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The Future of Web-Based Instruction Systems

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Abstract
The technological and socio-economic changes currently taking place are changing the learning behaviors and expectations of learners. This has led to a growing demand for a flexible, adaptive, time and geographic independent learning environment. This paper reviews some of these changes and their potential impact on the future of Web Based Instruction Systems.

Keywords: Web-Based Instruction Systems, Computer Assisted Learning, Intelligent Tutoring Systems

Introduction
The origin of WBIS can be traced back to the early computer based training (CBT) systems. These systems ran on the mainframe architecture, and were entirely text based. An example is PLATO (Alexander, 1998). With the advent of the personal computer and graphical user interfaces like Windows, CBT systems that supported multimedia emerged. However, due to the constraints of the operating systems at that time, these systems ran on individual computers, demanding the installation of multiple copies in order to support multiple users. The number of installations was therefore small, making this type of software very expensive, and thus inaccessible to most potential learners.

As local area networks and later the Internet matured, systems that supported multiple users were developed. These computer-mediated instruction (CMI) systems ran on a network architecture, supported multimedia, and eventually hypermedia, and since multiple users were connected at the same time, collaboration among them became possible. It is at this point that the use of information technology to provide education became feasible.

With the emergence of the World-Wide-Web (WWW), it became possible to reach an even larger population of users over the Internet, and to support many more types of media. Hence the advent of early Web-Based Training Systems. These early web-based training (WBT) systems were then institutionalized by academic institutions to provide credential based education, hence the emergence of web-based instruction systems (WBIS) (Szabo & Montgomery, 1992; Laffey, Tupper, Musser, & Wedman, 1998; Alavi, Yoo, & Vogel, 1997).

Technological Trends
Information technologies evolve rather rapidly. Because WBIS heavily depend on information technologies, any advances in these technologies are expected to radically impact their quality, functionality and efficacy. Technological impacts on WBI can be analyzed from three perspectives: software, hardware, and networks.

Software
The recent years have seen the emergence of Lotus Notes, Microsoft Exchange, and Novell GroupWise as the leading group-ware packages (Chaffey, 1999). With the advent of the WWW, the firms responsible for these products have rapidly enhanced them into fully-fledged web products. The result has been the availability of powerful collaboration tools for use in WBIS.

Messaging tools have kept pace evolving rapidly to allow for application and hardware platform independent sharing of messages. The adaptation of universal mail and...
Messaging standards and the domain name system has provided a structured means by which content can be easily accessed on the web leading to an influx in the population of web users. Increasing usage of XML (extended markup language) will simplify the classification of documents through the use of tags that define both the display and the content properties. This will also make search and retrieval and overall document management much easier (Chaffey, 1999; McGormak et al, 1998).

Document management software including workflow systems, data base management systems, and electronic document management systems are maturing rapidly. These tools will provide for grater collaboration among the participants in an WBIS (Chaffey, 1999; Laudon & Laudon, 1998).

Push technologies are aimed at identifying content of interest to a user and making it accessible for the user. Intelligent agents go further to provide filtering services, automatic reply services, organization of content and provision of advice to the user with respect to the content. Advances in these technologies promise to increase the interactivity of WBIS. Combined with data mining and search and retrieval technologies, they allow the learner to source for high quality content from a wide cross section of sites external to the course and incorporate this content into the learning activities currently being undertaken on the WBIS (Williams et al, 1999; Hibbard, 1997; Laudon & Laudon, 1998).

Hardware
The overall cost of computing is dropping rapidly. This trend is expected to continue making it possible for anybody to afford the basic technology needed to access WBIS. With the technological improvements, the capacity and feature limitations inherent in current WBIS should be overcome. This will make developing a WBIS easier, since less effort will be expended worrying about the type of equipment at the client end (Williams et al, 1999; Laudon & Laudon, 1998).

Networks
With hardware being basically free, and software becoming more feature rich, more and more people will be able to access and thus use the Internet. This represents a growing potential market for WBIS. Additionally, the standards regulating the storage and transmission of multimedia on the Internet are beginning to mature. (Laudon & Laudon, 1998; Megginson, 1998). WBIS can now be developed using these standards and thereby reach any potential learner regardless of location, time of day, infrastructure and software.

The drastic rise in the population of people using the Internet and the volumes of data being exchanged is placing tremendous pressure on the Internet’s channel capacity. Sufficient bandwidth remains a major obstacle to the potential growth of WWW. This in turn limits the growth of WBIS. However, the bandwidth limitation will become a thing of the past once current high-speed networks such as Internet2 and Internet Next Generation are commissioned by the end of this millenium (Stallings, 1998).

The race between the increasing usage of the Internet on the one side and the increase in Internet bandwidth capacity on the other end will ultimately determine the rate of usage of WBIS.

Socio-Economic Trends
We are currently living in the Information age (Fulton, 1998). Several economic and social factors currently taking place will certainly influence the future of WBIS. Traditionally, education occurred in a linear way by starting at school, going to college, and obtaining the necessary skills for a livelong career. As the employees in their career realize the need for further training, they would return to school for graduate studies. As competition increased, corporations became less willing to release their employees for long periods of time to receive training. This lead to an influx in evening programs which allowed employees to work and go to school concurrently. However, they confined the employees to a particular location.

The transition from the industrial to the knowledge economy has revolutionized organizational structures and the work paradigm (Alavi et al, 1997; Guglielmino et al, 1997; Bernstein, 1998). The employee of today is expected to be more flexible, more mobile, and multi-cultural. This demands that the employee engages in continuous learning or frequent retraining in an environment that allows the employee access to instruction regardless of location and time of day. This new model of learning can not be satisfied via traditional methods like evening programs, hence the growing demand for web-based instruction.

The result of this development has lead to a new training paradigm: skill specific learning. Like many existing courses that teach a particular skill, employees want to learn only those skills necessary to be able to do their job. We will therefore have a large number of micro courses, each of them relying on a clearly defined set of prerequisite skills, and each of them teaching only one particular element (Schank, 1998).

This means that we will no longer have an Intro to MIS, but a micro unit on word processors, one on spreadsheets, one on databases, etc. An employee who wants to learn an advanced level micro course only has to learn that subset of micro courses that teach the knowledge required to learn the higher level course.
And here is the difference between a simple CBT/WBT system and a WBIS. The training systems teach the skills, but do not provide the learner with an accredited certificate for successfully completing the course.

Employers will want to see from new hirers some documentation of proof that they can do the job. Therefore, WBIS are needed that not only teach the material like CBT/WBT systems do, but also perform some form of quality control in form of practice and testing, ending with a quality seal in form of a certificate or grade. At the same time, a standard is needed that defines the content of these micro-courses and how a level of proficiency is to be demonstrated in them. This could be done by some controlling governmental organization, but most likely such a standard will be defined by the company that develops the first successful and widely used WBIS (Alavi et al, 1997; Guglielmino et al, 1997; Bernstein, 1998).

Conclusions

Current WBIS implementations are designed to support traditional methods of instruction. They automate testing, make lecture notes available to students, and provide messaging services to support team work. Advances in information and communication technology are contributing to the emergence of improved WBIS through the incorporation of new technologies such as push technology, intelligent agents, workflow and document management systems, search and retrieval and data mining. The maturing Internet standards will make it easier to incorporate interfacing technologies into a WBIS. Further, advances in networking technology eliminate access and data transfer limitations that impede present WBIS. Figure 1 illustrates the systems perspective of the next generation of WBIS.

References


Other references are available upon request from the first author.