Constructive, Inquiry-Based, Multimedia Learning in Computer Science Education

Project Summary

This project will design and implement a framework for constructive, inquiry-based learning, using multimedia, for introductory and upper-level computer science courses. *Constructive* learning goes beyond learning by receiving knowledge, to learning by building systems, with immediate, visual feedback. Moreover, *inquiry-based* learning guides the student into pursuing exploratory research in a community of students and scholars. A "reference librarian" avatar will suggest research topics, then help extract content from dynamically mined material and traditional library resources, answer typical questions and help construct annotated bibliographies, reviews and research proposals.

The framework will be an integrated, multi-track model of inquiry-based learning. Into this framework we will incorporate content from a base of multimedia courseware that has already been developed for an introductory course. This introductory material will be the starting point in the development of modules for two upper-level courses on Object-Oriented Software Engineering and Artificial Intelligence with Applications in Textual Data Mining. Our cost-share industrial sponsor, Allstate Insurance Company, will help design, implement and evaluate the AITDM module, for workforce dissemination by Allstate's Multimedia Education Group.

Textual data mining will be both a course subject matter and research topic in this project. The reference librarian avatar will act as a client communicating with a text data-mining server (at NCSA). This resource will help students learn by studying emerging technological trends in selected topic areas. The project also seeks to advance the state of the art in automatic data mining of textual repositories with the help of NCSA industrial partners and Allstate Insurance.

An important component of the learning environment is the range of assistance students will have available to them as they pursue their inquiry. Students will be able to reach beyond the instructor and librarian avatars to communicate directly with a live person—an expert that the avatar represents. Our goal is to provide a communication medium that allows an instructor or librarian to show how he or she would solve a problem, through a combination of audio, video-over-IP, and remote control. We will use a protocol for a collaborative desktop interface to communicate mouse pointer position, mouse actions and interface events. If the expert is not available, the avatar can help the student select from a library of "show me" answers to frequently asked questions.

In summary, we believe the research and curriculum development proposed herein will interest colleagues seeking to modernize computer science curricula, researchers in educational technology and industrial partners intent on leveraging such technology in workforce augmentation initiatives. The proposed general framework will feature a multi-track instructional design that accommodates diverse learners and learning styles. Avatars will represent a collaborative community of teachers and professionals who help students use dynamically mined materials, traditional research methods and networking to facilitate inquiry-based learning. The interface will focus on usability and performance enhancement. Our goal is to make the interface and content accessible to novices and challenging to advanced students. A long-term goal is develop new textbooks with accompanying multimedia for introductory and upper level courses.