Collaboration and Negotiation through the Learning Web

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Abstract: The *learning web* approach can be effective in supporting collaborative learning involving major groups of students operating as goal-directed, structured teams. It is natural for such teams to use hypermedia technology to record their own group processes in achieving their goals, particularly if communication with another team is an intrinsic part of their task. This article shows how an effective learning web can be established through a situation in which students play roles in customer and supplier teams concerned with a system development task. The only technologies used are commonly available web servers, browsers and text editors.

Summary

Learning web methodologies may be applied to existing courses in order to facilitate collaborative and self-directed learning and break out of the traditional lecture and classroom format (Norrie and Gaines, 1995; Gaines, Norrie and Shaw, 1996; Shaw and Gaines, 1996). CPSC451, a required software engineering course for Computer Science majors, is centered on projects that involve the students playing roles in teams representing customer and supplier organizations. Each student is assigned to two different groups of 10 to 12 students. In one group she is one of the supplier team, and in the other one of the customer team for a different project.

It has been natural to use the learning web in CPSC451 to support the group collaboration and the customer-supplier negotiations which in previous years were communicated only through documents. All the course materials are already made available to the students through the web, and it is a simple extension for students to place the documents relating to customer requirements, supplier comments and proposed solutions, the ensuing negotiations, and descriptions and screen dumps of the developed applications on the web. The notes below were given to students on how to use web facilities in a simple and natural way to manage their projects.

Using the Web for Requirements Tracking

The World Wide Web supports the sharing of structured multimedia documents with links to one another and to other material, not necessarily in HTML format. This makes it a suitable base technology on which to develop a requirements tracking system for software engineering that tracks the relationship between requirements, analysis, design, implementation, application and maintenance.

For CPSC451 we will use the web to develop a set of linked documents tracking the customer group requirements specification, the negotiation with the supplier group to clarify them, the design specification, the customer commentary on this, the implementation, acceptance procedures, and so on.

Rather than use special-purpose servers we will take advantage of the web's capability to link documents held in different locations, and generate a sequence of documents held in the directories of those in the customer and supplier groups. A single master index managed by someone in one of these groups will be used to make the distributed set of documents available to everyone in the groups.

Linking and Annotating Material

By putting all the customer and supplier documentation in the web directories of members of the customer and supplier teams it automatically becomes available to everyone. However, it is not linked together and it may not be obvious how the documents relate to one another. Two things can be done to improve the situation.

First, someone in the customer group should agree to become documentation manager for the entire project and maintain an index in their web directory of all the documentation from both customers and suppliers. This index will contain pointers to the distributed set of documents allowing them all to be accessed from one place. Anyone needing to look at the project documents will start with the index and click on a document in it to fetch that document. Anyone generating a new document that should be entered in the index should email its url to the documentation manager specifying where it belong in the index.

Second, while you cannot edit a document in someone else's account, you can fetch it with a web browser, save its source, annotate that source with your comments, and make the annotated document available in your

account. Thus, the index will grow to be a sequence or a tree of documents such as a customer specification, a version annotated by the suppliers with queries about the specification, a version of this annotated by the customers with answers to queries, and so on. Similarly, an initial design specification from the suppliers can be annotated by customers.

Style of Annotation in HTML

You will need to establish some style guidelines for documents so that you can distinguish annotations from the original. One good technique is to use a horizontal rule before and after annotation. Tags for bold and italic can be used to mark particular sections of text to which you are making reference. There is no obvious or standard way of doing this. Experiment with HTML and decide on an approach for your group (but don't spend more time on an annotation scheme than you do on the actual software engineering project!).

What Should be Documented on the Web

Any documents that you can generate on paper you can also put up on the web, so that your project web should finally provide a complete account of all the activities of the project. For example, you can link to design material that includes screen-dumps as GIF images. In a real-world project that used the web itself to implement a client-server system you would even be able to link to the working system so that the requirements and design information was available for maintenance and enhancement support. If your implementation is on the departmental unix system then you should be able to provide a link that starts a live demonstration.

Conclusions

In the first paper on the learning web we argued that, given appropriate initial conditions, groups forming learning webs would organize themselves in a robust fashion to achieve their learning objectives. The experience with CPSC451 and other courses has shown this prediction to be correct. With the appropriate definition of the social dynamics, specification of the objectives, motivation of the participants and provision of supporting technology, the learning web approach is very effective in promoting collaborative learning.

The supporting technology is very simple and already widely available to educational institutions. CPSC451 used only standard web servers, browsers and text editors. No special-purpose tools were used. The students were third year computer scientists and hence had familiarity with computer use and text editors, but most had no prior experience in the use of the World Wide Web. We have found in other courses with students across a range of non-computing disciplines that the capability to prepare documents for the web is easily acquired in a few hours experience. The approach described in this paper can be used in any discipline.

The web created by CPSC451 students in 1996 is part of the learning environment supplied to CPSC451 students in 1997. Thus collaborative learning is being encouraged not only within cooperative groups, and across negotiating groups, but also longitudinally between classes in different years. The students who are learners in one year know that they are also teachers for the next, and hence can take pride in knowing that their achievements will be of value to others, not just exercises for the instructor to assess and then forget.

CPSC451 is an important course for students seeking employment in industry, since most potential employers see computer science students as lacking in the group collaborative skills that CPSC451 develops. The archiving of the materials on the web automatically creates a "portfolio" for each student through which they may show to a potential employer that they have had experience both in specifying requirements for others and in developing systems through teams that have negotiated requirements with others.

References

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URL's for Materials: CPSC 451 archives for 1996: http://ksi.cpsc.ucalgary.ca/courses/451-96/
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