Visualizing Student Activity in a Wiki-mediated Co-blogging Exercise

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Abstract
Students benefit from jointly reasoning, explaining or "arguing" about the course material. There are significant advantages for moving the discussion online e.g. where students co-blog vis-à-vis a wiki. For the teacher, keeping track of who is participating and the degree to which they participate is not straightforward. This paper presents visualization mechanisms we are developing that address these issues.

Keywords
Wiki, computer-supported collaborative learning, visualization, co-blogging

ACM Classification Keywords
H.5.3 [**Group and Organization Interfaces**]: Asynchronous interaction, Collaborative computing Computer Supported Cooperative Work, Web-based interaction. H.5.2 [**User Interfaces**]: User-centered design.

Introduction
Students that jointly reason, explain or "argue" about the course material have been shown to achieve deeper learning as a result of explaining and justifying their views to other students [1].

Some discussion can take place during lectures but requires everyone to be co-present. Some students are

also reluctant to voice their opinions in class and too much discussion reduces time available for introducing new material. Using technology that enables non-collocated students to asynchronously discuss the course material potentially remedies this situation.

We have been exploring co-blogging as an approach to facilitating online discussion amongst students. At their convenience the students first explore their own ideas about the material. Later, they compare and debate shared and contrasting opinions under less pressure than in the rough-and-tumble of in-class discussions. On surveys students have stated that the co-blogging exercise has significant educational value. Analyzing transcripts of the students' online work shows that this style of interaction produces numerous substantive conversations and a wealth of valuable material that students review e.g. when preparing for exams.

During the semester, ideally, the teacher can easily keep track of who is participating and the degree to which the students participate. Detailed records of the students' online activities can make this difficult or cumbersome. Visualizations can help the teacher to realize the extent to which each student is engaged in the exercise and identify activities beneficial to learning. Being able to locate students that require assistance or encouragement to become more engaged in the class discussion can potentially increase their learning.

In this short technical brief we describe visualization mechanisms we are developing that enable the teacher to extract meaningful information about the students' level of participation and the kinds of roles or activities they engage in while co-blogging on a wiki.

The co-blogging activity

Using a wiki-based educational toolkit, the WikiDesignPlatform (WDP), we have built and deployed a co-blogging website in numerous courses. The WDP automatically produces complete transcripts of the students' online work in greater detail than standard wiki revision histories.

In the co-blogging exercise each student has a *blog* consisting of multiple *blogposts.* Students can read, and *comment* upon, each other's blogposts. Students are required to write at least two posts and one comment each week and encouraged to read a lot of blogs.

A course focused on the *Internet & Society (CS33)* taught in Fall 2008 had 26 students collectively blog throughout the semester. 21 students completed a survey where they assessed the usefulness of their co-blogging work. Questions used a 6-point Likert scale (from 1 not useful to 6 very useful). 95% (avg. response 5.6) said their co-blogging work gave them first-hand experience with online collaborative learning. 76% (avg. response 5.3) said it enabled them to build a knowledge community. 80% (avg. response 4.5) said it prepared them for writing their term papers. On a yes/no question 67% said being able to re-read their blogposts when writing term papers was useful.

Initial analysis of the CS33 transcripts has shown that students do engage in extensive conversations about the course material. Reading or commenting upon another students' blogpost/comments constitutes a conversation. 486 conversations took place on the co-blog wiki. 44% contained contributions from 2 or more students. Each student participated on average in 96.7 conversations.

We have seen some evidence that students self-select different kinds of activities to engage in as they participate in the blogging exercise. Some students are *bloggers* and spend the majority of their time writing blogposts. Others spend on average up to 80% of their online time *browsing* the blog-o-sphere where they read a lot of blogposts and write comments.

Monitoring the co-blogging activity

The CS33 transcripts contained 14344 unique events concerning 550 blogposts and 500 comments. For the teacher to follow the students' online work as it progresses and identify the kinds of activities they partake in is nearly impossible without visual aids. Developing interactive visualizations that provide cogent overviews of the students' online activities has benefits that go beyond grading the students' work.

Being able to identify the students' type of participation provides valuable insight into what kinds of online activities are beneficial to improving the students' learning. Not every student is tech-savvy or used to participating in "electronic" discussions. For many, wikis may be too intangible; they never become fully immersed in the exercise. Locating these students early on enables the teacher to assist them in getting into the routine and potentially elevates their learning.

The rest of this paper presents a brief overview of the visualizations we are currently developing that address these kinds of issues.

Visualizing student activity

Our development cycle uses a combination of HCI user-centered design methods [3] and design-based research [2]; the teacher is an integral part of the "design team" and the visualizations are developed and evaluated in a naturalistic context (in a sequence of real courses).

One visualization mechanisms is accessible by the students during the co-blogging exercise (the *Conversation Locator*, see Figure 3). The students are unaware that the teacher has access to the other visualizations but know that their online work is being recorded into transcripts. The visualizations depicted in this paper show real data collected in CS33; student names have been changed to protect privacy.

Level of participation

During co-blogging the students' participation primarily manifests itself in three kinds of actions: *blogging, commenting* and *reading* (blogposts and comments). A basic "counting and averaging" of the total number of times a student performs any of the actions traditionally suggests their level of participation. This can skew the "real results" as some students who may write fewer blogposts frequently read and/or comment upon blogposts instead. These students are exposed to more views of the course material and have greater opportunity for discussion. Both activities have proven educational value.

The visualization in Figure 1 places students on a horizontal axis according to the level of their participation (execution of the main actions). By default all actions weigh the same. Students (circles) are placed on the axis from left (high level of participation) to right (lowest level of participation). Each circle has a blue color indicative of the average length (word count) of his/her blogposts. The darker the color the longer the blogposts. The circle size represents the attention

that the particular student attracts. The larger the circle the more frequently are his/her blogposts read. Using sliders, the teacher can change the significance of each action. For example, in Figure 1 *reading* actions (top slider) weigh less than *commenting (middle slider)*.

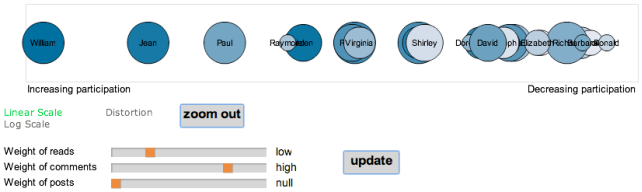

Figure 1. Visualizing the students' level of participation. Students are ordered from left (most active) to right (least active). Larger circles mean more students read that student's blogposts.

Changing the significance of each action enables the teacher to explore on-demand who is participating and to what extent. For example, from a blogging perspective who is falling behind? Alternately, the teacher can mine the data in terms of the students' different participation levels. The teacher can easily identify that a student was not really "absent" from the co-blogging exercise as initially suggested by a simple count of written blogposts. Instead, he/she was a *browser* (vs. *blogger*) following the class narrative closely by reading and commenting.

Balance of participation

The visualization in Figure 2 also focuses on participation but evaluates the students' balance of the three main actions.

Each corner on the triangle represents an action. The top corner represents *reading* actions and the bottom left and right corners represent *writing blogposts* and *comments* actions (respectively). Students (circles) are placed within or around the triangle depending on the balance of their execution of the three actions. If a student performs any particular action more than others his/her circle is pulled towards the corner representing that action. An equal balance of the actions places the student at the center of the triangle. Having done only a single action places a student outside the triangle but close to the relevant corner.

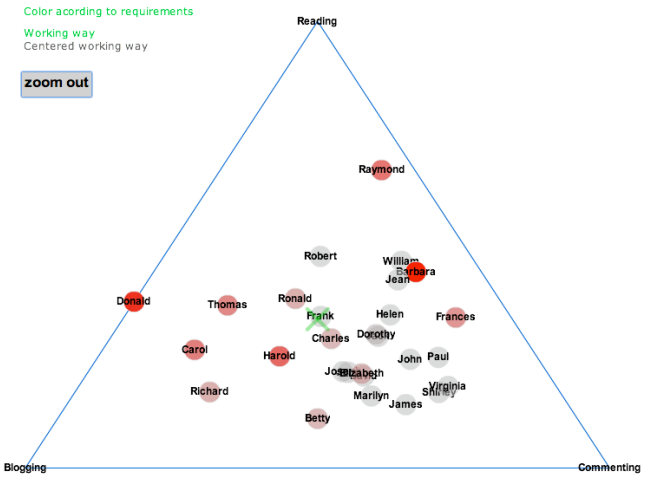

Figure 2. Visualizing the students' balance of executing the three main actions: reading (top corner), blogging (bottom left) and commenting (bottom right). A perfect balance of the actions places a student at the center.

This visualization provides the teacher with a better overview of the actions preferred by the class as a whole and by each student. It can potentially help in identifying "pockets" of students that prefer a particular kind of activity. For example, in Figure 2 it appears that slightly below and to the right of the triangle's center is a group of students that prefer to read and comment (browse) over blogging. One student has clearly not

done any commenting and more blogging than reading (shown far left on the triangle). The student is not submerged in the exercise and potentially missing out on a wealth of information. Realizing this, the teacher can provide help and encouragement so the student becomes a more active member. The circles can be shown in shades of red indicating how well a student meets the assignment requirements. A darker color indicates that the student is falling way behind on blogging or commenting.

Conversation locator

The conversation locator (Figure 3) helps teachers and students locate conversations within the blog-o-sphere.

On our blog-wiki each student is required to assign pre-defined tags to their blogposts that match the lecture topics each week. Each circle represents a conversation that is taking place between two or more students on a particular topic. The circle gets larger as more participants join the conversation. The number of contributions (comments) in the conversation is shown inside the circle. The length of the conversation (word count) determines the blue color of the circle – longer conversations (more words) have a darker color. Clicking on a circle takes one to the location of the particular conversation on the wiki.

The data can be sorted in chronological order within each topic or globally across all topics revealing the evolution of the class narrative. The topics can be ordered by the most recent topic (left) to the oldest (right) or by topics with the most recent activity (left) to the least active topic (right).

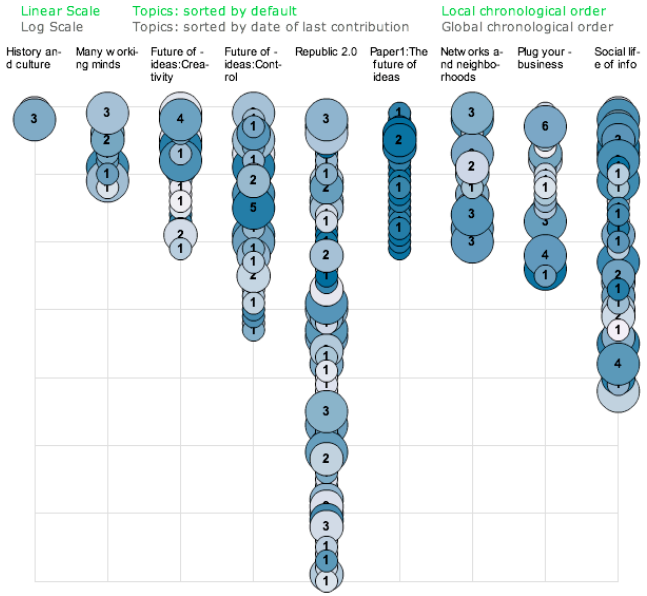

Figure 3. Identifying conversations on the wiki focused on each lecture topic. Topics are chronologically ordered from left (latest) to right (oldest). Each conversation is represented as a circle and shown below the respective topic.

This visualization benefits both students and teachers. Students can locate conversations related to a topic they may be writing a term paper on. Teachers can identify where (and if) conversations are emerging and get some preliminary information on how (potentially) extensive they are.

Visualizing interaction

The "interaction visualization" (Figure 4) is a networked graph that reveals the interaction (arrows) between students (circles). An arrow that points from Bob to Anne shows that Bob either read or commented on any of Anne's blogposts and vice-a-versa. The visualization

is either viewed from the point of view of commenting or reading activity.

The graph can become cluttered. Hovering the mouse over any student focuses the graph only on the interactions related to that student. Green arrows indicate what blogs the selected student has read or commented on. Red arrows point toward the selected student and reveal what students have read or commented on his/her blog. The arrow "weight" can correlate with the degree of interaction. For example, the more Bob reads Anne's blog the thicker the arrow.

Arrow direction indicates the direction of the interaction: Is Bob paying attention to Anne or vice-a-versa or both? The arrow weight indicates how extensive the interaction is (e.g. the no. of comments Bob has written on Anne's blog).

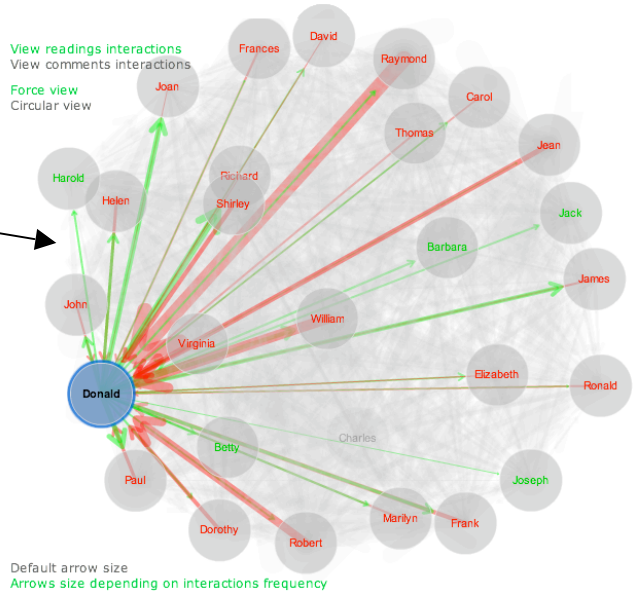

Figure 4. Visualizing (reading or commenting) interactions by drawing arrows between pairs of students.

Ideally, majority of blogs regularly receive readers and commentators benefiting both the blogpost author and reader. If students read few, if any, blogposts or pay exclusive attention to certain bloggers they are exposed to fewer ideas, reducing their potential learning benefit. This visualization enables the teacher to quickly identify students that are not receiving ample interaction from others and give them advice on how they can become an integral part of the community.

Future work

We are currently improving the visualizations. In the spring of 2009 we will re-deploy the co-blogging website in a new class. The environment will include the visualizations for the teacher to use throughout the semester to monitor the evolution of the co-blogging space and the level of the students' engagement. This will provide further feedback that highlights design problems, missing functionality and significance of the information, which will motivate the next design cycle.

Acknowledgements

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