Social Comparison Visualization for Fostering Participation in Online Learning

Purpose

The purpose of this report is to describe a study of the use of social comparison information and visualization techniques to foster and support participation in online learning. The study is part of a broader and long-term design research project to develop a context-aware activity notification system (CANS) to support online learning (Authors, 2007; Authors, 2007a). CANS is a notification system first developed in 2005 being used within the Sakai learning management system (LMS) in order to improve the processes and quality of online education by providing activity awareness information. CANS operates by monitoring activity in the LMS and then providing notifications, such as who has read what documents or what documents are most frequently read, based on rules and subscriptions that intend to make the notification information salient within the users context. A key challenge in developing a notification system is the method of delivery so that the information fits the work and learning styles, needs and preferences of the instructors and students. CANS has a number of mechanisms for notification including email digests, static web page reports and online widgets. The study reported here examines an innovative approach to using dynamic visualization techniques along with social comparison information.

This paper describes the design work and early testing of an interactive visualization tool (IVT) and the use of this tool in online learning to provide social comparison information. The first implementation (**Period 1**) is the winter of 2008 in which the IVT with social comparison visualization was explored through a usability study with representative users and a pilot test with two online courses, and the second implementation (**Period 2**) is the summer of 2008 in which the IVT was implemented in an online course throughout the semester.

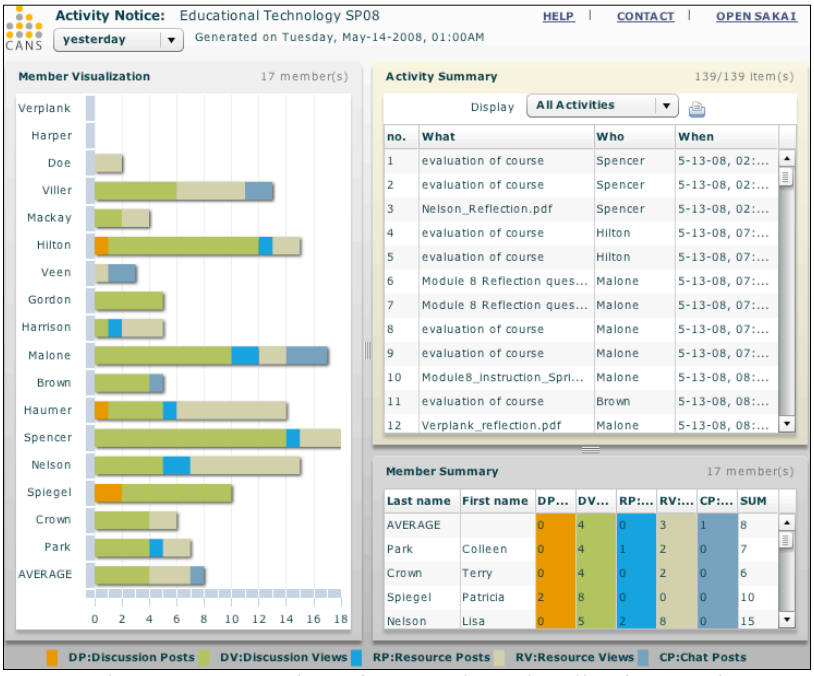

Figure 1: Screenshot of Interactive Visualization Tool

The IVT (see Figure 1) is an interactive way to see and compare student activities within a course in the Sakai LMS. The interaction allows users to customize how they visualize the quantity and relative levels of participation; for example, individual postings and views of discussion, chat and resource tools can be viewed in comparison bar graphs and tables for different time periods. It is intended to: (1) provide a

quick overview of what is going on in an online class, (2) help students know how much they are doing compared to others, and (3) encourage participation and equality of participation via social comparison visualization. The research questions that guided our design research for this phase are:
1. Is IVT perceived to be easy to use?
2. Is IVT perceived to be useful?
3. How do students use the IVT in online learning?

Theoretical framework

According to social comparison theory, people are driven to compare themselves with others to evaluate themselves (Festinger, 1954). In addition, people often like to know what others are doing in order to perform self-evaluation. For example, Buckingham and Alicke's study (2002) found that social comparison feedback significantly affected self-evaluations of performance.

The social comparison information is essential for group performance (Forsyth, 2000). Ringlemann (1913) first documented the loss of group productivity and social loafing (e.g., free-riding effect), and found that not all people work hard in groups. In other words, group members often compare themselves to other group members; if they perceive the other members are not as hard-working, they tend to decrease their effort. On the other hand, if they find others are hard-working and by being aware of the individual contributions of the other group members, they tend to work more.

In many online environments, it is often difficult to find such social comparison information. In the design of online LMS, designs which facilitate and encourage online participation is an important but challenging requirement. Several studies show that visualizations can provide social comparison information. For example, Janssen (2007) used visualization that showed each group member's contributions to online communication; this resulted in increasing overall participation rates during computer-supported collaborative learning. George (1992) found that task visibility that shows individual effort tends to reduce social loafing in groups.

Visualizations facilitate analysis and communication of information by amplifying cognition (Ware, 2004). In other words, visualizations help support more abstract cognitive processes, (such as those encountered in social comparison in online environments) by supplementing one's own cognition with a "helper" in the form of a visualization tool. In doing so, the visualization becomes a more natural form from which to glean information and support other decision-making processes. There have been numerous successful implementations of visualizations to support other difficult cognitive processes, such as pictures, animations, diagrams, or concept maps within the field of education. In this study, we implemented visualization to provide social comparison information to support self-evaluation and foster participation in online learning.

Methods

Period 1: Usability testing methodology was used to evaluate the IVT. The usability testing (Nielsen, 1994) involved having representative users perform realistic tasks using the system, while investigators observed and recorded their behaviors and comments. Usability testing was conducted at the Information Experience Lab. To collect data on participants' use of the IVT, we utilized the Morae software. Morae is a comprehensive usability testing and analysis program which enables the simultaneous capture of a user's keystrokes, mouse actions, audio comments and video of the user's facial expressions during computer interaction.

The think aloud method (van Someren et al., 1994) was used to help us understand user actions and gain insight into the design of the IVT. Participants were asked to think aloud what they were attempting to do

while engaged in the IVT. These sessions lasted approximately 45 minutes, and brief semi-structured interviews were conducted immediately after each session.

Lastly, we conducted a system pilot testing over a two-week time period in two online courses, and sent out an online survey to get the student feedback. We also created open-ended discussions in the two courses in order for students to freely post any comments and for us to learn about the students' perceptions about using the IVT. Following the usability testing and pilot testing, quantitative and qualitative data were analyzed and summarized, and revisions for design of the IVT were made.

Period 2: To explore social comparison through visualization in online learning, we conducted a mixed analysis of quantitative and qualitative data. We implemented the IVT in an online class to evaluate in-context usefulness of the tool. We asked the students to use the IVT throughout the online course, and conducted an online survey at the end of semester. For the quantitative analysis, we employed the Technology Acceptance Model (TAM) questionnaire that contains perceived ease of use and perceived usefulness in using a system within social context (Venkatesh & Davis, 2000). The TAM has been widely used to elucidate user intentions and social impacts in using information technologies.

Data Sources

To investigate usability and usefulness of the IVT, we collected data through usability testing, discussion boards and online survey over the two periods.

Period 1: In the winter of 2008, we developed a high-fidelity prototype and conducted usability testing with representative users using scenarios and think-aloud techniques. We then implemented the IVT into two online classes between April 14th and May 14th for a system pilot testing, and conducted an online survey to get student feedback. We requested a total of 34 students, who were taking the classes, to do the survey and collected 16 responses. Based on the usability study results and feedback, we modified the IVT between May 1st and June 6th.

Period 2: In the summer of 2008 starting on June 16th, we implemented the modified IVT in an online class and asked students to use the system throughout the summer semester. An online survey was distributed via email to 35 students who were taking the online course, and 31 responses were collected at the end of the semester. The questionnaire included 33 questions, grouped into four categories in the following orders: (1) TAM-perceived ease of use, (2) TAM -perceived usefulness, (3) open-ended questions, and (4) demographic questions.

Result

Given the 2000 word limitation we provide only a brief overview of the results.

Period 1: From the usability testing, we found that the interface of the system was friendly, easy to understand and pleasing to use, and the users liked the visually appealing graphs and interactivity of the system. The students preferred visual representations of activity awareness information as the most useful and effective method when compared to the textual formats used in our email digest.

The online survey result from the system pilot testing showed that 100% agreed that the IVT was easy to use, 87.5% agreed that the IVT was visually appealing, and 62.5% said they would recommend the IVT to others.

Period 2: The online survey result showed that students found (1) the IVT was easy to use, (2) using the IVT helped them to be more productive students, and (3) the information provided by the IVT helped

them gain a big picture of the learning tasks and activities in the course, and (4) the information provided by the IVT gave them a clear sense of what others were doing in the learning activities.

The qualitative analysis result of students' responses from the open-ended questions about the experiences of the IVT showed the IVT helped the students as follows.

(1) Monitor how active they are compared to others;

> "*What I usually do is to click on it and get a rough impression of daily activity of my classmates and what my level is compared with other's activity."*

(2) See a whole picture of what is going on in class;

> *"It was useful to me in that I was constantly updated and aware of what was going on around me in class and with my peers. It was a great way to stay in touch and get feedback on things because it came to you and you didn't have to expel lots of time looking around."*

(3) Track group member actions while working on group projects;

> *"Knowing what someone else was doing was helpful when working on a group project… At first it seemed like I was invading their space but reading posts is like attending a group work session in a f2f environment and we would know if someone was attending the session."*

However, some students felt as if they were being monitored and were concerned about creating a sense of competition;

> *"It's kind of creepy that this thing is monitoring my every move on our class website... I'm not sure how I feel about other students being able to see MY activity. That being said, it is interesting to see everyone's activity all laid out for comparisons. I think with everyone being to see everyone's activity, it might lead to activity competition"*

Educational importance of the study

Online learning in education is becoming more ubiquitous. Due to the lack of face-to-face interaction, the need to facilitate awareness of what others are doing and to foster participation is key in improving the quality of online experience. By providing activity awareness notifications, students are able to be aware of what others are doing around them such as who read what documents or what documents are most frequently read, and therefore are able to make informed inferences about their environment and their peers.

While previously this information has been displayed in text form, the IVT displays this information visually. The visual nature of the IVT takes tremendous cognitive load off of the student by summarizing the activity of peers and displaying it in a manner which encourages social comparison.

Social comparison has been a way for helping students self-evaluate their own progress and participation. By making this visual as well as interactive, students are able to quickly and easily support their own self-evaluation of progress self-adjust their participation according to that self-assessment.

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