Winter 12-5-2005

Instructing with Advanced Collaboration Technology: Lessons Learned and Unexpected Transformations

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Abstract: This paper provides lessons learned and some unexpected transformations in the learning process when advanced collaboration technology was used to overcome limitations of a popular, existing collaboration technology. The activities pursued in these advanced undergraduate and graduate computer and information sciences courses replicate many of the activities in collaborative knowledge work in organizations. Therefore, the lessons learned should be applicable to transforming other kinds of joint knowledge work in general.

Keywords: Collaborative Learning; Collaborative Support Systems; Collaborative Technologies; Collaborative Wor k Systems; Collaborative Writing; Electronic Collaboration; Knowledge-Based Systems; Learning.

I. Introduction

This paper describes the use of advanced collaboration technology to improve instruction and how such technology can transform the learning process in unexpected ways. The activities pursued in these advanced undergraduate and graduate computer and information sciences courses replicate many of the activities in collaborative knowledge work in organizations. This paper discusses the limitations of a popular, existing collaboration technology which propelled us to try something new; discusses the co-development of joint artifacts; describes the new technology used; and explores lessons learned and some unexpected transformations in the learning process which should be applicable to transforming other kinds of joint knowledge-work in general.

II. Problems with Current Collaboration Technology

While there is overlap in functionality in collaboration technology, and these technologies can be used in a complementary fashion, it is useful to divide collaboration technology into three categories:

⇒ Technology that overcomes the limitation of people not being in the same time at the same place where they can meet face-to-face and can share common artifacts, such as documents. This includes real time technology such as Instant Messaging; web-, video- and tele-conferencing; and application sharing, such as Microsoft's Net Meeting. This also includes asynchronous technology such as email, email and attachments; shared folders on LANs and the WEB; and chat and threaded discussions.

⇒ Technology that assists in the co-development of artifacts. Specifically, technology that helps to overcome the social, cognitive, and procedural complexities in planning, creating, evaluating, negotiating, and consolidating joint artifacts.

⇒ Technology that assists in the coordination of tasks that can be completed independently but are interrelated to others. This includes workflow and project management technology.

Most collaboration technology seems to be stuck in trying to overcome the limitation of people not being in the same place at the same time [3, 6]. Blackboard™, an electronic version of a blackboard, is a popular collaboration tool used in education that fits within this category. Blackboard™ is the typical portal-based architecture that is mostly used to store various artifacts, such as syllabi, class documents, and presentations; and has little-used add-on tools, such as chats and threaded discussions. In Blackboard™, if one wants access to a document for displaying to and updating by a class, one must typically do the following: 1) navigate to the document through a series of Web pages; 2) download it; 3) navigate to the downloaded location; 4) open it up in the application; 5) modify it; 6) save it to the file system; 7) delete it in Blackboard™; and 8) re-add it to Blackboard™. While the document is available for viewing, the document cannot be jointly edited. This makes it all but useless in real-time and asynchronous interactions. In addition, Black-board's functionality reinforces a prevailing notion that course documents are static. Is there something limiting in Blackboard's conceptual view of collaborative support as essentially providing a common depository for static artifacts that affects its design and usefulness [6]?

III. Co-development of Work Products within a Collaboration

There must be an intellectual break away from the notion of individual tools that incorporate collaboration functionality in a non-integrative fashion [6]. Joint work products that evolve as part of the sensemaking process include such things as plans, reports, budgets, specifications, architectures, contracts, designs, and software code. Technology must

Proceedings of the Fifth International Conference on Electronic Business, Hong Kong, December 5-9, 2005, pp. 747 - 749.

support all phases [5, 8]:

- Planning. Collaborators establish the objectives, structure, and divide up parts of the shared work product to be created.
- Creation. Collaborators compose their portion of the joint work product. Although they may work alone, it is important that they are aware of what the other collaborators are doing.
- Evaluation. Collaborators review, propose changes, and add comments to each other's work.
- Negotiation. Collaborators discuss proposed changes with one another and decide on what changes should be made.
- Consolidation. The collaborators resolve conflicts and merge changes into the shared work product.

IV. Transformations to Instruction and Learning

One class is a senior-level, two-semester undergraduate course where groups of students create real information systems for real-world clients; the other class is a graduate course in human usability design. Much of the instruction focuses on experiential learning and deals with the co-development of information system artifacts for a given problem scenario over the course of the semester. Students are then tested in skill-based practical exams and teams apply these skills to design and develop real-world systems. This section describes the evolution of a better understanding of the process of co-development of joint artifacts and the unexpected transformations in the learning process that occurred as a result of using SenseMaker™.

Assessing Progress and Individual Contributions
Universally, instructors who employ demanding group projects find assessment of group progress and individual contributions within the projects difficult. SenseMaker™ can help mitigate these assessment issues by viewing work-in-progress and identifying individual contributions within overall group effort.

Transition Between Asynchronous and Synchronous Interactions Within Class
For the most part, the common notion of class is that an instructor interacts synchronously with his or her students. Usually the class breakout into project teams to work asynchronously. They then post solutions in SenseMaker™ to support transition back to synchronous interaction.

Peer Learning and Transition Between Asynchronous and Synchronous Interactions Between Class
This is similar to within a class, but more pronounced. A major problem in following a problem in-class throughout the semester is the problem of providing some way for the groups to continue to work on the problem between classes and then pick-up with some progression in the next class – one can't easily save what each group has done on the board or project what one's solution is to the problem.

Several features of SenseMaker™ were invaluable to this process:

⇒ Subdividing. Artifacts could be subdivided and then assigned to teams to work on in parallel with other subdivisions by other team members. This permitted teams to work on their section and also see how other teams were progressing in their solutions. This also permitted progress on the solution as a whole.

⇒ Suggesting Alternatives. When class convened for the next section, some group's solution would be displayed to the class. As a class we could review the solution. However, instead of making changes directly to the solution, using SenseMaker™ an alternative can be suggested. This means a copy is made and linked to the original solution. Then, as a class, we could work on the alternative together and save it. Students have available the original result of their thought processes and the corrected version. In this manner, the differences of their understanding and the solution are always available for review.

This process meant almost the complete elimination of the use of the whiteboard in class and Blackboard™ in general. All work was created and available for use by the class. Since exams were practical exams to demonstrate learned skills; some students either downloaded the joint artifacts to their own notebooks for use during the exam, while others made hard copies. In the future, we intend to provide wireless access to SenseMaker™ artifacts during classes, including exams.

Co-development of Joint Artifacts
The enhanced features of SenseMaker™ provided "controlled" co-development of project submissions required of each team. Project teams could subdivide submission documents and work in parallel.

Joint Evaluation
SenseMaker™ permits parallel evaluation where instructor, teaching assistants, and students interact to understand each other to achieve satisfactory evaluation. In situations where the artifacts are created based on some interpretation, the feedback of the creator may be critical in understanding the thought processes. Instead of a black hole until the graded submission is returned, the student can see the evaluation in progress and even provide feedback to assist in the evaluation.

Virtual Nods (vnods)
An assumption behind most collaboration technologies is that face-to-face is the best medium and one must use technology to overcome the limitation of not being able to collaborate in person [1]. However, there is growing evidence that face-to-face interaction may not always be best

[2, 4, 7]. In an effort to incorporate motivational characteristics of face-to-face interactions within asynchronous interactions, SenseMaker™ records the date and time a participant "virtually nodded" by reviewing some content. In addition to the motivational benefit of virtual nods, Vnods within SenseMaker™ helps to controls interaction feedback in a number of ways: First, it eliminates countless numbers of emails that would be needed to incorporate virtual nods on ideas or comments; Second, the instructor "pulls" the information when needed by easily reviewing who in the project/class has visited some content; Third, there is functionality within SenseMaker™ for the instructor to easily "push (send email)" to request a vnod from the whole group or from the subset who has not yet vnodded on something.

Rethinking What is Static and Dynamic

With current web technology that provides the ability to post, there is an implicit assumption that the posted documents are static. For example, prior to using SenseMaker™, a syllabus seemed like a static document that was distributed or posted. However, the syllabus is far from static. The schedule can change. Students can have questions as to what is meant by some aspect of the syllabus. There could be errors in the original syllabus. Using SenseMaker™, the syllabus was subdivided into major subsections and these further subdivided as necessary. When a change was made to a section, only that section was updated. In the usual process, the complete syllabus would be deleted from the website, modified, and then reposted. In lengthy syllabi, it is unlikely that the student will take the effort to see the change; and without vnods, there would be no way to ensure whether the student is aware of the change. In another example, a student posted a question by attaching the question to a particular section. The response was made by the instructor and the section modified. Other students could see the question, the response, and the modification. Through the use of vnods, the instructor can see who saw the question, the response, and the modification. Finally, one can make questions that students have about the syllabus a positive experience. For example, students, who question the clarity of some wording in the syllabus, are encouraged to use SenseMaker™ to suggest alternative wording. This provides an opportunity to provide feedback to improve the syllabus and students gain practice in writing in a more clear style. Those students who provide such feedback can be awarded with extra credit.

V. Summary

Incorporating collaboration functionality in a piece-meal approach as add-ons within a portal-based architecture c an limit the potential of collaboration technology to tran sform joint work processes. This paper discussed the li mitations of a popular, existing collaboration technology which propelled the use to try more advanced collabor ation technology. The co-development of joint artifacts was discussed and SenseMaker™ functionality was pres ented. The activities pursued in the advanced undergrad uate and graduate computer an information science cour ses replicate many of the activities in collaborative kno wledge work in organizations. Therefore, the lessons le arned should be applicable to transforming other kinds of joint knowledge work in general.

VI. Trademarks

SenseMaker™ is a trademark of SenseMaking Technologies Corporation. Blackboard™ is a trademark of Blackboard Corporation.

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