Chapter VIII
Web-Enhanced vs. Traditional Approach for a Science Course

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ABSTRACT

The use of Web enhanced curriculum to teach and reinforce science concepts based on specific learning objectives has been a positive experience for faculty and students. This chapter provides a review of the rapid development of Web enhanced science courses as a teaching-with-technology alternative to the traditional approach. The main theme of the article is a step by step introduction to the design, implementation, and usage of a computer-aided system in teaching undergraduate science (physics, mathematics, electronics, and chemistry) courses with an adequate laboratory experience. These steps are (i) the learning management system evaluation and selection; (ii) computerized course curriculum adjustment to a Web-based format; (iii) the simulations (virtual labs) and animated illustrations, either selection or development, if needed; (iv) the establishment of threaded discussion board where each student is expected to participate in discussions moderated by a professor; (v) computerized test set ups; and (vi) student feedback summarization and analysis.

INTRODUCTION

Thousands of educators across the globe are involved in activities exploring the opportunities and innovations of education in the XXI century. The Internet is now extensively used for commercial, personal, and educational purposes. One of the most popular tendencies in contemporary education is the development of either Internet based (online) or Internet enhanced or just computerized courses (Azad & Nadakuditi, 2006; Herskowitz & Kuleshov, 2004; Swearengen, Barnes, Coe, Reinhardt, & Subramanian, 2002). Various companies offer learning management systems, which provide integrated assessment tools. Among these are Blackboard, Web Course in a Box (WCB),

Web Course Tools (WebCT), CourseNet, ClassFronter, and many others. What is the difference between these learning–teaching environments, and which one should educators select? This is the first question that appears in front of the prospective instructor. One challenge to faculty who design and implement Web enhanced courses is the development of good teaching material in an online format (Hansson & van Heugten, 2006). Simply putting the same material that was used in an on-campus class on a Web site and expecting the online students to learn at the same level as their on-campus counterparts is not logical (Encheva & Tumin, 2006). A new style of learning requires a new pedagogy and alternative teaching tools to enable the learner to grasp material without the benefit of an instructor's lecture. This is the second point to be discussed here. One of the major limitations of Internet-based courses is their failure to deliver laboratory-related courses (Azad & Nadakuditi, 2006). First of all, the lab assignments should be reconsidered and most of them should be rewritten in order to allow the users access to the simulation of an experiment not using the actual lab device. This relates to the safety aspect of college/university lab usage (Standler, 2005), a subject not considered here. This simulation interface in turn should be available to download either from the Internet or a local server. Analysis of a number of attempts that have been made to provide students and instructors with practical exercises over the Internet is the third subject to be briefly discussed here. The next topic of interest is the development of science experiment simulations. With the availability of modern programming and prototyping tools, many useful simulations and Web-based applications have been added to the regular teaching techniques (Hill, Ray, Blair, & Carver, 2003). For example, there is a lot of physics simulation freeware available on the Internet. However, some chapters of the course are not supplied with appropriate simulation software. Some easy examples of simulation application are discussed. One more topic that deserves to be discussed is the availability of Internet tutorials and interactive tests. The article describes the set of ready to use simulation software that can be utilized for both the lesson illustrations and the virtual lab assignments. The interactive simulations allow students to explore a topic by comparing and contrasting different scenarios. Users may get a deeper exposure to the subject matter either by modifying parts of existing simulation or by building a new simulation from scratch. Another advantage for the users is the ability of simulation illustration to be paused and restarted for reflection and note taking. The last part of the article describes a set of originally developed computerized tests. They are applications of three hierarchical levels of difficulty which provide random access to the question data bank (Herskowitz, Khaitov, & Kuleshov, 2004; Kuleshov, 2006). These Web-compatible interactive tests might be used either as self-tests by online students or as local tests within a traditional class environment by on-campus students.

LEARNING MANAGEMENT SYSTEM

None of the three most popular e-learning environments (WebCT, Blackboard, and CourseNet) allow courses to be easily switched from traditional teaching style to the Web enhanced one. They are rather the frames containing more or less similar features to support either distance or Web enhanced education. Being most acquainted with the two last management systems, I will compare the Blackboard and CourseNet as two representing different tasks on which they are focused. Blackboard is a well structured and convenient tool for developing the course itself, whereas CourseNet is basically oriented on instructor–student communication including a semi-automated grading process. Three screen shots represent the hierarchical structure of the Blackboard management system branch which is related to the course itself. Course assignments scheduled