekly basis. The two-week online discussion took place in the middle of the semester (sixth and seventh weeks). Six people (1 male, 5 female) participated in the research. A guest instructor, who is the first author of this article, led the two-week discussion on online interaction. The course instructor took a participant role like the four regular students who were part-time working adults. Table 2 provides a summary.

Table 2: Summary of the online discussions of the two classes

Class	Time of offering	Topic of discussion	Forum duration	# of Participants
Philosophy	Fall 2007	The public sphere	2 wks	11 (8 M, 3 F)
e-Learning	Spring 2009	Online interaction	2 wks	6 (1 M, 5 F)

Both classes received a demonstration of the Marginalia software before they started their online discussion. All participants had participated in online discussion before. A questionnaire was emailed to all the participants (n=17). Nine responded.

The two classes varied significantly in terms of their content of discussion, number of participants, and mix of gender. Both used the software over a period of two weeks.

### Methods

No experimental design was used at this initial stage of our research, as we mainly wanted to observe how teachers and students used the tool. Both quantitative and qualitative methods were used for analysis of the results. Basic descriptive statistics of posts and annotations provided a measure of activity volume and its similarity and variance between classes. Content analysis applied to both forum posts and annotations allowed us to look into the nature and quality of users' writing and to trace the lineage of idea development. A coding scheme based on the moderating functions achieved an inter-rater reliability of 0.71 (Fleiss kappa) with three raters. The unit of analysis is the message. A message can perform multiple functions and therefore may be assigned to multiple categories. We also used keyword analysis to identify topics of discussion and their associated posts and marginal

notes. Combined with the analysis of the use of moderating functions, this allowed us to see how topics were raised and developed. It also showed the interaction between participants, the building of common ground, and the dynamic movement between the two processes of communication and intellectual engagement. A survey of user experiences and perceptions helped us to explore further details about usage, such as the use of private notes, and to verify the interpretations of the online transcripts.

## OBSERVATIONS FROM INITIAL TRIAL CLASSES

### Basic usage

We did a basic usage count of the level of activity in the two classes. All the analyses in this section include the data from both the students and the instructors. The 11 participants of the philosophy class made 25 discussion posts. Five of the participants used Marginalia, creating 84 annotations – 16.8 per user (standard deviation 14.7). The 7 participants of the e-learning class made 45 posts. All but two used Marginalia, creating a total of 178 annotations – 29.7 per user (standard deviation 16.7). Table 3 summarizes the usage of the two classes.

Table 3: Activity and usage level of the two classes

Class	Forum duration	# of Participants	# of Posts	Avg # of post per participant	# (%) of Marginalia (M) Users	# of Annotations	Avg # of Notes per M user
Philosophy	2 wks	11	25	2.3	5 (45%)	84	16.8
e-Learning	2 wks	6	45	7.5	6 (100%)	178	29.7

The above table shows that the e-learning class had much higher levels of activity than the philosophy class in terms of both the total and average number of posts created and the total and average number of marginal notes created. This difference may be due to the fact that the e-learning class met less frequently than the philosophy class and relied more heavily on online discussion. The e-learning class was also more interested in the tool given the focus of the course and topic of the discussion. The different timing of these two two-week online discussions (one at the end of the semester and the other right in the middle) may also have contributed to the difference in levels of activities. It should be noted in any case that many of the posts in the philosophy class were lengthy and well argued. However given the very different nature of the two classes and the absence of controls, it is impossible to tell for sure what factors caused the variances in the data.

Despite the differences, one thing does stand out: users created many more annotations than forum posts. Also, the student asked to write a weaving message at the end of a week's discussion in the philosophy class made 2.5 times number of annotations (33) as the next most prolific student (who made 13), and 11 times as many as the least prolific (who made 3).

Still more revealing was an examination of how the annotations were used, and the survey responses of the participants.

All together we received 9 survey responses out of 17 participants. Seven out of the nine respondents had used Marginalia and two did not, though the latter reported that they tried the software and would have made use of it if there were more time for discussion. One student from the philosophy class said s/he wished the tool had been used for the whole semester.

Highlighting and annotation were by far the most used features, followed by the summary page. Two instructors and one student used tagging. Two students from the philosophy class reported that they would have used the tagging feature had the online forum lasted longer than two weeks. As a newly-developed feature, quoting was introduced only at the end of the last class (e-Learning). Only two people used the feature. In our previous research on the use of quoting in TextWeaver, we found it was one of the most popular features.

The following comments by students and teachers provide more detail about usage. They are not grounds for making claims about the effectiveness of Marginalia; rather they are here to illustrate the kind of testimonies we have received from our users.

### **Active Reading**

At the level of the individual forum participant, marginalia provides a way to easily record thoughts while reading. Based on our own study of the users' annotations, we observed that they were created to

- clarify in one's own mind what is happening in a post and record such thoughts;
- paraphrase or restate the highlighted text in the reader's own words;
- summarize what was said in the highlighted text;
- make connections to other readings, thoughts, or personal experience;
- label texts under keywords or tags

Users commented,

"I used the highlight function to mark up other people's texts for personal referencing when the time came to write my own response."

"I used the highlights and annotations as a sort of index for the whole discussion."

"I used highlighting and annotation in the same way I'd use them when reading a physical text. It reminded me of what I found significant and allowed me to summarize entire discussions with ease."

"I made a few notes relating to my readings for the term paper"

The immediacy of the margin - always available directly beside the text being read - makes it easy to write quick notes. One user remarked, "This technology is like thought graffiti. Captures instant ideas in a flexible manner. [It] was the immediacy and the personalization of the annotations. They can be 'of the moment' - as is graffiti - sort of 'writing on the wall' but with some thought behind it - pedagogical thought."

These comments tell us that Marginalia has blurred the line between reading and writing, making it easier for readers to quickly and reflectively engage with a post. This is evident simply from the number of highlights and marginal notes made by the users. In particular, one user said, "I'm also finding that I'm writing to express my thoughts on others' text entries as a way of engaging myself with the text - that I interact with the text, makes me more connected to the message and therefore hopefully more engaged as a learner."

### **Past and Present**

Marginalia allows users to do more than just add notes to the posts: it allows users to interact with the texts through various types of sorting and filtering. Six out of eight survey respondents (not counting the Marginalia non-user) reported that they referred back to their annotations when writing new posts. For example, they commented,

“I used summary page to scan my own annotations.”

“I used the annotations as a memory aid, so that I could write a summary of the discussion.”

“I liked being able to go back [to the annotations] and reread for clarification or to pick up on something I had missed earlier.”

“I found myself constantly going back over things to review.”

The experience of reviewing the written record of a forum discussion is completely different from that of a participant in the action. The latter is situated in a “rolling present”, while the former is witnessing the surviving evidence of a conversation. The use of annotation creates a second-order temporality bridging the past and the present. As one user put it, “I like the fact that you can reignite your points by using Marginalia - i.e. you can go back and highlight a key point and essentially ‘say it again’ in the margins with perhaps a more directed question.”

Of course all discussions do this to some degree. With no reference to the past there would be no thread of conversation, no connection between isolated statements or posts. The discussion would suffer from a narrow attention span, likely repeating itself or going off on a tangent. Marginalia extends and refines the cyclical process of taking elements of the past and incorporating them into the present with new ideas and material. Its features support continuity with change over a longer time span, enriching and deepening the discussion.

### **From Private to Public**

We anticipated that most users would use the forum margin as they might use the margin in a book: to make notes for future personal reference, as described above. However, only one user reported private use. She said she made a couple of private notes, once because she disagreed with something in a post but did not want to contest it or “open a can of worms”, once for use in a paper that had nothing to do with the class discussion.

All other notes were public. Had we chosen a different default, presumably the results would have been different. Defaulting to private might change the character of usage significantly but not necessarily for the better. It was because their notes were public that participants were able to use the margin as a second channel of communication.

### **Chit-chat**

Margin notes were often more conversational than the more careful writing in forum posts. Initially, when we found students carrying out conversations in the margin, we thought this would create further confusion in an already multi-threaded discussion. Besides which, the margin is small and not designed for discussion. Regardless, participants persisted in talking to each other in the margin. In a number of cases someone would highlight a passage of text and make a note in the margin. Then someone else would reply with a second note on the same passage. Further responses often followed. Perhaps the model for this unexpected usage was text messaging, Twitter or the “Wall” in Facebook, interfaces with which we were less familiar than the students.

We worried that the margin would clog up. We observed users splitting text across multiple margin notes to circumvent Marginalia’s 250-character-per-note limit. Yet when all the notes in the margin reached a certain length, seldom much exceeding the length of the post, users stopped adding more. Any further discussion was folded back into the main flow of the forum.

As we watched participants engage in the margin, we realized we had been wrong: these conversations had a positive impact. They promoted more dialogue. Short notes provided an easy way for reluctant participants to overcome communication anxiety and get involved. A good portion of the notes were simple statements of agreement or support, such as “I agree” or “Thanks.”

One user pointed out that marginal notes sometimes resemble the non-verbal cues in face-to-face conversations. Because they are shared, and because it is so easy for many users to make a short comment, they contribute to the sense that the whole group is present and participating. Such brief responses reassure participants and build common ground but are relatively rare in conventional forums where an entire post might feel wasted on a single word.

Here are some comments from users that confirm these observations.

“I am beginning to think of 'thought graffiti,' or annotations as being rather like the non-verbal communication you get during a face-to-face discussion. Instead of nods, to agree with what you are saying, or frowns and a tilting of the head to express confusion, or a little remark that indicates that person is listening and comprehending what you are saying, this discussion has annotations. They add a group feeling to the discussion because now we can read not only what one person is writing (or listen to what one person is saying), we can also read the rest of the groups' immediate responses (or smiles, or nods, or frowns) and hear their interjections into the conversation.”

Another user pointed out the use of the technology to call for responses to what she had written: “I am passionately interested in this tool. As a user of discussion forums, I've had many post[s] fail to get a response. Some of these times I've taken it personally, as I posted something that is important to me and when it isn't picked up by someone, I find it sometimes disheartening. . . This technology allows me to go back to my post, add another layer of clarification/or expansion which might perhaps then evoke a response.”

Annotation can reduce the community anxiety participants often feel when they receive no response. A response to a post – any response – is generally interpreted as a success while silence means failure (Feenberg, 1989). Additionally, the sender of a message needs to know not only that it was received, but how it was received. Writing online can be uncomfortable without the nods of the head, smiles, glances, and tacit signs which in everyday conversation often take the place of words.

One user commented: “[T]here is more motivation to post when it is fuelled by something dynamic and interactive, something conversational and social—Marginalia, for example. . . There's a certain joy in the pursuit of responding to graffiti. It hearkens back to the human need for call-and-response.”

This use of the margin as a form of lightweight conversation (often less serious than what was carried out in posts) lubricated the discussion. It thus fulfilled important social functions in online conversation. Even when they had nothing substantive to say, these notes helped to involve people in the cycle of reading and writing by which the discourse proceeded and developed.

## **Recursion**

While chit-chat and “nods on the side” were significant uses of Marginalia, they were not the only uses. Often the margin played an important role in deepening substantive discussion in the forum.

In the e-learning class, students used Marginalia extensively as a conversation tool, responding to the authors of posts and to the authors of other marginal notes. These responses were either comments or questions, often triggering a stream of conversation in the margin.

We observed that many times when a new message was posted, comments about it quickly appeared in the margin. These mini-conversations branched off from the main discussion, forming a background in which participants could clarify points, repair communication breakdowns, or chat socially. Sometimes these conversations introduced new ideas. When this happened, the ideas introduced in the margin were often brought to the main discussion area where they were elaborated in more detail.

Thus the social nature of the activity in the margin contributed to the recursive development of the discussion. Ideas and attention shifted between the foreground forum posts and the background conversation in the margin. The two spaces fed each other, driving the overall discussion forward. At the individual level understanding was enhanced, while the group enlarged their common ground and established mutual understanding and convergence of ideas.

## Moderating

We observed that Marginalia helped people to perform the moderating functions. Each public annotation recognizes the post author unless the author made the annotation herself. Many notes also performed functions such as prompting, referring, and meta commenting. Short weaving notes that linked multiple ideas together also appeared in the margin.

The performance of moderating functions via marginal notes varied between the two classes. The e-learning class had significantly higher level of performance (79% of the total notes) compared to the philosophy classes (20%). The overall level of interaction in the e-learning class was also noticeably higher. Although it is difficult to pin point the cause of the difference, in both classes Marginalia helped people to perform the moderating functions in various ways. Many notes performed one or more functions. These marginal notes questioned each other, provided materials and context for discussion, clarified misunderstanding or confusion, and repaired communication breakdowns. Table 4 provides a summary.

Table 4: Use of prompting, recognition, referring, meta-commenting, and weaving via marginal notes of the three classes

Class	# of Users	# of Annotations	# of prompting (%)	# of reply <sup>1</sup> (%)	# of referring (%)	# of meta commenting (%)	# of weaving (%)	Total <sup>2</sup> (%)
Philosophy	5	84	12 (14.3%)	0 (0%)	4 (4.8%)	1 (1.2%)	0 (0%)	17 (20.2%)
e-learning	6	178	25 (14.0%)	139 (78.1%)	20 (11.2%)	27 (15.2%)	4 (2.2%)	140 (78.7%)

Note:

1. Since by definition, each highlight or marginal note is a form of recognition to the post author, instead of counting them all, we counted only the replies in the marginal notes. A reply is defined as an explicit response to a question or comment in a post, or an explicit response to a marginal note.

2. A note can perform multiple functions and therefore can be assigned multiple times. In calculating the total, a note counts and only counts once when it performed one or more functions.

## **Summary of observations**

Based on our initial observations of these two online classroom trials, we conclude that the margin is used to

- index and recall,
- think and reflect,
- explain and clarify, and
- share and communicate.

Further study will be necessary to support our initial conclusion that using Marginalia improves the exercise of the moderating functions through both forum posts and marginal notes, and encourages forum participants to be more engaged with the text and with each other.

## **FUTURE RESEARCH AND DEVELOPMENT**

So far our strategy of keeping our software open source and making it a plug-in to the popular Moodle system has proven successful. A number of institutions in Canada have been testing Marginalia. These include Simon Fraser University, Bishops University, University of Victoria, Kwantlen Polytechnic University, Thompson Rivers University, and Capilano University. We have received an overwhelming amount of positive feedback. This typically includes comments on the ease of use and elegant interface of the program. One of the biggest advantages for teacher is the ability to easily provide in-context feedback to their students. One teacher emailed us, "Using Marginalia in my Moodle Forums has changed my teaching fundamentally. Correcting/commenting my students translations – I'm teaching Latin and Greek – has become very convenient for me and clear for my students." Students appreciate the ability to quickly interact with others and make brief low-stake comments. In addition to this feedback, we also received many valuable suggestions for improvement. For example, some users have requested that teachers be able to share annotations privately with individual students. Many users have suggested that Marginalia extend its features to the Moodle Assignment tool.

As the software is being used in more online classrooms, we need to continue observing usage patterns, verifying our initial findings, and studying the use of the tool in connection with other channels of communication (e.g., face-to-face, email, online chat) in blended or completely online learning environments. We also want to examine whether certain user behavior patterns emerge. For example, would the conversational gravity shift from the main discussion area to the margin for some users? Would previously reluctant group members participate more because of the availability of Marginalia?

We plan to conduct controlled experiments to investigate the social and pedagogical effects of Marginalia. Does Marginalia indeed enhance online interaction, and under what conditions? Does it increase the level of critical engagement, and under what conditions?

A number of faculty members from various disciplines such as English, communication, business, nursing, computer science and social science have expressed interest in using Marginalia in their



classes. We are keen to see how Marginalia is used with the different pedagogies appropriate to literary criticism, case history analysis, contract negotiation, programming, etc.

Both tagging and quoting features are relatively new. We need to continue observing how users make use of them and what effect they have on interaction and learning if any.

New developments are always on the horizon. As more and more people use Marginalia in more and more diverse contexts, we hope to refine the software and perhaps to inspire others to design similar program for other platforms. This is a cyclical process that will continue as the idea of online annotation gains in popularity.

## CONCLUSION

Online discussion forums are intended to add human contact between teachers and students to online education. This goal is widely shared by educational theorists and teachers skeptical of automated learning. But problems with online forums are commonplace and some recent research has cast doubt on their educational value. This article examines the sources of these problems and introduces a solution based on software features supporting appropriate pedagogical strategies. The Marginalia software described here is a pedagogy driven design that is easy to install and use. The pedagogy it supports emphasizes the role of leadership—“moderating”—in organizing successful education forums. Moderating functions are identified and explained briefly on the basis of earlier work by the authors. Good moderating contributes to learning by encouraging participation and interaction while delivering an academic agenda.

Annotation, a key feature of the software, can be used in many ways to promote interaction and learning. It facilitates access to and re-use of forum materials and makes it easier for teachers and students to recognize and comment on each others’ efforts. Annotation changes the way time is experienced in forums by prolonging the domain of relevance.

Tests on Marginalia in trial classes are analyzed here in view of understanding usages and improving the software. The software was employed in expected ways with some success by students and teachers in these classes, but students innovated unanticipated usages as well. Future work on the software will have to take into account what was learned in these first trial classes.

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## APPENDIX

As an example to show this circular motion of discourse, Figure 2 illustrates how Marginalia was used for developing a particular theme of discussion in the e-Learning class. Laura (signified by color burgundy) first introduced the idea of Marginalia as “thought graffiti” which was followed up, elaborated, and expanded throughout the whole course of the two-week discussion by everyone.

From this graph, we can tell a number of things about this particular thread of discussion:

- Everyone introduced new ideas via posts and/or notes.
- Some students were particularly active and productive.
- Ideas first introduced in the posts were frequently followed up in subsequent notes and posts, e.g. ideas #1, 6, and 9. The reverse also happened from time to time, e.g., ideas # 3, 15, & 31.
- Posts that attracted more notes tend to be the ones that introduced new ideas.
- The instructor (green) requested weaving comments in post # 25. A string of weaving messages appeared.

### Ideas by keyword

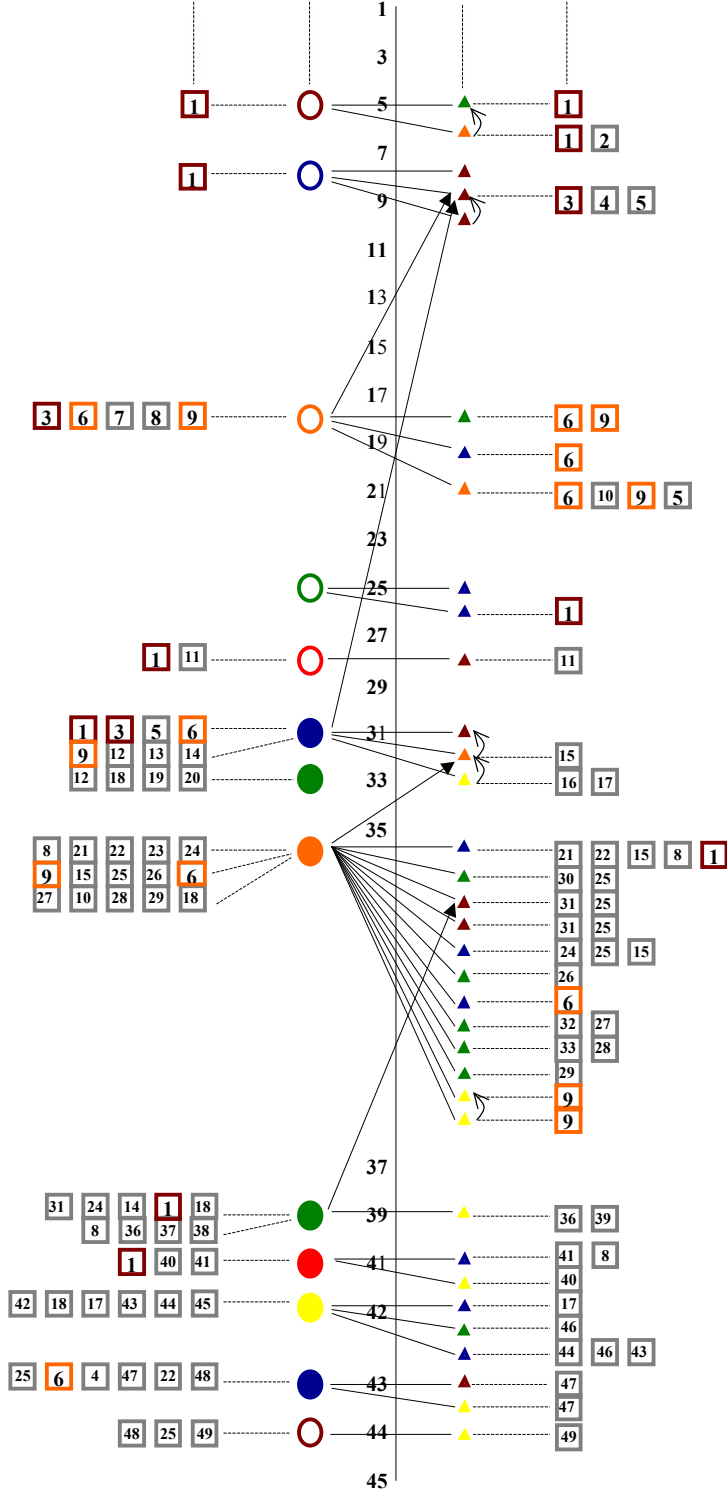
- # 1 – Thought graffiti (by Linda)
- # 6 – joy of graffiti (by D-L)
- # 9 – call and response (by D-L)
- # 15 – rhetorical (by D-L)
- # 18 – nod on the side (by Cindy)
- # 25 – write to think (by Linda)
- # 31 – persuasion to response (Linda)

### Author colors

**Linda**  
**Cindy**  
**D-L**  
**Hilary**  
**Norm**  
**Susan**

The idea of “thought graffiti” was first introduced by Linda in message # 5 and was immediately picked up by Cindy and D-L in the marginal notes and then later by Hilary in message # 8. The idea was again being referenced repeatedly by Hilary in note # 25.2, message #31 and note # 36.1; by Cindy in message # 39; and by Norm in messages # 28 and # 41. This idea also triggered subsequent ideas such as “joy of graffiti” (idea # 6 by D-L) and “call and response” (idea # 9 by D-L). Each of these two ideas were appropriated by Cindy, Hilary, and Susan.

Ideas by keyword      Posts      Post #      Notes      Ideas by keyword



- Post, color coded by author      ● Weaving comment, color coded by author      ▲ Note, color coded by author
- Idea. The number indicates the sequence in which the idea first appeared. The ideas associated with a post or a note is ordered based on the sequence in which they appeared. Only ideas associated with this theme of discussion are included. The default color is grey. Some of the ideas are highlighted and color-coded based on its initiator to show examples of idea development.
- Associates a post with its note(s).      ..... Associates ideas with a post or a note.
- ↗ Indicates an idea originated in a note was later referred to in a post.
- ↘ Indicates a note is a reply to a previous note.

Note: the numbers along side the central axis are post numbers. They are evenly spaced whenever possible; however, the scale is altered for the later posts to accommodate the higher number of notes associated with these posts.