Web Based Curriculum Development: A Case Study of Laboratory Safety

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Abstract
The objective of this paper was to explore the use of the World-Wide Web as an adjunct to normal traditional course delivery. The web site will involve laboratory safety and will impact students in chemistry, physics, biology, integrated circuit technology and, in general, any lab-based course. The web site was developed through a team approach. The team employed two faculty members, one graduate student and one undergraduate student. The team also employ the most recently creation platform (COSMIC CREATE) technology developed by our partner in the project Silicon Graphics Inc. During the test phase of the project the web site was used as an intranet site and involve only students at Howard. Once developed in its beta form, it will be available to the entire academic community sometime in fall semester of 1996.

Introduction and Background

During the last quarter of a century, the private sector and educational institutions have been in a never ending battle to remain competitive in an increasingly changing technological global world. The shelf life today for many college graduates is measured in years or perhaps months. Technology has changed the way we all do business and the way we live around the world. This technological change is reforming, repackaging and re-engineering the way colleges and universities do their jobs well.

The significance of the information technology age that it has the power to transform the way we work, learn, teach, sell, play, serve, buy, govern, or communicate at academic institutions. Educators that used primary "chalk and talk" today find themselves faced with a challenge to consider the Information Age's potential to alter the nature of education in our institutions. Many of us are familiar with the exponential improvement in computing and storage capability.

Those graduates who enter the work force will be constantly struggling to keep up with the state-of-the-art things while teamwork, communication skills, foreign language skills and global/international awareness are excellent resume enhancements, lifetime learning will be a common practice.

Those of us in the education and educational technology community have learned a great deal about how to use computers to aid in the education and training process. We have study, collaborated, design, and re-designed tools and materials dealing with curriculum and assessment. We know:

(1) Computer will not not and cannot replace teachers; but add productive activity in the classroom,
(2) Education technology ... student's curiosity and provide significant experience in making sense out of the world,
(3) Computers alone will never whisk many students along the path to life-long learning,
(4) And that a program focusing on connecting students to the Internet and World Wide Web without the integration of software into the curriculum may not add in learniful ways.

Project Description

For the first half of this century engineering, science and mathematics were taught in very different ways. For example, engineers training and tools were highly empirical. Experience in the laboratory and learning through "what works" were the foundation of engineering education. With the start of World War II, theoretical understanding became far more important. Emphasis shifted to mathematics and science with an intent to begin engineering, science and mathematics under a single "educational roof" based on pure science. The importance of laboratory experience, industrial practice and design synthesis waned from the curriculum of all the sciences and engineering
courses. Technically trained people sharpened their analytical skills and theoretical understanding. Today we are faced with another major paradigm shift forced and enabled by the computer.

To address this paradigm shift and to produce competitive scientists and engineers, educators must use every tool available. Not all the tools are technological, nor are they all new. Instructors of science and engineering related fields must increasingly use the findings from psychology, sociology, and educational theory to structure their classes in ways that promote “active learning”.

Students today routinely communicate with their instructor by E-mail and may even submit their homework the same way.

The objective of this paper is to show how the use of the World-Wide Web can be used as an adjunct to normal traditional course delivery. The web site will involve laboratory safety and will impact students in chemistry, physics, biology, integrated circuit technology and, in general, any lab-based course. The web site was developed through a team approach. The team employed the most recently created platform and technology developed by our partner in the project Silicon Graphics Inc. During the test phase of the project the web site was an Interanet site and will involve only students at Howard. It will be available to the entire academic community this fall. The sites does employ the latest HTML, Java, Hot Java, and Shockwave technology. With this type of development, using Netscape as the web browser, the sites can be ported to CD ROM, to be used during lectures, and made available to the web, thus, maximizing applicability and portability.

**Safety First**

In a university environment, laboratory safety is of the utmost concern. Students in chemistry, physics, biology, integrated circuit technology are just four courses taught at Howard and other universities that require a laboratory safety program. This program must be an integral part of the education mission and Howard University is committed to create and support a safe and healthy research/teaching environment. We believe that teaching/research of the highest standards can best be conducted in laboratories where the commitment to safety is exemplary. The goal of **Safety First** is to provide a range of instructional and resource materials to help researchers know how to incorporate the fundamental good rules of safety into their daily lab practices.

**Safety First** gives guidelines that are applicable to all research, teaching, and academic laboratories, your lab may require more specialized rules that apply to specific materials and equipment. In the web based version of this program, the web site will have ten sections. The sections are awareness, personal safety, and hygiene, fire prevention, housekeeping, emergency procedures, waste disposal, in-line training materials, National Institute for Occupational Safety and Health Pocket Guide to Chemical Hazards, Occupational Safety and Health (OSHA) checklist for Hazard Communication Standard and a miscellaneous section. The awareness section includes: 1) guidelines for labels of all chemicals; 2) unsafe conditions; 3) electrical cords hazards and; 4) guidelines for ordering flammable reagents. In the on-line training section line interactivity Shockwave Quicktime videos will appear. The OSHA checklist outlines requirements certain manufacturers distributors and employers must meet in order to satisfy the hazard communication standard (29CFR 1910.1200). The NIOSH Pocket Guide to Chemical Hazards is in the public domain and with the new data based tool in Web Force, we is integrated this into the Web site. In the miscellaneous section, there will be a question and answer section along with a detail reference list, pointers to other web sites, the safety manual, and a special section on lasers and integrated circuit technology related safety.

**Creation Platform/WebForce Server**

The WebForce family from Silicon Graphics provides a high standard for creating and serving media-rich content on the World Wide Web. The entire WebForce product family has a distinct advantage over many other systems. WebForce products provide innovative solutions for the Internet.

The WebForce Indy Author provides a comprehensive authoring solution. This authoring tool that enables creation of interactive, media-rich web sites in a graphical environment. WebForce provides solutions for all common Internet file formats including images, audio, video, HTML Java and VRML come pre-installed. The Cosmo Code (Java development environment) is clearly a state of the art software package. Dr. Harris and Dr. Todd Shurn have had special training with this package and have coordinated Howard University beta test site for this software.

The WebForce Challenge S System architecture is the hardware solution. This
Challenge S System maximizes performance with first processors in a high capacity bus. It supports the MIPS R4600 and R4400 as well as the MIPs R5000 CPUs. The system bus provides 267 MB/second of sustained bandwidth and a 400 MB/second bus from CPU to memory. WebForce Challenge S comes standard with two Ethernet parts and two 20 MB/sec Fast/Wide/Differential SCSI-2 channels. This development platform will also be the server platform.

WebForce Indy Author and Serve is the ultimate solution both authoring and serving Web content. The Netscape enterprise server, combined with the WebForce Author station, delivers a comprehensive authoring and high-performance Web serving solution in one computer.

Conclusions

We have developed a web-based curriculum in laboratory safety. Safety First has been tested in in several classes and proven to be an effective tools in teaching and preparing students about the dangers and safety precautions associated with a laboratory based science or engineering course at the college level.

References