Lifelong Learning and The Virtual Campus - A Proposal for Asynchronous Learning

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Abstract - Lifelong learning has traditionally been a challenge for highly specialized professions such as engineering, where the central core of knowledge tends to change continuously. Emerging technologies such as the Internet, multimedia-based training, computer-based videoconferencing and others will facilitate the access to critical, data rich information by professionals all over the world. Increasing demand for this kind of learning will pose new challenges for learning institutions that are not prepared to serve this potential audience. This paper describes the state-of-the-art in distance learning technologies and the implications for both students and learning institutions interested in creating the “virtual campuses” of the future.

Introduction
In today’s world of rapidly advancing technology, the technical knowledge taught to an average engineer has a useful life span of about four years. This, in all practicality, means that most engineers, in order to keep their knowledge as current as possible, would need to go back to school every four years just to keep up with the current state-of-the-art. In today’s hectic, “downsized” world, running on so-called “Internet time” (characterized as an ever-changing work environment where everything is just-in-time), most professionals cannot afford to spend large amounts of time getting retrained on the latest technologies.

On the other hand, these professionals need to find ways to remain up to date with the latest technologies that do not interfere with the demands and time constraints that are so commonplace in the work environment of the late nineties. Sprague (1993), considers training of engineers, especially in the field of electronics engineering, a critical success factor for the survival of the US electronics industry.

Advances in new, computer-based communication technologies may provide the solution to the above problem by creating “virtual” learning environments. These will enable professionals to use their computers as learning tools, connected to major learning centers to receive real-time information and training on a variety of subject matter at almost any location and at any time.

This essay will review the current state-of-the-art in distance learning technologies and will also explore the implications of incorporating these technologies into institutions of higher learning as well as suggesting first steps to prepare for what will be the viciously competitive world of on-line learning environments or “virtual” campuses. These virtual campuses will be the key to providing lifelong learning opportunities to professionals in many different fields. Learning institutions may find that they are able to offer all kinds of courses by means of these technologies to audiences that would not have previously attended regular “live” courses.

Synchronous Learning in an Asynchronous World
The decade of the nineteen-eighties and early nineteen-nineties in the United States was characterized by an economic climate that forced many corporations to lay off large numbers of employees in order to maintain their profitability at reasonable levels.

Workers remaining behind in many of these corporations were forced to “do more with less” as workloads increased and resources steadily decreased. Ever faster improvements in computer and communications technologies allowed many of these workers to do the work that was previously done by two or three employees. Examples of these technologies include the cellular phone (calls can be taken almost anywhere), alphanumeric paging technologies (important messages can be displayed on a small, pocket sized pager carried by the employee at all times), portable computers (allowing employees to carry their electronic computer files with them so they can work anywhere) and others.

The latest revolution in computer technology has been the explosion of the Internet, currently with close to 100 million subscribers. The Internet is fast becoming the largest worldwide repository of human knowledge, providing massive amounts of information on thousands of subjects while also allowing users to communicate via electronic mail or “e-mail” worldwide.

As a result of these technologies, the average professional today is more productive than ever before, thanks in part, to the fact that critical, job-related information can be obtained just about anywhere and at any time.

It is not unusual today to find many people accessing work-related computer files from their homes in the evenings and weekends, on airplanes and hotel rooms thanks to the relative ease with which this can be done with today’s technology.
What is then, the best way to reach these professionals with the latest training and development information and techniques? Do our traditional models of classroom training with a live instructor fit into the world of these busy professionals, always on the move and perpetually working?

The work environment of the average, globally connected professional today is characterized by events and work tasks that happen in parallel and simultaneously. Information comes and goes and is not worth much more than the few seconds that it appears on the computer screen and is often non-linear, i.e. Events and information that are seemingly disconnected are in fact closely related even though this is not immediately apparent. Also, much of the information exchanged between professionals is done asynchronously - e-mails are sent and answered at a later time, for example. Having to “be there” at the same time to do business is no longer necessary in a lot of cases. Contrast this with the traditional model of education that involves attending a live class with an instructor and where data is presented linearly. This kind of instructional event is commonly classified as “synchronous” i.e. the student and instructor must be in the same room at the same time on order for the instruction to occur. Seymour Papert (1993), distinguished MIT technologist, points out that in the last two decades, almost every field of human endeavor has been affected in some way by computer technology with the exception of schools, where computers are still used marginally and occasionally as teaching machines but rarely as work tools. He makes a call for educators and educational institutions to embrace computer technology as an integral part of students’ educational experience.

How can learning institutions that are steeped in the traditions of synchronous learning cater to the needs of these new professionals, living and working in an asynchronous world? The likely solution is for learning institutions to develop their own asynchronous learning and teaching models using the computer-based technology as the delivery mechanism of choice.

**Training Delivery - the Internet**

The Internet offers tremendous potential as a training delivery mechanism. The two most compelling reasons for the utilization the Internet and the World Wide Web (WWW) are the fact that:

1. It is widely used - over 100 million users worldwide and over 300 million published web pages.
2. Training materials can reside on one server, which makes version control easy. If the intended audience is widely dispersed, “mirror” servers can be deployed.

The main disadvantage of using the Internet as a training medium is the lack of widespread high data bandwidth connectivity. This situation currently prevents the use and deployment of rich multimedia content such as video and high resolution graphics and audio. There are many efforts currently under development to ease this bandwidth limitation and hopefully, in the next few years this will hopefully, no longer be a problem.

**CD-ROM Technology**

CD-ROM technology offers a compromise between a direct connection to the Internet and the stand-alone technology of CD-ROMs. Although CD-ROM technology can deliver media-rich file formats necessary for learning, it cannot be updated in real time as would be the case with Internet-based training. With every course material change, new CD-ROMs need to be made, making it difficult for students to keep up with the “latest” version of a particular subject matter. The positive side to CD-ROM technology, however, is its relatively low cost, currently at about 1 cent per megabyte of information. CD-ROM technology will eventually evolve into DVD-ROM technology, effectively increasing the storage capacity of a disc to over 4.5 gigabytes. DVD-ROM discs look exactly like a CD-ROM, however, because the frequency of the laser beam reading it is different from conventional CD-ROMs, a DVD drive is required.

**Hybrid Applications**

In order to have “the best of both worlds”, some software developers have created applications that use the Internet for retrieval of real-time data and a companion CD-ROM that stores the rich multimedia content such as videos, animations etc. This solution seems to work well but is seen as only an interim fix. The disadvantage to this technology is that the media on the CD cannot be easily updated and new CDs must be made and shipped to recipients if the media is updated.

**The Ideal Scenario - Broadband access to the Internet**

Broadband access to the Internet, understood as 512KB/Sec or higher, will bring rich multimedia to all Internet users. This kind of technology will allow users around the world to access vast visual databases of human knowledge 24 hours a day and will have serious repercussions for learning organizations that are able to offer their curricula on-line.

A typical learning scenario in this context is described below:

Student A - Enrolled in an “virtual” MBA program at University X is in her second year. She has a paper due on Creating Organizational Culture in about three weeks and is pondering ideas on where to begin. She dials up her high-speed Internet connection and logs into her virtual university Internet site. She then logs into the University’s video server and sees that Andy Grove, chairman of the board at Intel Corp. delivered a speech on “strategic inflection points” last week. She calls up the video and watches it on her PC. As the video plays in a quarter screen resolution, she also watches a simultaneous transcript of the speech in another window. As the speech moves on, she decides to stop and review a couple of key
points. She then copies and pastes from the transcript window into a draft document that’s open on her word processor. After she’s done viewing the video and transcript, she decides to send a few e-mails to some of her classmates to find out what ideas they’re toying with for their papers. It’s interesting to note that our student is located in Wisconsin and the three classmates she sends the e-mails to are located in Alaska, Arizona and Australia. Their physical location doesn’t really matter, they can chat over e-mail asynchronously or even synchronously by means of an interactive chat client. Our student decides to log onto the chat area of her course and finds there are five other students logged in and “chatting” precisely about the paper she’s been thinking about. She joins in the conversation and gets several good ideas from some of her classmates in the discussion. Finally, she logs into the virtual library, and downloads a few articles from on-line journals. Armed with a wealth of information, she begins writing the first draft of her paper. Later, she will share drafts of her paper with her classmates at the virtual campus. A few hours later, it’s time to dial into her lecture. She uses her computer to dial into a special Internet-based video conferencing session and waits for her professor to come on-line. The professor finally arrives and appears in a video window on her PC. Unfortunately, she hasn’t bought a PC video camera yet so her only way to interact with the professor is via e-mail. She promises to herself that she will buy the camera next week. Halfway through the lecture she gets paged with an urgent work-related problem. She disconnects from the lecture knowing that she’ll be able to access the lecture on the University’s video server tomorrow.

All of the technology described in this scenario is currently available. Widespread broadband access will enable the sharing of “rich” data such as audio, graphics and video to any place around the globe. This kind of data will provide opportunities that will closely parallel a real learning experience with the advantage of access at any time and at any place.

**Rethinking Media and Data for Learning**

Building the virtual campuses of the future will require the storage of massive amounts of digital data for student consumption. This digital data should encompass all types of media ranging from simple text documents to full motion video, audio and 3-dimensional animations and graphics. As these repositories of data grow, it will be of critical importance to organize them in a logical, easy-to-search manner, much like a virtual “library”.

Another issue to consider is the “capturing” of events for future use. Currently, most lectures and presentations at a College or university are rarely captured for subsequent use. Occasionally, a lecture or presentation is videotaped and placed in a library for future reference. In the virtual campus of the future, remote students will need to access digital media of many different kinds in order to feel connected. This means that the University media department will play an important and crucial role in the virtual campus of the future, capturing events and other media for subsequent uploading to the university’s servers and its “virtual” students.

**Examples from The Real World**

**Qualcomm** - This company, now known around the world for its world-class digital cellular technology, is delivering over 85 percent of its corporate training courses over the company’s intranet. Employees use their internet browser to simply go to the corporate training website and either download files for subsequent viewing or run web-based computer-based training (CBT) programs right from their desktop computer.

Qualcomm found that by implementing their training programs in this way, students felt pleased and comfortable with this mode of training delivery, giving Qualcomm one of the highest training satisfaction scores on the industry and also earning a coveted industry award in 1996.

Qualcomm does offer traditional, instructor-led classes, usually with external instructors. An interesting point to note is that the corporate training department has no dedicated instructors.

**Siemens** - This company began implementing their virtual university project in the last few months and the preliminary reaction from students has been overwhelmingly positive. By using a combination of web-delivered courses and also distance learning technology. This technology allows students to dial into a “virtual” class being hosted by an instructor on the phone using a personal computer to manipulate students’ computers remotely. An example of this would be an instructor the U.S. talking to students in London over the phone while, at the same time, showing slides on their PCs that he/she is manipulating.

Siemens’ initial data is very encouraging:
- Estimated saving to the company is over $800,000 in 6 months after implementation (mainly travel and housing costs)
- Students love attending virtual university classes - every class is full with wait lists
- There are preliminary estimates of 25% better knowledge/skills retention
- By not taking engineers out of the field, the company has saved billions of dollars

**Intel** - The Intel Corporation has not embraced the Virtual University concept yet. Over 80 percent of the company’s training courses are still taught using the traditional stand-up instructor approach. In early 1998, the company announced lower-than-expected earnings and this created an increased environment of cost-savings in the company. This new
environment has made it easier for training organizations to propose the virtual learning center concept. Intel’s College of Quality is one of the leaders in this area, providing on-line course materials and also Microsoft Netmeeting based distance learning classes in the near future.

Barriers and Challenges to Implementing Virtual Learning Centers
The biggest challenge to implementing the virtual campus concept, curiously, seems to be not so much the implementation of the appropriate technology (which will inevitably come) but changing the culture of the people, both instructors and students using these new learning methodologies. A multi-company group who visited Siemens recently came up with the following key problem areas:

- How to instill a culture of web-based training in both learners and trainers,
- Instructor-led class can not translate to web class without some rework.
- Human factors such as manager driven interventions when someone is attending a class at their desk.

When an instructor stands up in a classroom, lectures with transparencies and students follow along in their books, we are essentially using teaching technologies that are over one hundred years old. Learners and instructors feel comfortable in this environment and it will take a lot of work to change the mental models people have of what a “learning event” really is.

Recommendations for Learning Institutions
If a learning institution is serious about participating in the virtual learning environments of the not-so-distant future, here are some recommendations in order to get started:

- Invest in technology infrastructure - Start purchasing the computer servers that will drive the virtual campus of the future. Be sure that these servers are expandable, fast, and capable of storing large amounts of information.

- Make sure that all the data that the institution is producing is being captured digitally - If documents are being typed, make sure electronic copies are being placed in some central repository. If a key presenter is delivering an important lecture, make sure it gets captured on video for subsequent digitizing and transcribing.

- Put licensing agreements in place with your key contributors - As lecturers and other professionals in the content generating business begin to realize the potential value of their information, licensing of content will definitely become an issue. Begin working with these professionals now to secure the rights to this content for future dissemination to virtual students. Many of these “content generators” may not have envisioned that a lecture could be captured and used later as a digital file and will consequently have no idea on what an appropriate license would look like for this kind of work. Work with a legal expert on these matters to assure the best possible arrangement for all parties.

- Invest in technology training for your faculty - Writing HTML code for the World Wide Web (WWW) is the equivalent of word processing and your faculty should be well versed in these skills. Eventually, many research papers and other documents will never make it to a word processor, they will, instead, be typed directly for the WWW and on-screen viewing. The hypertext (being able to “jump” from one place in a document to another or even to another document) capability of the WWW documents will spawn whole new ways of writing. Writing will be “for the web”. Referencing systems for web-based documents will also have to be invented.

- Communicate with your virtual students often - There will be many options out there for virtual study and many students will be enticed to move to other learning institutions for their convenient on-line capabilities. The best solution to what will surely be vicious competition for these students will be to constantly communicate with them to find out what their needs are and what features they’re looking for in the services you provide. This will be the key to ongoing student loyalty and success.

- Partner with companies and corporations as much as possible - Many of the virtual students coming for graduate degrees will be working adults sponsored by their employer. Partner closely with these companies to discover the needs they may have now and in the future and offer programs tailored for their employees that will help them advance.

Summary
In the very brief span of about three years, the Internet and the World Wide Web have dramatically changed the way we communicate, do business and obtain our news. As broadband access to the Internet becomes more widely available, other areas will also be affected, including education.

The concept of having to attend a live lecture with an instructor will change as more and more asynchronous content delivery technologies begin to appear in educational institutions around the world. These technologies will greatly appeal to the young, time-starved professional of the nineties both because they will utilize technology that is familiar to this group as well as provide an opportunity to work asynchronously.

Learning institutions that cater to these students will find a willing and motivated audience, willing to actively participate in these types of distance learning programs.
These virtual campuses will also provide an opportunity for all professionals to keep their skills up-to-date with the latest trends and technologies in a convenient, cost-effective manner.

**Bibliography:**