Project Year
2006

Project Team
Richard Brown, Director of Undergraduate Studies, Mathematics Department, Krieger School of Arts & Sciences ; Brian Macdonald, Student, Mathematics Department, Krieger School of Arts & Sciences; Siddique Khan, Student, Mathematics Department, Krieger School of Arts & Sciences

Project Title
A Virtual Classroom for First-Semester Calculus

Audience
Undergraduates, primarily from the Krieger School of Arts & Sciences and the Whiting School of Engineering, taking *Calculus I*

Pedagogical Issue
The standard lecture-based course environment is a required part of the University experience, and is a very successful model for the dissemination of information and the education of a student. Within this model, physical proximity to the university and its resources is a requirement. However, we feel that today, it is now feasible to try to remotely conduct the entire lecture-based model of classroom social interaction. Both the advent of the Internet and the current state of technology make this experiment possible by facilitating the remote provision of content and personal interaction.

Solution
The advantages of the old educational model are already known; the advantages of the new model, beyond the obvious practical benefits of remote education, cannot yet be imagined. The team proposes to explore the many uses of current states of technology and to use that research to design and implement a university freshman-level calculus course, accepted for credit within the Johns Hopkins University, conducted solely over the Internet. The goal is to develop the tools and methodology needed to conduct this course without any sacrifice of material or experience from that of the standard lecture-based course model, except that the enrolled student need not physically attend the campus to attend and successfully complete the course.

Technologies Used
Courseware (WebCT development), PowerPoint/Presentation, Virtual Classroom, HTML/Web Design, Adobe PDF

Project Abstract
We propose to design and implement a university freshman-level calculus course, accepted for credit within the Johns Hopkins University, to be conducted solely over the internet. This course will coordinate and synthesize the virtual classroom environment of Eluminate Live! (eLive!), the course design and organization capabilities of WebCT, a custom digital library of single-issue streamed mini-

lectures, and various other supplemental materials. Working with the Team Leader, Professor Brown, two graduate students will exploit the facilities in this environment to design and modify the existing course content to this new environment. We will implement this course over the first summer session of 2006. This process will permit us to experiment with several structural improvements to the current state of affairs in calculus pedagogy. We propose to conduct the entire course online in the WebCT environment, with lectures and recitation sessions performed in the virtual classroom of eLive! Supplemental material can then easily be coordinated and synthesized with the lectures via the posting of previously performed lectures, single-issue pre-filmed sessions, pointers to other online supplemental material, the electronic submission of homework, online timed quizzes, etc. If this can be effectively done, then the constraint of proximity to campus for university-level education may be eased. While there are currently many attempts to provide content online to supplement a course, we believe this is one of the first fully implemented online courses with a lecture component to it. The Technology Fellows will 1) design the content and flow of the course, working out how best to convey the same information from the lecture course into the new environment 2) conduct the virtual classroom lessons and the recitation (problem-solving) sessions, 3) manage the WebCT design and implementation, and 4) manage the chat rooms. The faculty member will oversee the project, setting the curriculum and overseeing the quality of the presented material as it compares to the lecture-based model. The faculty member will also run a continuous quality control evaluation to monitor the flow and effectiveness of the course, as well as a post-course analysis of outcomes versus objectives. The project will be successfully completed if, at the end of the course, both the students and the Fellows are satisfied that the result has been a fully enriching experience and that the technology has either not degraded the quality of the course, as compared to the standard model, or has enhanced it. Via an ongoing rating system during the course and a comprehensive evaluation and debriefing at the end of the course, we will measure the relative satisfaction of both the students and the instructors. Also, we will be running a concurrent standard session of the same course, and (to the extent that it is feasible) we will standardize the exam material between these two for comparison and evaluation purposes. We view this project as a pilot. If successful, we would like to expand this project to both more sections of the same course and to other service-level courses in the Mathematics Department, like *Calculus II* (110.109) and *Calculus III* (110.202), *Linear Algebra* (110.201) and *Differential Equations* (110.302). Once the tools have been developed adequately, the adaptation of this course design to the material from other departments should be feasible, and we would be very open to a future study of this kind of adaptation.