Developing an Effective and Efficient eLearning Platform

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Abstract

The Web Based Training (WBT) or eLearning is emerging to replace traditional training. "eLearning", is rapidly becoming the preferred route to building and maintaining advanced performance capabilities via improved efficiencies and effectiveness. It transcends the normal classroom mentality in favor of a Web-based method of delivery that meets specific needs and is self-paced, extremely interactive, and measurable. eLearning offers a new way to think about workforce development. eLearning activities on offer range from simple tutorials in Flash or PowerPoint presentation to enterprise-wide learning portals that may offer pre-packaged and custom courseware, individual assessment and monitoring devices, directories of course offerings from different vendors, and support for virtual learning communities. Intranets and the Internet are a natural vehicle for supporting and delivering eLearning. The purpose of this paper is to research the problems with current eLearning platforms and recommend ways to improve the effectiveness and efficiency of eLearning platforms.

1. Introduction

Distance learning has been an alternative to face-to-face learning, in which instructors and students are physically separated by time, location, or both (Hodgins, 2000). As early as 100 years ago, instructional materials and student responses were delivered by the postal system, and by the late 1960s and early 1970s, significant changes resulted from development of new media technologies and delivery systems such as orbital satellite communication. Colleges and universities started to transmit educational program via satellite. In the late 1980s and the 1990s, numerous systems were launched with the primary purpose of delivering distance learning via one-way video and two-way audio communications – students at remote sites could see instructors located at a central site, but could address only through audio communication. There are, however, some disadvantages of distance education, such as lack of immediate feedback from instructors and lack of interaction. Since 1990, a dramatic shift to Internet-based learning has vastly expanded the world of open and distance learning, leading to what has been referred to as Electronic Learning (or eLearning).

2. eLearning

Innovative learning systems based on various electronic technologies have been around for many years, and numerous terms have been used in various learning contexts such as computer-mediated learning and, web-based training and most recently, eLearning. Computer-mediated learning is defined as the use of (personal) computers for education and training (*Price, 1991*). It has also been defined as any software system

that provides some form of user assistance in employing software guides, and tutorials (*Corrigan and Kennard, 1997*). eLearning is the most recently introduced term in this area (Bruckman, 2002).

With the increasing use of networked computers, the Internet, and advances in telecommunication technologies, eLearning has been widely recognized as a valuable tool for learning and training. eLearning, sometimes also called online learning, or web-based learning, is a type of distance learning in which training or educational material is delivered electronically to remote learners via the Internet or Intranet. An eLearning system provides a configurable infrastructure that integrates learning material, tools, and services into a single solution in order to quickly, effectively, and economically create and deliver training or educational content. It has become an important alternative to classroom learning.

Its role in the currently emerging revolution makes eLearning an inevitable element of doing business in the new economy. Companies in the United States spent $62.5 billion on training or educating their employees in 1999, with more than $3 billion spent on technology-delivered training (Khirallah, 2000). Effective and efficient training methods are generally required by companies to ensure that employees and channel partners are equipped with the latest information and advanced skill in a timely manner. It is a daunting task to maintain a well-educated and highly-performance workforce in today's global economy. Recognizing a promising solution, companies such as Dell Learning, Cisco eLearning, and HP Virtual Classroom are using eLearning to reduce training time and cost by expanding their training market to previously out of reach employees, (Wulf, 1996).

In academia, educational opportunities have been carried to many remote corners of the earth via the Internet. Much research has showed that students benefit from eLearning (Beam & Cameron, 1998; Burgstahler, 1997, Carswell, 1997; Hiltz & Wellman, 1997; Lang & Zhao, 2000; McCloskey, Antonucci, & Schug, 1998). Today, thanks to widespread access to the Internet, eLearning has emerged as one of the fastest-moving trends in higher education, enabling professionals to learn from afar and keep pace with technological and managerial change. Thousands of online courses, including degree and certificate programs, are now being offered worldwide by universities.

Innovative use of the Internet and hypermedia helps educators and trainers viable alternatives for eLearning. Not only can instructional materials such as syllabi, lecture notes, and assignments be made available on the Internet, but online collaboration and discussion can also occur. Knowledge stored on the Web can be given well-timed updating for the benefit of e-Learners, as is not possible with other knowledge delivery formats such as CD-ROM/DVD (Thomas, 2000).

eLearning can be either synchronous or asynchronous. Synchronous eLearning requires simultaneous participation of all learners and instructors at distributed locations. It refers to any learning event delivered in real-time to remote learners and includes immediate, two-way communication between participants. It can be considered scheduled delivery of learning and may take the form of multicasts, video conferencing, and virtual classrooms, etc. (Mehrotra, Hollister, & McGahey, 2001). Asynchronous eLearning does not require simultaneous participation of learners and instructors but refers to a situation in which a learning event does not take place in real-time. Therefore, asynchronous eLearning is "on-demand" delivery of learning, which gives learners more control over learning time, process, and content. Currently, the majority of eLearning systems are

asynchronous, since they are simpler to develop and implement and are less expensive than synchronous eLearning.

In contrast to traditional classroom learning, eLearning has several advantages for learners (Beam & Cameron, 1998; Burgstahler, 1997; Daugherty & Funke, 1998; Hiltz & Wellman, 1997). First, eLearning provides time and location flexibility. Second, in the long run, eLearning results in cost and time savings for educational institutions. Third, it fosters self-directed and self-paced learning by conducting learner-centered activities. Fourth, eLearning offers a collaborative learning environment by linking each learner with physically dispersed experts and peers. Fifth, it allows unlimited access to electronic learning materials. In addition, knowledge stored in a Web repository can be updated and maintained in a timely and efficient fashion.

While much of the literature emphasizes the potential value or benefits of eLearning, other studies have pointed out such drawbacks as frustration, anxiety, confusion, and reduced interest in subject matters (Hara & Kling, 2000). Improving eLearning effectiveness and making it more appealing to learners is a critical challenge. Researchers are now developing new multimedia technologies and research frameworks to make online learning more personal, more interactive, and more effective.

3. The Current eLearning Systems

More and more eLearning systems are available today, but many of them have limitations that hinder improvement of the effectiveness and societal potential of eLearning. Some of these problems are:

- **Text-based learning materials**
  Many eLearning systems present only text-based content (Burd 2000), which may seem boring to learners and cause them to disengage during online learning. Learners may be reluctant to read large volumes of text on screen. A multimedia-integrated systems allows learners to take advantage of multiple human senses and tap into their feelings and emotions.
- **Lack of rich content for good understanding**
  A number of eLearning systems lack adequate instructions for students. Some systems provide only PowerPoint slides, which may not ensure that learners understand the learning content. It is not uncommon for readers of slides to fail to understand what an instructor really means by all those bullet points.
- **Insufficient interactivity or flexibility**
  Unlike traditional classroom learning, in which students interact directly with instructors at the same time and location, an important issue is that studying online requires students to be more actively engaged. Many current eLearning systems are not quite interactive. Learners have little flexibility to adapt learning content and process to meet their individual needs. For example, it may not be possible to find exactly what is wanted or to skip a portion of content that is already known. Consequently, eLearning is less likely to hold learners (Hammond, 1995). In other cases, a student may want to ask a question and get an answer right away instead of sequentially going through an entire instructional video or other multimedia content to find an answer. So far, most multimedia-based eLearning systems do not provide this capability.
- **Unstructured and isolated multimedia instructions**
  In recent years, multimedia technology has advanced remarkably and has potential for influencing both processes and products of eLearning. However, many multimedia-based eLearning systems simply post content on the Web

without any processing. Postings are usually static, passive, and unstructured, without any indication of close associations among relevant materials in different media. For example, instructional videos and PowerPoint slides of the same lecture are presented separately. E-learners may even have to go to two different Web sites to view both of them.

4. Multimedia Based eLearning

The emergence of multimedia presentations using technology presents opportunities both for technological breakthroughs and for theoretical advances in online learning. Technically, we need to engineer a method of integrating multimedia content. While technology itself does not determine learning outcomes, technologies differ significantly with respect to the learning environments they foster. Theoretically, we need to understand how to control different factors in order to improve eLearning effectiveness. The literature records relatively little research on providing theoretical guidance for development of effective multimedia-based eLearning systems.

Multimedia technologies combine several communication media such as text, graphics, video, animation and sound. Simply defined, the term multimedia refers to a computer-based presentation that delivers information integrating two or more media (Beckman, 1996). Multimedia technologies such as audio/video encoding and decoding algorithms, compression and decompression techniques, computer representation of sound, sampling rate, MIDI devices, and WAV files are examples of promising multimedia technologies. For many learning tasks, multimedia methods are not only more appropriate, but also more efficient, and multimedia instructions frequently motivate learners more effectively (Megarry, 1998).

Multimedia content, transmitted over ever-increasing network bandwidth, has dramatic impact on both the processes and products of learning and provides a multi-sensory learning environment that can help maximize learners' ability to retain information (Syed, 2001). Multimedia courseware can entice learners to pay full attention to a task through vivid presentation that are more actively intriguing, and fascinating (Agius & Angelides, 1999; Weston & Barker, 2001).

Much research has shown multimedia instruction superior to traditional face-to-face instruction because it can enhance students' problem-solving skills, and motivate and authenticate the learning experience (Carville & Mitchell, 2000; Gross, 1998). Multimedia learning, along with massive storage requirements, raises research questions about data management (how to store and manage multimedia), how to synchronize real-time delivery of video and audio, and how to perform content-based retrieval of multimedia instructions.

Video is by far one of the most powerful and expressive non-texual media that captures and presents information (Hampapur & Jain, 1998). It is thought to have benefits that may offset its liabilities. Videos can convey more forms of information than a more meager medium such as text. It allows students to learn both verbally and visually, providing the means to view actual objects and realistic scenes, to see sequences in motion, and to listen to narration and other sounds (Wetzel, Radtke, & Stern, 1994). Exploration of video-based learning environments has indicated that videos can enhance the learning experience, and the students find video material very compelling (Kelsey, 2000). A number of studies have examined whether learning outcome is affected by the concurrent presentation of visual and verbal information in video. For example, Nugent (1982)

compared several components of video presentations and generally found better retention for stories presented via the combination of visual and auditory information than those presented via a single information source (video, audio, or text) only.

Interactive multimedia is defined as the use of a computer to present and combine text, graphics, audio, and video, with links and tools that let users navigate, interact, create and communicate (Hofstetter, 1995). Interactive multimedia permits learners to interact with it and be able to define and change the nature of verbal, numerical, visual, and audible display systems and therefore aims to offer more flexibility and increase learner engagement. Interactive multimedia technologies are having a dramatic impact on eLearning. It is appealing to combine lectures and dialogues with visual presentation, animation, and other multimedia effects.

Interactive video-based instruction reduces limitations associated with linear video communication by providing variable control over the learning process and the course of instruction and being actively responsive to learners' performances. Learner-content interaction is unavailable in the use of conventional analog videotapes and one-way broadcasts. Learning achievement comparisons favor interactive videotapes and one-way broadcasts. Learning achievement comparisons favor interactive video over linear video (Dalton & Hannafin, 1987; Phillips, Hannafin, & Tripp, 1988). The convergence of computing, knowledge management, and digital library technologies is standing by to produce an all-digital, interactive, and multimedia learning environment.

High interactivity of an eLearning system can enhance learner engagement. A study examined engagement in two types of multimedia training systems – a more passive medium (videotape) and a less passive medium (interactive software) (Chapman et al., 1999). The measures were a quiz and a questionnaire, which showed that learner engagement was stronger for interactive computer-based training than for the videotape based training.

A new trend in applying interactive video technology to learning is emerging. It integrates speech recognition, natural language processing, image processing, human computer interaction (HCT), and information retrieval techniques to create a new class of multimedia information access systems. The basic premise is that information or knowledge of experts can be represented in the form of instructional videos. For example, a French Chef can be videotaped while he is teaching how to make a delicious dish. These videos are segmented according to their content into small chunks called video clips, which are stored on a video-streaming server (the video repository). The appropriate video clips will be identified and retrieved from the video repository in response to learners' knowledge demands. The retrieved video clips will then be delivered to remote computers and played as if learners were interacting with the expert in real-time (Marinelli & Stevens, 1998; Wactlar, 2000). The Synthetic Interview technology developed at Camegie Mellon University allows people to chat with a virtual Albert Einstein over the Internet or to talk with doctors at a children's hospital. For a videotaped interview with a character, either a real person or an actor plays the role. A search engine within the Synthetic Interview system matches users' questions with the most appropriate video clip(s) (Marinelli & Stevens, 1998). For example, if a user were to ask the virtual Albert Einstein, "When did you come to America?" a video clip of Albert Einstein in which he talked about his immigration to America would be identified and delivered via the Internet and then start playing on the questioner's computer. In

order to reduce video transmission delay, video-streaming technology is often used to play a video file while it is downloading.

In recent years, a number of learning systems based on interactive instructional videos have been developed (Burke & Kass, 1995; Marinelli & Stevens, 1998; Pimentel, Ishiguro, Abowd, Kerimbaev, & Guzdial, 2001). Kearney and Treagust (2001) developed a system to use interactive digital video clips to present 16 real world demonstrations to physics students in order to elicit their pre-instructional concepts. Feedback from student questionnaires indicated that students perceived meaningful interactions taking place during their engagement with the program.

Unlike CD-ROMs/DVDs, multimedia material is not susceptible to environmental damage from dirt, heat, and magnetism, etc, and can be regularly updated or easily revised. In the past few years, video technology has been widely adopted to enhance learners' perception of live interaction with virtual instructors via the Internet. These systems vary in the way the multimedia content is organized and presented. Particularly, those systems can be classified into either synchronous or asynchronous.

5. Conclusion

The platform or learning Management System (LMS) is the core of any eLearning course ware. In order to enable the involvement of students in a more active learning style, more interaction between the LMS and the student is needed. The dialog can include both natural language and GUI actions and should have a natural language processing component built into the LMS system, which is used to interpret students' responses and generate follow-up dialogs. The use of animation and multimedia in various course wares could greatly enhance the learning capability of a student.

The organizations providing eLearning should consider the following points:

- What are the program objectives for the individual learners, training institutions, and sponsoring organizations?
- How will progress be measured, tracked, and reported?
- What learning content will be required for each learner, now and in the future?
- What support tools (labs, references, collaboration, etc.) will be required by the learners?
- How well are the various components integrated?
- How well does the platform (LMS) support a rigorous instructional design model? Does the platform allow full exploitation of the qualities of the content?
- How well does the platform manage professional development objectives including specified learning paths and bricks-and-mortar events?
- How well does the platform support administrative objectives?
- Is the platform secure?

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