2000

What is the significance of online technology as a training tool

Thomas Clifton Peterson

What is the significance of online technology as a training tool

Abstract

This paper examines the current directions and future trends of using online sources and activities as a tool for learning. It concentrates on the developmental progress of the most powerful force shaping the evolution of this technology: the Internet. As we enter the 21st Century, online training is becoming the dominant educational technology. The Internet has succeeded in removing the time and space barriers to online multimedia instruction.

WHAT IS THE SIGNIFICANCE OF ONLINE TECHNOLOGY AS A TRAINING TOOL

A Graduate Literature Review

Submitted to the

Division of Educational Technology

Department of Curriculum and Instruction

in Partial Fulfillment

of the Requirements for the Degree

Master of Arts

UNIVERSITY OF NORTHERN IOWA

by

Thomas Clifton Peterson

May 6, 2000

This Literature Review by: Thomas Clifton Peterson

Titled: What is the Significance of Online Technology as a Training Tool

Has been approved as meeting the research requirement for the Degree of Master of Arts.

May 5, 2000
Date Approved

Sharon E. Smaldino
Graduate Faculty Reader

5/5/2000
Date Approved

Terri McDonald
Graduate Faculty Reader

5/5/00
Date Approved

Rick Traw
Head, Department of Curriculum and Instruction

Abstract

This paper examines the current directions and future trends of using online sources and activities as a tool for learning. It concentrates on the developmental progress of the most powerful force shaping the evolution of this technology: the Internet.

The computer is rapidly changing our culture. The ability of computers to be linked together has enabled us to access an infinite amount of information sources. "Going online" describes tapping into this information stream. Although the systems that support these sources may vary, they are becoming increasingly homogenized to work together.

As we enter the 21st Century, the ability of digital mediums to deliver graphic and sound images is changing all aspects of our society. Online training is becoming the dominant educational technology. The latest support system for delivering online technology, the Internet, has succeeded in removing the time and space barriers to online multimedia instruction. Increasingly apparent is the belief that the evolution of the Internet will greatly affect the growth of future online technology.

TABLE OF CONTENTS

CHAPTER I

INTRODUCTION

Background

Online technology is becoming increasingly popular for those involved in the training process. There are many reasons for this. Commercial interests are shouting in the marketplace to join with them in this "online" movement. Moreover, the equipment and programs associated with this new technology are rapidly evolving. Advances in technology are blurring the distinctions between previously separate categories of online learning. Internet-based training, interactive learning, and intranet-based training, while different in functional details, are beginning to converge around some common technical standards. The driving force behind these changes is the magnetic-like pull of the most influential infrastructure of online delivery: the Internet. Going online to access information is a popular activity for many. However pervasive the activity becomes, there is still some confusion from people who wish to use the computer as a training tool. Those involved in the training process, whether in education or business, want to know where online learning is headed. Many are responsible for equipment decisions. They have heard that acquiring the expertise and hardware required to go online requires a costly investment

in time and money. This paper will help them to become acquainted with the status quo of online technology.

Purpose

The purpose of this study is to examine the use of online technology in the teaching environment.

Significance

Among the recent developments in educational and training technology is the growing use of multi-media training via online technology. The online learning tool represents a quantum leap beyond conventional textbooks, training manuals, tapes, and videos by incorporating computer-generated sound and video into an interactive learning experience. Online learning technologies deliver learning to audiences at disparate locations. They have begun to converge around common technology standards and the delivery infrastructure currently called the Internet. Educational institutions from primary schools to universities are also establishing intranet systems with a wide range of instructional, tutoring and training applications. Delivered through personal computers in classrooms, workstations and school computer labs, Online-Based Training (OBT) greatly extends curriculum resources and training tools of the lone instructor. To understand how the digital revolution in training technology has come

about, the origins of the Internet and the costs and benefits of online technology today will be reviewed.

Research Question

What is the significance of online technology as a learning tool?

Definition of Terms

1. Intranet: This is an Internet system usually operating under more security with a limited customer base.
2. Extranet: A network of intranets.
3. Infotainment: A video program primarily designed to inform in a manner that is more entertaining than educational.
4. Infomercial: An extended television commercial designed primarily to sell a product.
5. Hyperlinks: Words that connect data fields in an Internet document.
6. HyperText Markup Language: The language in which World Wide Web (WWW) documents are written.
7. HyperText Transfer Protocol: The program language that ensures compatibility before transferring information within the Internet.
8. Universal Resource Locator (URL): An address that identifies a server on the network and a particular document on the server.

9. Web browser: Software, such as Microsoft Internet Explorer and Netscape Navigator, used to search the World Wide Web and to access multimedia information on the Internet.
10. World Wide Web: A series of communication protocols between client and server, riding on top of the Internet in the same way an application like PowerPoint is supported with an operating system like Microsoft Windows.

Organization of the Literature Review Remainder

This literature review examines the potential of online technology as a teaching aid. Chapter II summarizes the methodology. Chapter III is a discussion on the literature related to historical developments, evaluation, issues, and changes in the field of online technology. Chapter IV offers a conclusion.

CHAPTER II

METHODOLOGY

The method of identifying and locating sources pertaining to the subject occurred over time as a graduate student of Educational Technology in the Curriculum & Instruction Department at the University of Northern Iowa. During that time, various aspects of online learning were discussed and experienced. Sources for the paper were selected to provide a basis of understanding and answering the needs of a specific audience: those interested in online learning as a teaching tool. An assumption is made that some of this group could be computer illiterate. Beyond the basics, sources were selected on their ability to provide an accurate and timely description of the current and future usage of online learning. Articles were also chosen for their perceived ability to help potential users of online technology understand mechanical aspects of being online.

CHAPTER III

REVIEW OF LITERATURE

Background and Development of the Technology

Before 1980, computers were rare in American schools and colleges. When the first 64k Apple IIs and IBM PCs were introduced in K-12 schools around 1981-2, the national pupil-to-computer ratio was around 750 to 1. By 1987, the ratio was approximately 30 to 1 (Sobol & Sobol, 1987). Ten years later, there were less than ten students for every computer in a classroom or computer lab. In more advanced areas, second and third graders are already working with powerful PCs and Macs. They are going online to search the Internet and digging up facts and figures on everything. Topics range from the destruction of the Brazilian rain forest to the population of the People's Republic of China.

For many years, tradition-bound educators had regarded electronic media and computers as the nemesis of the three R's in K-12 education. Through the 1950s and 1960s, the very idea of television invading the classroom was disturbing to most teachers and parents. Most skeptics and traditionalists decried educational television as an electronic baby-sitter. Proposals by commercial producers to sponsor educational

broadcasts with even a limited amount of advertising, were quickly dismissed (Kay, 1990).

With the advent of the personal computer and the Internet, however, those early preconceptions and prejudices against electronic instruction are largely a thing of the past; American classrooms are moving quickly toward online technology. Today, the barriers between public and private educational resources are falling fast. Private corporate sponsorship and participation are no longer very controversial. Public schools hold community fundraisers to buy new computer equipment; private corporations offer matching grants to school districts to help them meet basic funding goals for new technology. Private companies, government agencies, and public school systems alike maintain resource centers and websites. A wide variety of educational materials are made available at little or no cost. Television terms like "infotainment" and "infomercial" do not really apply to the Internet, where entertainment, data, and education have merged and transformed the learning process.

The Internet as a Training Tool

The Internet has been described by Heath (1996) as a "global information system instantly accessible to anyone with a telephone line, modem, and personal computer" (p.24).

The Internet is the first truly global computer training system. Users are connected to thousands of networks, file servers, and databases in a vast hierarchy of telecommunications links. The original Advanced Research Projects Agency network (ARPAnet) was set up by the U.S. Defense Department to support the military in the 1960s. The chief purpose of this network was to connect various radio, satellite, and navigational networks within a single system that could exchange strategic information. In particular, this network was designed to support research that could withstand power outages and still function (Krol & Ferguson, 1995). There was great alarm in the Free World over the launch of the Sputnik rocket by the Soviet Union in 1957. Sputnik was the first artificial earth satellite launch. The people of the United States did not like the Soviet Union being first and decided educational reform was needed to catch up. School curriculum became a matter of national defense. Soon the computer became a powerful communications tool. The zeroes and ones of the computer replaced the dots and dashes of the telegraph. With mass production of personal computers around 1975, pressure began to mount for computer instruction in the classroom. The launch of Sputnik and the personal computer were seminal events signaling the

dawn of a new era in education technology (Muffoletto & Knupfer, 1993).

The Internet first developed in the early 1970s out of the U.S. military defense network (Krol & Ferguson, 1995). This peer-to-peer distributed network soon expanded to include the Defense Data Network, a non-secure system running many smaller networks like MILNET that carried less strategic Internet information. These systems were operated by the Department of Defense National Information Center, which coordinated Internet activities and eventually connected university research centers. This established the first education and training mode of the Internet. One of the networks was run by the National Science Foundation, also an agency of the federal government. The NSF set up five supercomputer centers in the latter part of the 1980s. Prior to this time, only the military and a limited number of large corporations were able to use these powerful computers. Now the fastest computers were available to access for scholarly research purposes.

The World Wide Web (WWW)is a graphical interface environment that rides on top of the Internet. This was a later development that grew out of a communications project by Tim Berners-Lee at CERN, the European particle physics laboratory in Switzerland (Maney, 1999). The Internet

specifications developed at CERN were based on a simple object-based data linking language called Hypertext, which connects data fields by Hyperlinks. A set of public specifications and libraries of code are used to connect individual sites and networks.

Currently, the Internet describes a series of service layers consisting of software over hardware links (Krol & Ferguson, 1995). Although composed primarily of telephone lines, the Internet does not operate like a circuit-switched network. When you make a telephone call, a piece of the phone system is assigned to you and made unavailable to others. The Internet is a packet-switched network analogous to the U.S. Postal Service. The information, composed of data bit assemblies, is labeled at the sending end, delivered through a pipeline with other messages, and reassembled at the delivery end. The pipeline is composed of a set of computers, called routers, that make decisions how to route the data bit assemblies, called packets. Packets range in size from one to 1500 characters. The rules governing router decisions are called protocols. The Internet Protocol (IP) works like an envelope to deliver messages. Within this envelope is another set of rules called Transmission Control Protocol (TCP). Large messages are broken into numbered pieces. If some pieces are missing

at the receiving end, the TCP asks the sender to re-transmit them. The pieces are then re-assembled in the proper order for use in a specified application. The three most important protocols are known as Uniform Resource Locator (URL); HyperText Markup Language (HTML); and HyperText Transfer Protocol (HTTP). Krol and Ferguson (1995) described how they interact with each other:

> A URL is an address that identifies a server on the network and a particular document on the server. . . . indicates which type of service(or protocol) a Web browser must use to retrieve the information. (p. 161)

Global Network Navigator (GNN) is the title of a popular website of hypertext presentations published by America Online. Krol and Ferguson (1995) continue:

> For instance, take a look at the URL for the GNN home page: http://gnn.com/gnn/GNNhome.html
>
> The document that a Web browser retrieves with this URL is an HTML file named GNNhome.html. That file is found on a server named gnn.com, in the directory /gnn. The browser retrieves . . . using the HyperText Transfer Protocol (HTTP).
>
> The HTTP service is different from the HTML file format. The HTTP service name tells the

> browser how to transfer the file. . . . tells the browser to contact a Web server. The HTML file type tells the browser how to interpret the file. (p. 162)

These Internet Protocols are universal standards that support a reliable, multi-platform global computer network. These rules govern an environment enabling business trainers and academic teachers to interact with learners across previously insurmountable boundaries.

In the early 1990s, an additional piece was added to Tim Berners-Lee's invention. That came from Marc Andreessen, who led the way in the development and deployment of the Web browser (Maney, 1999). Later, other computer networks wanted access to the extensive government resources and joined in. By 1995, the Internet was a connected collection of many networks and increasingly influential. Technologies such as the PC and phone lines were in place to make the Internet accessible almost anywhere. Advanced societies accepted that they had entered the Information Age—an era when information and knowledge would be among the most valuable resources.

As a world-changing invention, the Internet is similar to the printing press. Both technologies enabled a dramatic drop in the cost of creating, sending, and storing

information. While originally conceived as a military tool and academic university-level resource, the Internet today is accessed in thousands of classrooms around the world. The education potential of the Internet is enormous for school children and professionals of all callings (Frost, 1996). The Internet is changing the way organizations handle and store information. The American Medical Association, for example, has set up an on-line database of more than one million physicians for referrals and consultation worldwide. Other professional groups are quickly following suit. The Internet breaks information monopolies. For example, much of this medical information on the Web, previously available only to doctors, exists in an open environment of the Web. With a strength greater than any previous medium, the Internet can send information more cheaply, easily, and in greater volume.

Modes and Levels of Computerized Instruction

While the popular business and entertainment applications of computers and the Internet are fairly obvious, there are many different modes and levels of instruction and training for more serious educational applications. According to Kruse (1997b), there are five basic levels of online-based training that exist today:

1) General Communication (e-mail, publication)

2) On-line Reference (encyclopedias, databases)

3) Research Gathering (testing, assessment, surveying)

4) Distribution of Computer-based Training

5) Delivery of Multimedia Materials (p. 66)

Each of these modes and levels has inherent advantages and disadvantages from the standpoint of the academic instructor or business trainer. Digital databases and training materials can be built up and operated at a relatively low cost. These media materials are quickly and easily updated. Delivery formats can be revised to keep current with changes in the state of information technology. The instruction programs are highly adaptable to the individual needs and limitations of the learner or trainee.

Technical advancements are creating broad variations in the amount of user interface and interactivity within system types (Barron, 1999). The variety of ways that organizations can use the Internet is dramatic. One business choice is to download courseware from a centralized server to a learner's desktop. An optional electronic bulletin board can display their questions and receive answers. A second choice features two-way audio in an instructor-led format with digital document sharing by hundreds of learners. A third choice is assembling learners in a specially-equipped classroom of workstations with access to broadband

transmissions. Such connections are digital pipelines enabling simultaneous audio and video data delivery. Since cost goes up with the level of interactivity, determining the transmission requirement is a major decision. At the low end is the bulletin board where learners can post questions. In the middle is the virtual chat-room where learners and instructors share ideas. All fall short of the interactivity provided by the traditional classroom, except at the broadband end. Here resides the virtual classroom linking instructor and learners in synchronous audio or live video. For example, the instructor can display content over the PCs, while using TV cameras and microphones to conduct the learners in a classroom format. Desktop systems from companies such as One Touch Systems, Centra Software, Lotus LearningSpace and ILINC compete in this growing market. One Touch has begun offering an Internet-based online learning system with two-way audio-video capabilities. Centra and Lotus, pioneers in document-sharing technologies, have systems that feature two-way audio and software-based instructor controls. ILINC offers a similar product with an option for two-way video.

When an organization privatizes a portion of the Internet to service indigenous needs, the network is referred to as an intranet. Usually, these are dedicated to

delivering programs that have been developed for a special group. A company can connect their established databases with the working papers necessary for daily business routines. Operations speed up because data updates become instantaneous. This intranet operations support technology method is called an Electronic Performance Support System (EPSS). Computers are used to collect, store, and distribute information throughout an organization. These systems allow employees to reach their highest performance potential in the fastest way, with the least amount of staff support (Marquardt, 1996).

Intranets can also support the delivery of (CD-ROM)-based training. Individual and group training now employ audio, animation, colorful graphics, and interactive video. As the power of the computer increases, the ability to create a more realistic artificial environment, called virtual reality, is enhanced. Trainees can now handle and view objects in cyberspace in a way that would be impractical, or impossible, in real life (Marquardt, 1996).

Interactive distance learning can bridge the separations between people in space and time. Developments in this area are happening quickly. For example: Stentor, an alliance of Canadian telephone companies, has recently announced an $8 billion, 10-year initiative called BEACON.

Their goal is to bring broadband, multimedia services to 90 percent of all homes and businesses in Canada by 2004. Coupled with supporting technologies of fax, phone, and the WWW, distance learning is a more accessible, wider reaching, and less expensive option than classroom instruction.

Multinational distribution of training materials to remote learners is an obvious benefit for increasingly global institutions. For business corporations with facilities and partners all around the world, the cost to deliver paperwork can become sizeable. For example, Schlumberger, a multinational corporation based in France, distributes pre-training materials to employees in over 67 countries before their visit to one of 15 regional training facilities. The system allows them to track the number of employee training website visits ("hits"), the courses they choose to access, and the amount of time spent there (Barron, 1999).

Bill Gates envisions a positive future in education for the computer (Gates, Myhrvold, & Rinearson, 1996). He believes there are many ways in which the computer will enhance the student's ability to learn as well as the teacher's ability to teach. The computer will bring the best work of countless teachers and authors to the interactive exploration of students. He says the computer will help to

distribute education into areas where the lack of financial and community support has been confining.

Emphasis on delivering training through online technology is increasing in the business community as a result of recent developments (Bassi, Cheney, & Lewis, 1998). Growth in four specific areas is reshaping the future. Of paramount importance in first place, Internet growth has surpassed all projections in the last few years. In second place is Intelligent Tutoring Systems (ITS) technology. Dorothy Park Woolf (cited in Bassi, Cheney, & Lewis, 1998) has identified the attributes of ITS programs. She identifies them as:

> Generative. The capability to generate appropriate instructional interactions at run time, based on learners' performance.
>
> Mixed-initiative. The capability to initiate interactions with a learner as well as to interpret and respond usefully to learner-initiated interactions. Natural language dialogue is sometimes a focus of this feature.
>
> Interactive. The provision of appropriately contextualized, domain-relevant, and engaging learning activities.

> Student modeling. The capability to assess the current state of a learner's knowledge and the implied capability to do something instructionally useful based on that assessment.
>
> Expert modeling. The capability to model expert performance and the implied capability to do something instructionally useful based on the assessment.
>
> Instructional modeling. The capability to make pedagogical inferences and decisions based on the changing state of the student model, prescriptions of an expert model, or both.
>
> Self-improving. The capability to monitor, evaluate, and improve its own teaching performance as a function of experience. (p. 67)

The third place technology, object-based learning, is similar to object-oriented programming (Bassi, Cheney, & Lewis, 1998). Information is organized, delivered, and stored using independent, reusable, software objects. These bite-sized components are called learning objects and can be used in different combinations with each other, as well as with other learning technologies, to satisfy a particular learning need. At a later date, they can be rearranged for another training purpose. In fourth place, voice recognition

technology is freeing the user's hands from the keyboard, enabling a higher level of interactivity. For example, a system employing voice recognition and synthesized speech capabilities can tutor students in a foreign language.

Christine Good of Motorola describes the four steps towards creating a global training plan she envisions (cited in Bassi, Cheney, & Lewis, 1998). First comes the network infrastructure on which to build the system. Second is an object-oriented database that will store a library of leaning objects for everything from technical to management training courses. Third is a design template to create online learning using objects stored in the database. Fourth are the refinement of an end-user interface and the development of an end-user's profile. Both will aid in matching needs with content.

Five training trends of today indicate what may be in store for the future. According to John Ball (cited in Hall, 1996), director of engineering, Convergent Media Systems, Atlanta, they are:

> Desktop training. Off-the shelf or custom interactive training materials delivered to a training room or the desktop without compact disks.

Desktop video and conference systems. Simultaneous video, audio, and data received at the desktop in real time.

Personal communication devices. PDAs will provide a wireless connection to an employee's office for retrieval of information that can be displayed in real time on a laptop.

High-definition television (HDTV). Improvements in picture quality will make HDTV popular as a training medium. HDTV is particularly useful in architecture and design firms for project reviews and in the medical profession for remote participation in MRI and CT scan diagnostics.

Virtual reality. In the near future, virtual reality will become practical for live, remote interactive training simulations. (p. 55)

Benefits of Online-Based Training

The new technology of interactive multimedia has the ability to improve educational outcomes (Troxclair, Stephens, Bennett, & Karnes, 1996). At a time when school budgets are strapped and teacher-pupil ratios are too high, the computer workstation of the modern classroom provides a working partner for the teacher, beginning at the elementary

level. Today's multimedia Internet stations are sophisticated teaching tools providing open and independent learning. Their engaging formats provide a variety of interactive responses, reinforcing standard instructional methods.

The multimedia activities reflect the criteria for differentiated learning experiences. There are opportunities to develop flexibility, diversity, and decision making skills. Students are provided instruction on the basic skills necessary to operate the computers and work with the programs. Few limitations are imposed (Clark, 1992). Among the advantages of multimedia training is the capacity to address a wide range of learning styles simultaneously. According to one of the most widely accepted learning-style models, we can classify people according to their preference for kinesthetic, auditory, or visual approaches to learning. People tend to favor one of their five senses when engaged in a learning experience: a visual person learns information best by using their eyes; an auditory person by using their ears; and a kinesthetic person by using their sense of touch (Cohen & Rustad, 1998).

The multimedia revolution in the classroom does not eliminate the need for regular classroom instruction nor the need for parental involvement with the child (Kay, 1990). In

most cases, the new technology offers traditional information resources and instructional methods in an exciting new Internet format (Negroponte, 1995). Public school students can open up their classroom encyclopedia on-line, using for example Microsoft's excellent Encarta program. Kindergartners who began with simple programs like Reader Rabbit ten years ago have by now graduated to a more sophisticated multimedia platform. Virtual visits to a major museum or a distant planet are equally possible. Perhaps most exciting is the growing use of the Internet as a direct communication tool, enabling students and whole classrooms to e-mail, chat and exchange educational experiences online. Morgan (1993) asserts that educators of the gifted need to develop technical literacy and proficiency in order for their students to become effective leaders of the 21st century.

Meanwhile, a fierce debate continues about the growing gap between the classroom computer "haves" and "have-nots", with the disparity being measured in PCs and Internet links per pupil (Gates, Myhrvold, & Rinearson, 1995). The most troubling discrepancy is between the number and quality of classroom computers available to public schools in poor districts, and the abundance of new computer technology available to pupils in wealthier districts and in private

schools. Parents investigating new schools for their children ask anxiously about how much computer time their children will get. Their concern is justified. High school graduates are now expected to be computer literate just to qualify for most entry-level job positions. College application forms are asking now about a prospective student's computer skills and programs. In five more years, private schools may be providing all of their students personal computers, programming classes, and on-line services. This practice has already been adopted at some of the more expensive private universities. Recently, a school district in Texas passed a resolution to provide a computer for every student. The district does not buy any textbooks now.

What does all this mean for the K-12 schools of today? The classroom has changed in the use of electronic media (Postman, 1985). The slow pace and uninspired content of the slide show and 16 millimeter projector film are giving way to newer forms of video. Since the end of the 1970s, technological revolutions, in cinematic special effects and theater sound, have made the idea of traditional televised classroom instruction outdated. Today's students are a sophisticated new generation of media-savvy video devotees accustomed to sophisticated visual effects. For children

raised on shows like Nova, tolerating the mediocrity of taped lectures and rote drills is difficult.

The computer has the ability to marry graphics and text in an effective learning medium. If the technology of the past had something to do with the separation of pictures from text in the past, then the technology of the future will certainly have the power to reverse the trend. The evolution of the medium will be profoundly affected. This prophecy is the idea of comic-book philosopher Scott McCloud (1999):

> My whole career has been on flat, dead, wood. I grew up in a world where print had no rival for the delivery of words and pictures. But words and pictures are information. . . . and when information must exist as objects it can be too easily suppressed, withheld, controlled. . . . The day art breaks away, even the most dedicated Luddite may find reason to rejoice. (p. 1)

Online-Based Learning vs. The Classroom

The digital revolution is changing modern life (David & Meyer, 1998). The worlds of work and learning are rapidly changing as a direct result. New jobs are being created and old jobs are disappearing. The acceleration of change is affecting individuals as well as companies. Much like

looking at the landscape going by in a fast car, things that were once clearly identifiable are becoming a blur.

Three major forces are changing the conditions affecting economics. First, online technology is blurring time and space boundaries between people. Second, the speed of business change makes situations appear blurry and difficult to keep in focus. Lastly, there is the blur of intangible value as the future arrives at such a pace that physical capital becomes outdated and more of a liability rather than an asset. For example, there is the blur between products and services. Products take on a service element and services take on a product element. When this happens there is a blurring between buyers and sellers in the exchanges of information and money.

The emerging technologies are blurring the line between work and learning (David & Meyer, 1998). The two will happen together increasingly. This will occur most profitably in organizations that focus on making this interchange happen. For example, to enable learning in environments where information is always changing, there are electronic performance support systems (EPSS). These are ideal for knowledge workers who routinely make complex decisions on the job while using computer applications. The support is built directly into the application. The best of these EPSS

systems can detect mistakes as they happen and offer immediate feedback. The line between what is learning and what is work becomes blurred (Caudron, 1996). This will require the teachers to also retool. Although classroom training will continue to exist, online training will be present as an enhancement and in some situations as a replacement. Teachers are encouraged to embrace the new technologies and develop the literacy and skills required for their application (Bassi, Cheney, & Lewis, 1998).

Despite the growing sophistication of online technology as a training tool, there are many who have reservations. Despite their research showing that tele-training is at least as effective as classroom training, the federal government says there is no substitute for face-to-face, hands-on interaction (Hunter, 1995). Tele-training is not recommended for hard skills, like machinery operation, unless a local instructor is available. Conversely, an online presentation works well for training in soft skills like leadership training. A facilitator is helpful, but not necessary. For another perspective, Jim Botkin (cited in Caudron, 1996), president of Learning Association in Cambridge, says:

> When you look at the overall future of learning in business, technology plays an important but minor role

> . . . because the single most important element in a 21st century networked organization is trust, and I have not yet seen technologies that promote trust. (p. 34)

There are some who consider online learning inferior to traditional learning experiences. Without the traditional teacher interface, the content can suffer. There is no corresponding filter online that considers the quality of the information presented, no longer a lower limit for filtering out triviality. The Internet gives permanence to new levels of information that would never have found their place in traditional media. Millions of people now post their own Web pages, detailing the minutia of their lives (Maney, 1999). Amazon.com publishes book reviews by individuals, not just professional reviewers, capturing what the masses think.

As a source of information for students, educators have concerns about the Internet. Since there is no governing agency controlling content on the Web, much of the material is age-inappropriate. Also, since all of the information on the web is in a digital mode, downloading copyrighted material for use in original work is a temptation. Administratively, providing access to the Internet is a costly proposition, requiring sophisticated electronics and

people with enough technical skills to keep a computer network supported (Heinich, Molenda, Russell, & Smaldino, 1999).

Most noted among the precautionary voices is Clifford Stoll (1997). He argues that computers offer plenty of data, but not wisdom. He says they work against literacy and creativity. He proposes that the fast and cheap attributes of the Internet tend to promote lethargic scholars and worthless information. He believes that nothing of value is fast and cheap. For his second point, he says that people who surf the Internet would be better off having real-life experiences with people and nature. He asks where the richness and texture of life is in a glass tube: the phosphorus glow of a computer screen. Third, he feels that the overuse of computers and online networks is undermining social relationships, including those in libraries and schools. He questions the wisdom in placing a computer on every desk, thereby advocating solitary learning and implying that the computer is the only tool they will need. Stoll reflects on his own change of heart (1995):

> I began this mediation with a perplexed ambivalence toward computers, networks, and the culture that enshrines them. At first, I wanted to think about technical issues. But I found myself returning to the

same themes: real life and authentic experience mean much more than anything the modem can deliver. (p. 236)

Equipment Cost and Marketing Strategies

One of the best places to compare prices of equipment needed to access online technology is on Internet websites. For example, the Yahoo website (yahoo.com) has information on the approximate costs for a workstation with a high-end Pentium-based PC or Power PC-based Macintosh computer, a high-resolution color monitor, a 56Kbps modem, network software and cabling. A Pentium PC costs roughly $2,000 and a Macintosh around $2,500. There are also websites concerned with educational software. One website lists current products (computerlearning.org). Software applications for intranets that can be customized by a lab director or classroom instructor already exist. The software cost of a single site license can generally be purchased at a reduced educational rate. At the Microsoft website (microsoft.com) such widely used programs as Microsoft's Encarta encyclopedia can be purchased as part of a bundled package of the Windows 95 operating system. Included are Internet Explorer, Microsoft's answer to the industry standard Netscape Navigator, and a CD-ROM package: educational titles on everything from dinosaurs to ancient history and modern art.

For online training, system coordination is becoming less of an issue than before. The breakthrough performance systems (EPSS) use networking technology. This enables one person to update information immediately for everyone on the network. According to Parder Wynn (cited in Caudron, 1996), president of Stanford Testing Systems:

> The Internet is an effective way to train from ten to ten million people. . . . you don't have to worry about what kind of computer each of your trainees is using, how much of RAM they have installed, whether or not they have a CD-ROM drive, or what version of operating system they are using. (p. 35)

For large companies and institutions, moving to online learning provides unique opportunities to partner with hardware and software providers. For example, Dow Chemical, a multi-national 40,000-employee company, made an agreement with provider WBT Systems in 1998 to develop a delivery system infrastructure. As a result, WBT is able to market the system they made for Dow, called TopClass, to other giants. As part of the agreement, Dow obtained a custom-designed system at a low price (Barron, 1999).

Many software providers are using the Internet to distribute their multimedia courseware. For example, CBT Systems packages Web-delivered courseware with a bulletin

board, chat features, and instructor support. In the early days, software providers wrote their own material, controlling the entire creative and technical process. New niche marketers are creating alternate business structures. Some are specializing by reformatting software developed by others with the latest technologies. Their focus is on providing web-based services with content provided by many other partners. Others are interested in servicing any interested organization with all aspects of online training. Formed as a collection of computer consultants in March of 1999, Cytation has developed such a service: RollCall. One of their customers is WebEd, Inc., a provider of training content for educators. WebEd works with educators to provide content for teacher re-certification, then Cytation formats and uploads the result to a web host.

There remain some limitations for online technology, especially in non-English speaking countries (Gates, Myhrvold, & Rinearson, 1996). The hardware infrastructure necessary for a global Internet is progressing slowly in some areas, because of socio-economic differences and previous history with communications. Unfortunately, the speed of online technology installation can be predicted by the size of a country's per capita gross domestic product.

The Internet will continue to evolve. According to one visionary, the wire connections needed for expansion have been in place for decades: the byproduct of sophisticated telephone technology(Penzias, 1986). As a medium for future communication, the Internet goes beyond the printing press and challenges the telephone by being visually interactive (Kluger, 1988). For that reason, James Q. Crowe, formerly a leader in the development of the telephone industry, has turned his attention to the Internet. His company, Omaha, Nebraska-based Level 3 Communications, is spending eight billion dollars building an international fiber-optic network based on Internet Protocol. Crowe is betting that packet-switched IP technology will replace older circuit-switched telephone hardware (Rafter, 1998). He is building onto an IP network that was started by Qwest Communications in Denver. Founded in 1996, Qwest has commitments from GTE and World Com. Crowe believes the Internet is only in the beginning stages of supporting interactive multimedia images. The future growth plans of the Internet have been driving other communications systems towards integration in recent years. A new communications tool interface could emerge. This tool would be a synthesis of computer, modem, fax, and file cabinet gathered together in one information appliance. This device would allow a group of students to

teleconference while sharing and sending each other documents.

Technological Limits and Modes

At the present state of the technology, cost still places restrictions on the mode of delivery and data format of online-based training. As Kruse (1997a) has pointed out, "Text takes very little bandwidth . . . goes through a network quickly. Graphics and sound are bigger, so they take longer. And video takes the longest of all" (p. 55-6). The choice of technology bandwidth depends on whether the system uses an intranet, a Local Area Network (LAN) using hub and connector technology such as Ethernet, or a conventional Internet link.

Some other restrictions placing technological limits on data delivery systems are disappearing quickly. Integrated Services Digital Network (ISDN), a system of digital phone connections, has been available for over a decade (Penzias, 1986). This system allows the simultaneous transmission of data across the world using end-to-end digital connectivity. In addition to conventional phone lines and ISDN hookups, Internet training systems can now use satellite transmission technology. These Asynchronous Digital Subscriber Lines (ASDL) and very high-speed local area networks have almost no restriction of throughput. For the present, however, the

standard bandwidth of delivery will probably remain the 56 Kilobits per second, Kbps, ISDN line. However, many schools and small business continue to use 28.8 Kbps and even 14.4 Kbps systems.

The costs associated with two-way electronic interactivity have recently dropped below six figures. Technological innovation as a result of standardizing hardware to support the Windows platform and improvements in data-streaming methods have made this possible. Along with variations within platforms, technological advances are merging capabilities that previously existed on distinct platforms. For example, two-way video has come down from the satellite domain to the Internet. Differences in delivery methods will diminish as technologies combine and develop new approaches (Barron, 1999).

Ray Kurzweil (1999), a pioneer of artificial intelligence, predicts the distinction between human and machine will become blurry in a few years and writes:

> By 2029, a $1,000 computer will have a thousand times the processing power of the human brain. We will also have completed the reverse engineering of the human brain, which will enable us to create artificial assistants that won't seem so, well, artificial

anymore. Nonbiological entities will emerge that exceed human intelligence. (p. 124)

We will expand human experience and intelligence through neural implants. This won't require surgery: the requisite brain extenders will travel into our brains using nanobots, which are microscopic intelligent robots. . . . The nanobot implants will also enable you to multiply your memory a millionfold, improve your sensory and pattern-recognition abilities, download new skills and knowledge, and otherwise greatly expand your cognitive and creative abilities.

Note that this is not an alien invasion of intelligent machines. Before the next century is over . . . the earth's technology-creating species will merge with its own technology. There won't be a clear distinction between human and machine. (p. 125)

Summary

Within just a few years, interactive online-based multimedia instruction has become an integral part of regular classroom instruction and organization training in America. There are still many unanswered questions concerning funding and installations of the new wired classroom, as well as issues of access controls and age-appropriate materials. However, the revolution is well under

way. Groups concerned with the future of American education need to understand that interactive multimedia instruction will be an integral force for change. There are already signs that the Internet has removed the time and space barriers to self-instruction and on-line training, as students use public and private computers on an almost 24-hour basis (Greenhalgh, 1995). Talk of educational reform will pale in comparison to the classroom changes going on as online technology increase in use. For example, tenured teachers have a new role: traditional lectures are being scrapped in favor of graphic formats designed for the Internet.

The first renaissance occurred when the printing press connected the minds of Europe. What will happen when all the minds of the universe are wired together through the Internet? The worldwide synergy will spur creativity. The stage will be set for a second renaissance (Leyden, 1996).

CHAPTER IV

CONCLUSION

The incessant march of technology has reshaped the way we work, eat, sleep, play, and live. The same thing can be said of the way we learn, whether in academic or work-related pursuits. The tools of learning that show the most promise are the result of innovations in information and communications technologies. These hold the potential to enable learning anytime, anywhere, for anybody on the planet and beyond. The convergence of standards is being shaped by a network platform of support currently called the Internet.

With a working definition of the Internet, the literature has been explored. What began as a military tool for defense may one day become the most powerful tool for the peace of humankind through education. The language of document creation, hypertext, has allowed for the free association of ideas. The Internet has great potential to support online technology as a training tool. Travel costs for students and teachers can be reduced. Specific on-the-job learning experiences can be augmented. For many who were shut out of traditional training modes, an avenue of flexible and affordable education is now available. Combining all previous methods of communication into one

medium offers a powerful tool for training. The power of the Internet to support combined images of dynamic graphics and words, something past technology could not easily do, establishes a new benchmark for effective communications.

Online technology is creating challenges for the educational community. The information age is providing great amounts of data that must be sorted through to find the truth. Educators will need to develop new skills in the presentation of information. Appealing to a generation with increasingly shorter attention span is changing traditional styles of teaching. The number of people needing guidance as they increasingly depend on the Internet as a resource for learning is growing. Questions of copyright, ownership, accessibility, and censorship remain unanswered.

Along with the changes in educational circles, the computer is having a major impact on the business community. Companies are using the computer to maintain daily business operating systems and provide simultaneous on-the-job training opportunities for employees. Communications have improved, with the ability to transmit documents and personal letters through the e-mail system. Increased levels of computer power are enabling the development of sophisticated virtual reality environments and multimedia training materials.

The power of the Internet has swept most up in a frenzy of change and adaptive responses, say some refugees from the early days of computer development. They question the value of time spent with computer interfaces that could be spent vis-a-vis other human beings. However, there is an indication that the technology continues to shrink the distances between our various cultures, pulling formerly separate societal segments together to work towards common goals in learning and working. Working in this medium they will hopefully formulate new research to improve the computer/human interface. Sharing these discoveries in online technology, we will join together, educating each other, in our global electronic village.

REFERENCES

Barron, T. (1999). Harnessing online learning. Training & Development, 53(9), 28.

Bassi, L., Cheney, S., & Lewis, E.(1998, November). Trends in workplace learning: Supply and demand in interesting times. Training & Development, 52(11), 51.

Caudron, S. (1996). Wake up to new learning. Training & Development, 50(5), 33.

Clark, B. (1992). Growing up gifted. Developing the potential of children at home and at school. New York: Merrill.

Cohen, S. & Rustad, M. (1998). High tech high touch high time?. Training & Development, 52(12), 34.

David, S. & Meyer, C. (1998). Blur: The speed of change in the connected economy. Cambridge, MA: Perseus Press.

Frost, M. (1996, June). Is there a doctor on the net? HR Magazine,41, 34.

Gates, B., Myhrvold, N., & Rinearson, P. (1996). The road ahead (Rev. ed.). New York: Penguin Books.

Greenhalgh, T. (1995, April7). Cybercafe goes for student link. Times Newspaper Higher Education Supplement, 1170, p. iv.

Hall, B. (1996). Five techno trends to watch. Training & Development, 50(07), 55.

Heath, R. (1996). Miles of files. Marketing Tools, 3(6), 24-27. [On-line]. Available: http://www.demographics.com/Publications/MT/96_mt/9606_mt/9606MD06.htm

Heinich, R., Molenda, M., Russell, J., & Smaldino, S. (1999). Instructional media and technologies for learning (6th ed.). Upper Saddle River, NJ: Prentice-Hall, Incorporated.

Hunter, H. (1995). Distance learning and the Feds. Training & Development, 49(5), 81.

Kay, A. (1990). On computers in education. Byte, 15, 232.

Kluger, J. (1988, November). The world according to Penzias. Discover Magazine, 9, 88.

Krol, E. & Ferguson, P. (1995). The whole internet users guide. Sebastopol, CA: O'Reilly Associates.

Kruse, K. (1997a). Exploring multimedia internet training. Training & Development, 51(3), 55.

Kruse, K. (1997b). The five levels of internet-based training. Training & Development, 51(2), 66.

Kurzweil, R. (1999, October). The future of the digital man. Esquire, 132, 122.

Leyden, P. (1997). The historic moment. Star Tribune [On-Line]. Available: www.startribune.com/digage/main1.htm

Lewis, J. (1996, January/February). Confessions of an internet junkie. Gifted Child Today Magazine, 19, 40.

Maney, K. (1999, August 9). The net effect: evolution or revolution?. USA Today Newspaper, p. 2B.

Marquardt, M. (1996). Cyberlearning: New possibilities for HRD. Training & Development, 50(11), 56.

McCloud, S.(1993). Understanding comics. New York: Harper Collins Publishers, Inc.

McCloud, S.(1999). Objects-introduction. [On-line]. Available: www.scottmccloud.com/objects/objects-intro/objects-intro.html

Morgan, T.(1993). Technology: An essential tool for the gifted and talented education. Journal for the Education of the Gifted, 16(4), 358-371.

Muffoletto, R. & Knupfer, N. (1993). Computers in education: Social, political, and historical perspectives. Cresskill, NJ: Hampton Press, Inc.

Negroponte, N. (1995). Being digital. New York: Alfred A. Knopf, Inc.

Penzias, A. (1986, May 1). The world beyond digital. Telephone Engineer and Management, 90, 24.

Postman, N. (1985). Amusing ourselves to death. New York: Viking Penguin Inc.

Rafter, M.(1998, May 12). Building a $9 billion network. The Industry Standard. [On-line]. Available: http://www.industrystandard.net/article/display/0,1151,277,00.html

Sobol, T. & Sobol, H. (1987). Your child in school: The intermediate years, grades three through five. New York: Arbor House.

Stoll, C. (1995). Silicon snake oil. New York: Doubleday.

Stoll, C. (1997). The lecture. [On-line]. Available: www.oswego.edu/~boncek/Stoll/lecture.html

Troxclair, D., Stephens, K., Bennett, T., & Karnes, F. (1996, September/October). Multimedia presentation in the classroom. Gifted Child Today Magazine, 19, 34.