To Appear in Proceedings of the International Conference on Computers in Education 2003, Hong Kong

Supporting Online Learning with an Artifact-Centered Cross-Threaded Discussion Tool

Viil Lid and Daniel D. Suthers
Laboratory for Interactive Learning Technologies
Department of Information and Computer Sciences
University of Hawai`i at Manoa
United States
viil@hawaii.edu, suthers@hawaii.edu

Abstract: As online courses become more common in higher education, it is critical to ensure that supporting technologies are specifically designed to support the instructional objectives of those courses. In computer science and many other fields of education, collaborative design projects are an effective instructional paradigm. Learning from collaborative design requires discussion about designed artifacts, and benefits from interchanges between project groups. Yet many online learning environments provide poor support for artifact-centered discourse and fragment discussion across disjoint forums. In this paper we report on the design of a system that begins to address these problems by supporting artifact-centered discourse and threads that live in multiple discussion contexts. We have recently used this system in a graduate level design-oriented course with excellent results in terms of quantity and quality of discussion.

Introduction

There is a significant trend toward computer mediated distance collaboration in educational contexts ranging from K-12 through university to the life-long professional development of adults. This situation presents a great responsibility on the part of software developers to provide technologies that are specifically designed to support effective learning activities. Although various technologies are available and workable for conventional forms of instruction, the second author and his colleagues has found them to be inadequate to support the instructional objectives of many of our courses. Students of computer science and information technology need to learn to do design (whether of algorithms, software architectures, or interfaces), and they need to learn to work collaboratively. In collaborative design, discussion about designed artifacts is critical, yet in one major learning management system (LMS) available at our university the student project area is completely separate from the threaded discussions, and in another LMS students cannot even see each others' assignment submissions. A related problem is fragmentation of online discussions (Hewitt, 1997; Herring 1999). Discussion forums are organized in a hierarchical tree structure, and users must decide where in this hierarchy to post their messages. Yet sometimes a thread of discussion can be relevant to more than one forum's topic. For example, it is common in our courses to have discussion forums for assignments and for group projects. Some messages are relevant to both an assignment and a project.

Encountering problems such as these, it became clear that improved technologies are needed to support online problem-based learning and collaborative design. Therefore we undertook to develop an online learning environment to address these problems. This paper reports on innovative features of its design.

Software Features

Our learning environment, tentatively named disCourse, provides typical features of a learning management system, such as information about the course, a schedule, and places for students to provide personal information and customize the environment. The home page displays news and recent messages and artifacts. DisCourse provides an HTML interface with a MySQL database back end. PHP scripts provide the connection between the interface and the database. As a server-side scripting language, PHP keeps the processing demands for the client at a minimum. This technology may run on a wide spectrum of web servers and clients.

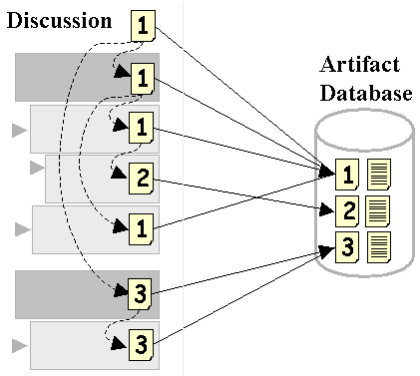

Figure 1. Inheritance of artifacts in discussions and threads

Artifact-Centered Discourse

Presently, an "artifact" in disCourse is a URL referencing an external web page. (Facilities for uploading documents to the disCourse server itself are contemplated for future development.) These URLs may reference resources on the Web such as articles, information repositories, or example sites, or may reference web pages created by students as part of their project work. All users can submit artifacts. All artifacts are cataloged in a database and can be retrieved by keyword searches on their category or descriptive text. Shortly users will be able to link from the artifacts to the various subthreads that discuss them.

DisCourse takes a "linked" approach to artifact-centered discourse (ACD), in which messages are organized chronologically yet are linked to the artifacts being discussed. See Suthers (2001) for a discussion of advantages as compared to "parallel" and "embedded" ACD approaches. Other examples of linked ACD systems include the Journal of Interactive Media in Education (Sumner & Shum, 2001), Pink (Takeda & Suthers, 2002) and Kukakuka (Suthers & Xu, 2002).

Artifacts may be attached to discussion groups, threads, or messages. As shown in Fig. 1, threads inherit their artifact from the discussion group and messages inherit their artifact from the thread or message replied to. The user may over-ride the inherited artifact with a new artifact in a reply.

Sharing Student Work

Many online learning environments provide support for handing in assignments, but student work is often not visible to other students to respond to and learn from. If the assignment solutions are visible to the other students as they are handed in, some students may look at others' work before they work through their own solution. When a student submits an assignment in disCourse, a thread that references the students' artifact is automatically created in the assignment discussion, thus inviting feedback and discussion. To prevent students from taking advantage of those who submit their assignments early, disCourse does not make other assignment solutions visible to a user until she has submitted her own assignment.

Cross-Threaded Discussion

Participants need a workspace for each project where group members can display and discuss their work. Yet in a project-oriented course, some assignments will mark the major milestones of project development. Should the assigned work and associated thread appear in the assignment discussion or the project discussion? Ideally they would be visible in both discussion contexts.

When a project group submits their assignment solution to disCourse a thread is automatically created, linking to their assignment solution as an artifact, and is made visible in two different discussions (Fig. 2): the discussion concerning the assignment in question, and the discussion concerning the group's project. Subsequently, replies to the thread may be posted in either discussion context and will be visible in both discussions. Students can use the

assignment's discussion to compare and discuss all project groups' solutions to a given assignment, or they can use a project discussion to review the progress of a single project.

Currently, cross-threading in disCourse is limited to project assignments. Multi-contextual threading has potential advantages that could be exploited by users if provided as a more flexible tool. We are considering enabling users to import any sub-thread to a new discussion.

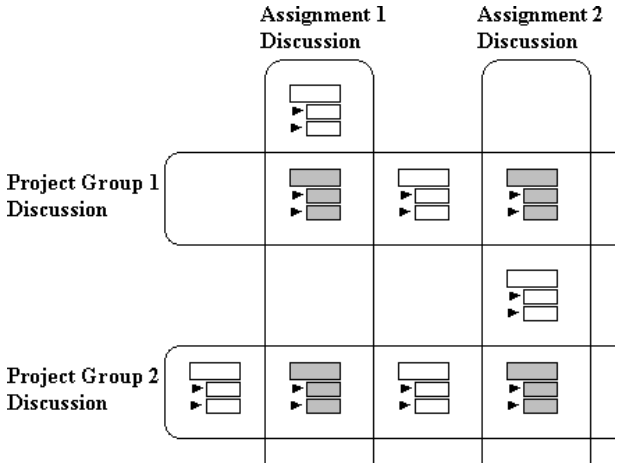

Figure 2. Project assignment threads appear in two discussions

Example

Fig. 3 shows an example disCourse screen. The user is in a project discussion and reading a thread that was created in response to an assignment on prototyping. Hence the thread would also be available if one entered the corresponding assignment discussion. This project's response to the assignment is linked to the message and is being viewed on the right. The user is replying to a message. As shown, disCourse enables one to compose the reply in context, immediately after the message being replied to.

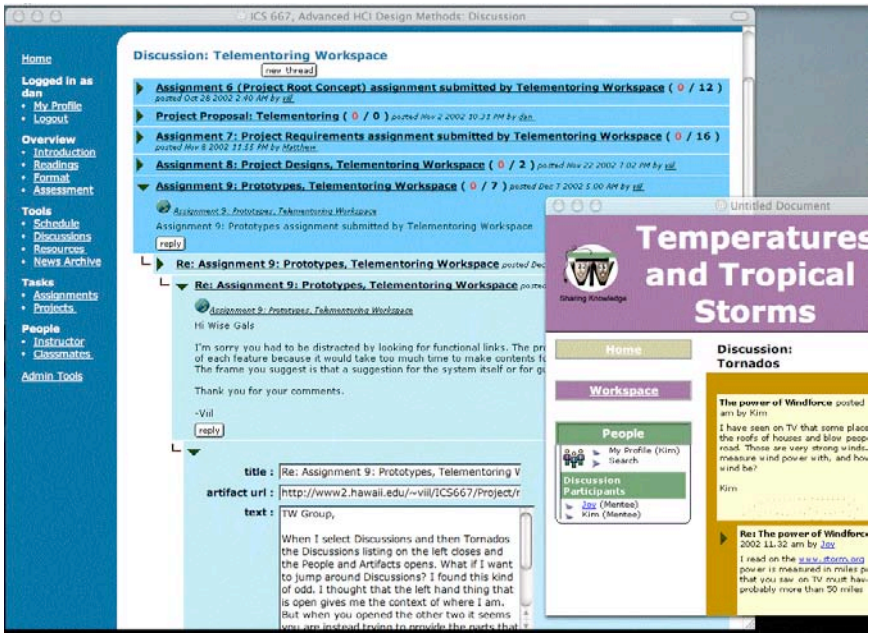

Figure 3. Replying to a message in a project discussion

DisCourse in Use

During the fall semester of 2002 disCourse was used for a graduate level course in Advanced Human Computer Interaction (HCI) Design Methods, conducted by the second example at the Department of Information and Computer Science at the University of Hawai'i. As of the end of the semester, 25 students and one instructor have entered 327 artifacts, and participated in 32 discussions containing 863 postings, including 268 messages initiating new threads and 666 replies, where 65 of the 268 threads are visible in two discussions. The average message starting a thread is 31 words and the average reply is 131 words long. Most importantly, much of the discussion is focused on the content of student design projects, and the quality of discussion was the best that the second author has experienced as an instructor. Subsequently, another instructor used disCourse for an undergraduate HCI course in the Spring of 2003. At this writing, disCourse is again being used by the second author for the Advanced HCI Design course.

Summary and Future Work

In addition to many typical features of a learning management system, disCourse has two innovative features: association of artifacts (presently URLs) with all granularities of discussion (discussion, thread and message) to support artifact-centered discourse, and cross-threading of discussions to avoid fragmentation and improve synergy across groups. We have found disCourse to be very successful in supporting project-based learning with a clean and easy to use design. Formal evaluation of how students use artifact-centeredness and cross-threading is underway, and will examine the nature and extent of referring expressions (is the presence of the artifact assumed?) and the contexts in which users read and reply to cross-threaded messages. We also plan to provide users with the option of immediate visual presence of artifacts (using frames as in Suthers & Xu, 2001), and compare this configuration with the option of having the artifacts hyperlinked in terms of user preference and types of referring expressions used.

Acknowledgements

This work was supported by the Sloan Foundation and by the National Science Foundation under Grant No. 0093505. Any opinions, findings, and conclusions or recommendations expressed in this paper are those of the authors and do not necessarily reflect the views of the Sloan Foundation or the National Science Foundation.

References

Herring, S.C. (1999). Interactive coherence in CMC. Proceedings of the 32nd Hawai`i International Conference on the System Sciences (HICSS 32). (CD-ROM). Maui, Hawai`i: Institute of Electrical and Electronics Engineers, Inc. (IEEE). Online: http://www.computer.org/proceedings/hicss/0001/00012/00012022.PDF

Hewitt, J. (1997). Beyond threaded discourse. Paper presented at WebNet'97. Online: http://csile.oise.utoronto.ca/abstracts/XXThreadedDiscourse.html

Sumner, T. and Shum, S.B. (2001). JIME: An Interactive Journal for Interactive Media. First Monday, 6, (2), Feb. 2001. Online: http://firstmonday.org/issues/issue6_2/buckingham_shum/

Suthers, D. (2001). Collaborative Representations: Supporting Face to Face and Online Knowledge-building Discourse. Proceedings of the 34th Hawai`i International Conference on the System Sciences (HICSS-34), January 3-6, 2001, Maui, Hawai`i, (CD-ROM), Institute of Electrical and Electronics Engineers, Inc. (IEEE).

Suthers, D. and Xu, J. (2001). Kukakuka: An Online Environment for Artifact-Centered Discourse. Education Track of the Eleventh World Wide Web Conference (WWW 2002), Honolulu, May 7-11, 2002, pp. 472-480. Online: http://www2002.org/CDROM/alternate/252/

Takeda, T. & Suthers, D. (2002). Online Workspaces for Annotation and Discussion of Documents. Proceedings of the International Conference on Computers in Education, December 3-6, Auckland, New Zealand.