Context-aware Activity Notification System: Supporting CSCL

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Abstract: This poster provides an introduction to the Context-Aware Activity Notification System (CANS) and a brief discussion of its design research process. We report the results of three phases of design work. The cumulative results suggest progress toward useful activity visualizations to support forms of social and collaborative learning. The notifications can raise motivation to participate, enhance awareness of group, class, and self-activity, increase participation, and support awareness of instructional and problem-solving opportunities.

Introduction

In traditional face-to-face courses, instructors and students come to a physical place where they mutually act out the course activities. Coordination and cooperation are facilitated by cues and structures in the context: such as, a bell ringing to signify it is time to attend to the teacher, the clock on the wall providing a common marker for knowing how long an activity should last, students passing completed work forward at the end of a class period, or seeing opportunities for dialog. Seeing how others use these cues and structures also shapes interaction. However, in online learning, the Learning Management System (LMS) is a black veil between the instructor and students and among the students. Faculty and students are limited in their knowledge about what is happening in the course to the "words" spoken. Students do not see other students working; nor for the most part do they see each other's products. Instructors do not see students working and can only influence them with words. Similarly, students do not see instructors working outside of formal presentations and feedback activity. The lack of social information constrains social and collaborative learning.

Context-Aware Activity Notification System (CANS) hopes to improve online learning by making it more social. Instead of simply being a "space" for threaded discussions and information access, we want a "place" that supports the social nature of education. Dourish argues that computation is a medium that communicates between social actors and that represents possibilities for action (Dourish, 2001). Thus, the online learning system must be a medium for the cues of the social nature of online learning which links students to a teacher and students to one another. In 2005 we developed a new architecture to implement CANS with the open source LMS Sakai. In 2007 we were awarded a FIPSE grant from the US Department of Education to advance the research and development of CANS.

CANS – the system

The CANS System includes the LMS, in this case Sakai, and the CANS Server, which provides communication and database services for notification. CANS is licensed under the Educational Community License (1.0) version of the open-source license. CANS supports capturing activity information by establishing a vocabulary of tools and action events, maintaining a history of activity, making notifications available based on the context of use, and allowing users to configure their notification preferences. CANS works by observing activity in the LMS, such as when a member logs in, reads a discussion board item, uploads a document, or enters a chat message. CANS observations are stored and matched with profiles for access to awareness information set by the members. Matches lead CANS to send information to members who want the information in a form they have selected. For example, a student in a group may want to know when the instructor has posted an assignment and have that information immediately emailed or delivered via a desktop widget. The student may want to see who has posted new messages or read existing messages, but only want that information when they enter the course website. An instructor may want the same information but want it organized in a table to see who has contributed and how much to a discussion. Thus the awareness information is a resource for instructors and students in knowing when and how to act, and also a tool for an instructor to quickly make sense of what is going on in the course, how to assess what is going on, and identify appropriate next steps for the class or individual students.

Design of CANS

This section describes phases in the design, development, and testing of CANS from September 2007 to October 2008 and includes a brief summary about the iterative design process, prototype development and evaluation of CANS. The main objective of CANS design is to provide awareness information that is easy to use and supports activity awareness in online environments. There were four phases of design during this period. Each phase reviewed prior design work, developed a prototype and conducted usability testing with representative users including scenarios and think-aloud techniques (van Someren et al., 1994).

Phase-1: Email Digest

An email digest provides a list of activity over a period of time. The daily email digest lists activity in the discussion board, resources (file sharing) and chat room. From usability testing, we found that as the number of activities increased, members opted for visual representations of notification information as the most useful and effective when compared to the textual formats used in the current digests.

Interviews were conducted with 34 students in 6 online courses that were receiving the CANS Email Digest during Fall of 2007. Students primarily spoke of using the digest as a useful reminder of the class itself and a way to track instructor activity, but were often overwhelmed in an active class by the lengthy Email Digest. While some skimmed the contents for actions that were important to them (group member or instructor posts), others simply viewed the unread email as a reminder of the class and deleted it. Because high levels of activity within the class created long lists of activity, many students used the list of text somewhat as a visual bar graph; having a long email indicated a high activity level for the class and encouraged the students to enter the learning environment.

Phase-2: Interactive Webpage

The Email Digests seem to serve a need for a quick snapshot related to certain actions, but respondents described many and varied ways they like to use the social information. We needed a new environment that was both visual and interactive. We used visualizations to provide social comparison information to support self-evaluation and promote participation in online learning. According to Festinger (1954), people are driven to compare themselves with others to evaluate and improve themselves. The Interactive Webpage is a way to see and compare individual student activities in class (see Figure 1). It allows users to customize how they visualize the quantity and relative levels of participation; for example, individual postings and views of discussion boards, chat and resources tools can be viewed in the comparison bar chart and tables for three different time periods – yesterday, last 3 days, last week.



Users can select view options – yesterday, last 3 days, last week.
When users mouseover an item in the chart legend, highlight the corresponding item in the bar chart.
Member Visualization: The bar chart shows activities of individual members and average in class.
Activity Summary: The table shows who did (posted/viwed) what when.
Member Summary: The table is the

number version of Member Visualization. By clicking the table header, users can sort the summary table and bar chart.

Figure 1. A Screenshot of Interactive Webpage

In the Summer of 2008 was used in 2 online courses. Semi-structured interviews were conducted with 7 students and a focus group was held with the instructors. The reactions of students and instructors to the Interactive Webpage differed from each other greatly. While students found the Activity Summary a "coollooking" tool, they were confused about the purpose of the Member Visualization. Many were often worried about how it would be interpreted or used by the instructors or peers, and if the quality or thoughtfulness of their postings would be taken into account. Due to the names connected to the graphs, students often felt they were invading other people's privacy by "spying on them." The Member Visualization also had different effects on people depending on their motivations. For some students, the visualization had no effect; to others it made them feel competitive to "get the longest bar graph", while others wanted to seem average and not look like they "didn't have a life" and therefore logged out early without reading everything they wanted. Students often used the Activity Summary as a way of seeing "what the masses were doing" and following suit; in other words, it was an easy way to see which discussions or documents were popular and then find those objects.

Instructors found the Interactive Webpage tool useful for observing patterns of non-participation or seeking history when a student would have problems or questions. Being able to interactively ask questions of the date by selecting, sorting or inspecting visual representations was valued for diagnosing problems or assisting a student with a question or problem. Most felt that this interface was a useful interface for the instructors, but too intrusive for students.

Phase-3: Homepage Widget

In the design of the Homepage Widget, we tried to create a simple and unobtrusive way of delivering class activities for users. The Homepage Widget provides a personalized view of course activities by showing "YOU" in the visualization. Therefore, each user can have a customized view of the bar chart. We currently are in the process of collecting user experience data on the homepage widget.

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• Activity last 7 days: The bar chart shows a personalized view of class activities – you, average and top 10%.

• A mouseover of an item in the chart legend highlights the corresponding item in the bar chart.

• Hot topics last 7 days: The table shows key discussion topics and resources.

• Users can select the drop menu options – new resources, new discussions, most

viewed discussions most active discussions, most viewed resources.

• Users can directly go to discussion pages or open resources by clicking titles.

Figure 2. A Screenshot of Homepage Widget

Implications of CANS for Supporting CSCL

We believe that notifications via activity visualizations are potentially a valuable tool for instructors who want to implement CSCL in LMS. Throughout our usability testing and user experience studies, we have learned that the notifications can raise motivation to participate, enhance awareness of group, class, and self-activity, increase participation, and support awareness of instructional and problem-solving opportunities. However, challenges remain to attune the notifications to the course environment. For example, social comparison visualizations, which identify students by name can have a negative impact on some students' participation, depending on each student's desire to look normal in the eyes of his/her peers or concerns about privacy issues. The use of a social comparison visualization that is customized to the user and eliminates the fear of "participating too much" may better support student self-evaluation and participation. Our next efforts at design for student notification are moving away from student-centered representations and toward object-centered representations. Also enabling customization in report generation and in the way reports are viewed should better support students working in groups as well as whole class activity.

For instructors, the Member Visualization, with each student identified by name, as well as the Activity Summary were useful tools for identifying troublesome patterns or when issues arose. Having an instructor tool which shows specific members yet also allows flexibility in troubleshooting issues and problems is a priority. Activity visualizations such as these show promise for supporting student participation and collaboration and enable instructors work to implement CSCL methods in their online courses.

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