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A web-based demonstration module for the electronic communications workshop

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**A WEB-BASED DEMONSTRATION MODULE FOR
THE ELECTRONIC COMMUNICATIONS WORKSHOP**

A Project Report

Presented to

The Faculty of the School of Library and Information Science

San Jose State University

In Partial Fulfillment

of the Requirements for the Degree

Master of Library and Information Science

by

Meri Rada

December 1998

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ABSTRACT

A WEB-BASED DEMONSTRATION MODULE FOR THE ELECTRONIC COMMUNICATIONS WORKSHOP

by Meri Rada

This project report describes the design and implementation of a demonstration module for Web-based training. The module presents content required in the Electronic Communication Workshop of the School of Library and Information Science at San José State University. This alternative method of instruction increases the options available to incoming students and serves as a framework for the design of future Web-based training modules. Web-based training offers platform independence, the ability to produce and maintain current and dynamic content, and a variety of methods for instructor and participant interaction. The incorporation of interactive programming for the exposition, demonstration, and reinforcement of course materials engages the learner and enhances the learning experience. Whether presented as adjunct material to onsite learning, incorporated with other aspects of distance education, or designed as a completely self-contained course, Web-based training is an important addition to the body of distance learning.

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INTRODUCTION

Market and political forces are conspiring to generate a new design for universities. The only questions are who's in, who's out, and who new is going to show up and compete for our customers (Denning, 1996, para. 6).

The classroom-based, teacher-student model of instruction forms the basis of traditional education in the United States. In this “one-to-many” model, the physical presence of teacher and students is required at a specific time, in a specific place - even though there is relatively little individual contact between a student and the teacher. This system has both advantages and disadvantages, but in recent years has come under heavy fire as being not only obsolete, but dysfunctional. It is seen to encourage passive learning and ignore individual needs. Unfortunately, few alternatives have been available and none have come into widespread use. When we think of school, of learning, of education, the traditional classroom setting continues to be the model.

Changes in the needs of students, shifts in student demographics, and advancements in technology are beginning to alter this perception. Additionally, the reality of competition in the educational marketplace has begun to awaken universities to the need for expanding upon the traditional method of delivery of their product.

In the past several years the variety of ways for an institution to provide a learning experience outside of the classroom has increased greatly.

It is no longer a given that teaching must occur within a physical boundary or that content be restricted to lecture, often outdated textbooks, and the occasional filmstrip, video, or field trip. Distance learning programs are being explored at all levels of education, as well as in business and industry.

Once limited to "correspondence courses", distance learning is now growing in many directions. The United States Distance Learning Association has formally defined distance learning as "the acquisition of knowledge and skills through mediated information and instruction, encompassing all technologies and other forms of learning at a distance" (United States Distance Learning Association, n.d.). At its most basic, distance education can be defined as learning which takes place when the student and the instructor are separated by geography, time, or both.

Given the appropriate equipment, it is no longer necessary for education to be restricted by physical constraints. A student may be at home, in the library, or in a computer laboratory nearby. Instructors may broadcast from a classroom or use a terminal from a remote location. It is also possible to incorporate a "many-to-many" model and offer team-teaching by a world-wide combination of experts. An archaeologist on a dig in Egypt can join with a museum curator in London and a distinguished retired professor in Uganda to provide course content for students of any age, in any location, via an ever-increasing assortment of modalities. It is also possible to have a "many-to-

one” model, where this same grouping of experts responds to a question on an electronic mailing list posed by a tenth-grade student in California.

The commonly used terms for the temporal aspects of distance education are synchronous and asynchronous. Synchronous means that regardless of location, teacher and student are communicating in real-time. This may be face-to-face, or through other real-time interactive media such as text, audio, or video. Asynchronous refers to delayed communication, with each person taking part at a time that suits their schedule. Among these methods are regular mail, email, audio or video tapes, electronic bulletin boards or mailing lists, and CD-ROMs. Interestingly, the printed page might be considered among the first asynchronous methods of distance learning.

Whether a class is conducted using a variety of these methods as adjuncts to onsite learning or wholly through distance learning, students are now being offered an abundance of choices. This new ability to offer instructional content anywhere, at any time, represents a fundamental change for education. Students and faculty are no longer tied to the classroom, library, or laboratory. Physical boundaries have been eliminated, and it is already quite possible to enroll in a course in a university in a foreign land or at the junior college down the street. The integration of these modalities to meet the needs of students is both a challenge and an opportunity for today's educators.

Last year Donald N. Langenberg, Chancellor of the University System of Maryland, stated that, "We must change our attitudes, our pedagogical models, indeed our very academic culture, if we are to adapt successfully to this new world. And we must do so quickly, for we find ourselves challenged by new kinds of higher education enterprises competing for our students" (Langenberg, 1997, para. 2).

Both educational and corporate institutions are devoting increased amounts of time, money and resources to distance learning. In fact, a new collaboration between education and industry is developing in the search for innovation in learning and training. Web-based training (WBT) in particular is receiving a great deal of attention as a vehicle well-suited to the provision of certain types of learning.

Web-based training has been defined as: "Individualized instruction delivered over public or private computer networks and displayed by a Web browser. WBT is not downloaded CBT [computer-based training], but rather on-demand training stored in a server and accessed across a network. Web-based training can be updated very rapidly, and access to training controlled by the training provider" (Kilby, 1997a, para. 10).

Among the benefits of Web-based training are timeliness, interactivity, efficiency, and cost savings. The ability to produce and maintain current and dynamic information, to provide multiplatform capability with relative ease,

and to precisely target key skills and knowledge areas makes Web-based training an important addition to the current body of distance learning opportunities. Particularly when introducing a new technology or process, Web-based training may be the most appropriate vehicle.

This project report describes the creation of a demonstration module for Web-based training. The module presents content required in the Electronic Communication Workshop of the School of Library and Information Science at San José State University. A tutorial in the use of WS_FTP, a graphical user interface program for file transfer protocol, has been developed using currently available technological applications for the World Wide Web. Research into the current state of Web-based training and the construction of this demonstration module have provided an opportunity to make a contribution toward the School's progress into distance education. Along with the distance learning applications already in place and those currently being developed, this module may serve as a framework for future Web-based training efforts.

LITERATURE REVIEW: DISTANCE LEARNING AND WEB-BASED TRAINING

. . . while courses delivered via the Internet are often devalued as second-rate by traditional faculty and by a public that views distance education as a poor alternative to attending class on campus, courses without distance education (DE) components may one day be considered second-rate (Redding, 1996, para. 6).

HISTORICAL DEVELOPMENT

The development of inexpensive postal services in the middle to late 1800's made possible the correspondence model of distance education.

Students received readings, study guides and other print materials by mail and gained institutional credit for completing assignments. This became the first widespread use of distance education, and it is still an option in many areas. The next generation of distance education is represented by broadcast and recorded media, while the third generation includes more recent advances in interactive and digital technologies (University of Houston, 1997).

The wide range of options currently available for the delivery of distance education encompasses four major categories: Print, Voice, Video, and Data. Print is the foundation from which all other distance delivery systems have evolved. These formats would include texts, study guides, workbooks, and class syllabi. Voice includes audio tools such as the telephone, radio, audiotapes, and others. In the Video category are photographs, slides, films, and videotapes. Data is used to describe any type

of information that is delivered electronically. This might include telegraph, fax, and all forms of data transmission utilizing computers (University of Idaho, 1995).

Computer-based training (CBT) (also referred to as computer-based learning (CBL), computer-based instruction (CBI), or computer-aided instruction (CAI)) is a subset of distance education. CBT is an interactive instructional approach in which specially designed training programs are executed on a computer. A series of choices or questions are presented, with feedback based upon the response received. This would include any type of instruction that takes place via a computer, including programs on kiosk, CD-ROM, DVD, hard drive, or disk (Public Health Training Network, 1997).

Internet-based training (IBT) is a subset of CBT and is any type of instruction that is provided through the Internet, using methods such as electronic mail (e-mail), mailing lists, and certain types of multi-user domains (MUDs) or multi-user domains object oriented (MOOs).

Web-based training (also referred to as Web-based instruction (WBI)) is a subset of Internet-based training and one of the newer forms of distance education. The term was coined in 1994 by Tim Kilby, who maintains the excellent Web-Based Training and Information Center on the World Wide Web at: <<http://www.filename.com/wbt>>. WBT is an innovative approach to distance learning using the technology of the Web, the Internet, and

intranets. Web-based training presents live content, fresh and easily modified, in a structure that allows self-directed, self-paced instruction on any topic (Kilby, 1996).

Of the methods of distance learning which incorporate computer technologies, the Web holds the greatest potential for promoting interaction and engagement. The capabilities of the Web make truly interactive learning possible and can go a long way in bridging the gap between distance learning and the traditional classroom environment (Hill, 1997).

Highly effective Web-based training is available today as a vehicle for the delivery of training anywhere in the world at any time. In the future, advances in computer network technology and bandwidth will allow for vastly increased multimedia capabilities, opening the doors even further. Web browsers that support 3-D virtual reality, animation, interactions, chat and conferencing, and real-time audio and video will offer unparalleled opportunities for educators.

The current focus of development is on proper use of the available tools and organization of content into well-designed instructional systems. Along with structuring content, the major issues are user interface design and programming for high levels of interactivity. As instructional designers and training analysts learn how to write and produce Web-based training and as educational institutions and corporations come to realize the overwhelming

advantages of this method, the number of training tools, sites, and systems can be expected to increase greatly.

INSTRUCTIONAL DESIGN

McManus (1996) describes instruction as the “deliberate organization and presentation of information with the end goal of promoting specific learning” (para 14). He points out that creators of Web-based training must keep sound instructional design theory in mind, rather than focusing on technological capabilities. Current content, logical organization, and clear exposition have always been the key to good instructional programs (Hackbarth, 1997), and the designer must take care not to distract the attention of the learner with excessive or unnecessary elements.

Duchastel (1997) feels strongly that a primary goal in the next generation of instructional design must be to overcome the idea that succeeding at learning is a struggle. Successful instructional strategies help students process new content effectively. They can activate student motivation, set expectations, direct attention, and increase retention (St. Cloud State University, 1997). A complete instructional strategy consists of the knowledge structure, presentation, opportunity for exploration and practice, and learner guidance, all consistent with and appropriate for the knowledge and skill being taught (Merrill, 1997).

The two major schools of learning theory in instructional design today are the objectivists and the constructivists. Objectivists describe outcomes in terms of behaviors, believing that information is mind-independent and can be transmitted in objective, concrete terms. Constructivists hold that the unique experiences of an individual student build an internal and personal representation of knowledge (Bannan & Milheim, 1997). Objectivist models deal almost exclusively with design goals, whereas learner objectives are paramount in constructivism (McManus, 1996).

The majority of currently existing Web-based training sites are based upon an instructivist [objectivist] approach, where objectives are identified and sequenced and the instruction is directed and highly structured. The approach owes far more to behavioral than cognitive psychology, with instruction designed to shape behavior through an arrangement of stimulus, response, feedback and reinforcement. (Reeves & Reeves, 1997).

Gagne (1985) has suggested that based on how we process information, there are nine "events of instruction." These are: gaining attention; identifying objectives; recall of prior learning; presentation of the stimulus; guiding learning; eliciting performance; providing feedback; assessing performance; and enhancement of retention.

When learners are new to the subject matter and new to Web-based training, they are faced with simultaneous tasks. Effort is expended both in

trying to understand the structure of the training module and in understanding the content of the lesson. Explicit and highly structured strategies reduce cognitive loading, conserving the learner's capacity for acquiring new skills and knowledge by limiting the effort necessary for understanding the structure of the learning situation (St. Cloud State University, 1997).

David Ausubel (1968) has proposed advance organizers as a cognitive strategy that links prior knowledge structure with new information. Ausubel emphasizes that advance organizers are different from overviews and summaries, which simply emphasize key ideas. Organizers give the student a meaningful cognitive structure to encompass the subject matter that follows.

A structured Web-based training course can emphasize experiential learning. Exercises which provide active practice may be included, and learners will have opportunities to practice the new skills. After the learning segment is complete, the learner can be given an opportunity to apply the knowledge or skill. To design adult learning materials that allow for active participation is challenging in any format, and especially so given the constraints of distance education (Woodall, n.d.). It is important, however, that the tedium of listening to a lecture should not simply be replaced by the tedium of reading from a screen (Bostock, 1997).

Since it is not possible to include everything, the goal of instruction must be to provide the most appropriate content for *these* learners, using *this* system, for *this* purpose, at *this* time. The content developer must be able to separate “nice-to-know” from “need-to know.” Dr. Thomas Sowell (1998), a noted economist and senior fellow at the Hoover Institute, has described his great frustration in attempting to follow written instructions. He makes a plea for directness and clarity, saying that, “Simplifying instructions does not mean adding a lot more words. Words that specify what act you are to perform need not be any more numerous . . . specific words are just more helpful” (p. 96). Tufte (1990, p. 51) tells us that “clutter and confusion are failures of design, not attributes of information.”

INTERFACE DESIGN

“In a computer based educational environment, user interface design refers to the creation of a seamless integration of content and control” (Jones & Farquhar, 1997, p. 239). The best instruction is that which engages and interests the student, while appearing effortless and enjoyable. The interface is the intermediary between the user and the system and can create a feeling of engagement by reducing the distance between the user's thoughts and the physical requirements of the system. The importance of this is that a properly designed interface does not tax the user's resources. The learning and cognitive effort required of the user may thus be concentrated in the task

domain, rather than on the system or interface (Hutchins, Hollan, and Norman, 1986).

Good interface designs all share one quality - common sense. The idea is to build an interface that makes sense to everyone, primarily by keeping it simple (Veen, 1998). As Shneiderman (1998) notes, excessive complexity, incomprehensible terminology, or chaotic layouts will engender frustration, fear and failure while coherent systems generate feelings of success, competence, mastery and clarity. In a 1997 paper on design principles for the Web, Head summarizes the value of visible and familiar affordances, meaningful and intuitive icons and representations, visual order and focus in content presentation, and functional consistency in increasing usability . The point is made that the challenge in Web interface design is to learn how to maximize the effectiveness and efficiency of the user's interaction.

User-centered design in all products is advocated by Norman (1988), and his principles apply equally well to interface design. He emphasizes that the task structure must be simplified, that it should be easy to tell what actions are possible at any given point, that the systems must provide actions that match intentions, and that the natural mappings between intentions, actions, and effects should be followed.

Using the ACM/interactions Design Awards criteria (Alben, 1996), Mandel (1997) has developed interface guidelines around three basic

principles. User control increases comfort, efficiency, and satisfaction; memory load may be reduced through visual cues, metaphor, and object-action syntax; and consistency in presentation, behavior, and context promotes usability.

Because people read differently on a computer, material for Web-based delivery must be presented differently. The consistent and predictable use of headings and sub-headings, prompts, ordered and bulleted lists, summaries, and highlighted keywords contribute to program integrity and predictability and serve to break up the monotony of paragraphs and focus the student's attention. Half (or less) the word count of conventional writing has been found to be optimal, and the use of objective language has been shown to improve usability by 27% (Nielsen, Oct. 1997).

Opening a new window with the browser toolbars removed and providing only task-based navigation, such as "next", "previous", or "quit" lessens the opportunity to interrupt the task at hand. Ideally, content can be separated into easily manageable chunks so that each page is short enough that scrolling is not required. When screens change, the only difference should be in the information on the page. Buttons and controlling features should always remain in the same place and should be intuitive, rather than clever (Brooks, 1993).

“If there are walls in Web design . . . then it is the designer’s job to find the doors, and light the path” (Black & Elder, 1997, p.22). Creating a coherent organizational structure and layout contributes substantially to the user’s sense of place, navigation, and orientation. A template which sets the color palette and grammar for text, background, graphic elements, and navigational icons establishes a consistent look and feel for each page, promotes site identity, and allows for a uniform appearance even when pages are designed by more than one individual.

Structured text will provide information in a sequential fashion. Pages should be designed to keep the cognitive load reasonable by making presentations short, chunking information, and creating spaced practice. Text should be written with active language and good mechanics, and the use of jargon avoided (Hites & Ewing, 1996).

Finally, a well-known maxim is that download times rule the Web. Designer Barbara Kuhr was recently quoted as saying that, “The most important aesthetic consideration is transmission speed” (Frew, 1998). Nielsen (March 1997) states that in every usability study he has done since 1994, users beg for faster downloads. He now believes that in fact, speed must be the overriding design criterion.

INTERACTIVITY

To maximize the learning experience, teachers look for ways for their students to interact with the information that is being presented. This encourages comprehension and understanding, motivating students to pay attention rather than tuning out (Schaaf, 1997). This applies to an even greater extent to Web-based training programs. Interactivity is what sets instruction apart from documentation, making the difference between a program that simply presents information and one that actually promotes learning (Hall, 1997).

At this time, the majority of Web-based training sites are little more than electronic books, with existing course content simply converted to HyperText Markup Language (HTML) for display upon the Web. Prestamo (1998), for example, has provided bibliographic instruction for the Oklahoma State University Library through a Web-based tutorial using HTML and non-interactive graphics. Another popular manner of presentation has been a series of Powerpoint slides placed as sequential pages on the Web. There is occasional use of quizzes, often with the correct or incorrect answer being a link to a separate Web page. However, clicking down a pathway and navigating through an instructional sequence is not representative of interactivity (Oliver, Herrington, & Omari, 1996). The use of java,

javascript, dynamic HTML, Flash, and Shockwave is increasing, but has not yet become commonplace.

In particular, Javascript's combination of simplicity, dynamic interaction, and object-oriented features allows developers to create interactive instructional units that react to student input. These capabilities make it an ideal tool for educators to use to create Web-based instruction that is superior to a static HTML display (Gillani & Relan, 1997).

Clever instructional design compels the student to roll and tumble an idea in his or her mind. Object-oriented programming components offer ways to add interactive design elements that engage the learner. Buttons, hypertext, hot spots, controls, movable objects, and data entry fields are all valuable in instructional design (Kilby, 1997b).

It is generally not possible for a program to be "too interactive." However, it is possible to suffer from gratuitous multimedia bells and whistles which contribute nothing to meeting instructional objectives (Hall, 1998). The design goal is to encourage intellectual interaction with the information, not simply to include lots of click areas, pictures, and noise. Interactions should activate additional information, reinforce learning, or test skills and cognition (Kilby, 1997b).

As pages become fully dynamic through advanced scripting and new presentational enhancements, creators of Web-based training will need to

start thinking of their work less as design and more as software development (Veen, 1998). With the continuing explosion in available technology and the increased complexity of programming techniques, the number of people involved in the creation of a Web-based training program can range from one very dedicated person who does it all to large project teams. Team roles might include a project manager, a subject matter expert, an instructional designer, a programmer, a graphic artist, a multimedia specialist, a Web master - and, of course, someone who can obtain funding (Hall, 1998).

There are an ever-increasing number of companies that provide commercial applications for Web-based training. The quality of these varies greatly, ranging from poorly designed templates to large scale courseware which incorporates high levels of interactivity, record-keeping, registration and payment options, and many other features. The technology can be used in place of an instructor, with exchanges made between the learner and the programmed instructional system rather than between a learner and an instructor (Oliver et al., 1996). In a strictly designed and self-contained Web-based training module, the role of the teacher is neither “sage on the stage” nor “guide on the side”. The teacher instead becomes the “mind behind” and is known to the student solely through the content of the program.

ADVANTAGES & DISADVANTAGES

Educators were quick to realize the value of the World Wide Web as a delivery method for distance education. Many of the books, articles, presentations, and Web sites which discuss Web-based training take note of the advantages and disadvantages of the format. In particular, the primary advantages appear to be in the areas of delivery and presentation of content, whereas disadvantages fall more into the realm of concerns about social and personnel issues. The list below presents a summary of the points found in the following bibliographic sources (Bassi, Cheney, and Van Buren, 1997; Gillani & Relan, 1997; Hackbarth, 1997; Hall, 1997, 1998; Hill, 1997; Khan, 1997; Kilby, 1997c; McManus, 1996; Paul, 1997; Redding, 1998; Reeves & Reeves, 1997; Rossner & Stockley, 1997; Schaaf, 1998; Steen, 1998; Tinker, 1997; Wulf, 1996).

Advantages

delivery of content

- platform independence
- can update and deploy worldwide in an instant
- globalization of courses - physical location irrelevant
- access is controllable
- options for online billing are available
- easy to link with other training systems
- multitasking capability
- options for installation on private networks for security or bandwidth
- easy update of content allows for constant improvements
- uniquely able to reach new audiences
- can use multiple modalities without changing equipment
- quick turnaround of finished product

cost-effectiveness

- any number of students at same cost
- no costs for duplicating, inventorying, or distributing hardcopy materials
- no facility and room costs
- no travel-related and course-related participant costs
- no costs due to last minute participant cancellations
- flexibility to add participants without additional cost
- shift from costly programming to interface and content design requires less technical support

quality of instruction

- more program choices
- access to remote experts
- alternative methods for instructor and participant interaction
- completely consistent - everyone receives the same instruction
- always available
- wealth of techniques
- innovative use can provide a range of new experiences
- may serve as an effective pre-requisite or follow-up to a class session
- instruction can be tailored to specialized groups
- capable of providing hands-on training
- students who do not communicate well in a traditional classroom may interact more effectively online
- provides small learning modules that will not overwhelm a learner
- learners often remain more alert
- can be personalized
- can be fun

location independence

- access from work, home, school, or elsewhere

can be asynchronous and self-paced

- students may learn at a pace that is comfortable for them
- students may learn at a time that is convenient for them
- able to stop and re-start at another time
- may move quickly through familiar material
- may linger over or repeat difficult sections
- no embarrassment in repeating a course
- is available when needed, as opposed to when instructor is available

Disadvantages

social

- concern about preservation of the learning community
- concern about level of student-student or student-faculty interaction

faculty issues

- intellectual property rights and faculty rights
- quality control - development of curriculum and standards
- concerns about disintermediation

technology

- bandwidth/browser limitations currently restrict instructional methodologies
- slow performance for sound, video, and large graphics
- need to deal with server problems, access control, payment issues
- slow server response time during periods of heavy use
- limited formatting of content in current browsers
- links to non-existent or altered pages
- short shelf-life of technology components
- uncertainty about future costs of telephone and Internet access

cost

- large initial cost associated with authoring tools and personnel
- cost of software, equipment and personnel for maintenance
- cost of equipment to student

DESIGN AND IMPLEMENTATION OF THE PROJECT

Not many creatures can spin webs. Even men aren't as good at it as spiders, although they think they're pretty good and they'll try anything (White, *Charlotte's Web*, 1952, p. 60).

BACKGROUND

In the fall of 1989, the School of Library and Information Science (SLIS) at San José State University began offering courses in Southern California on the campus of California State University at Fullerton. This initial step in distance education has been highly successful, and others have followed. In addition to CSU Fullerton, on-site faculty-led courses are now being offered in Pasadena, San Diego County, Sacramento, and Sonoma. Courses taught in either San José or Fullerton have also been made available to other locations via fully interactive two-way audio and video. These classes allow for real-time interaction between faculty and students in distant locations, as well as preservation for later viewing on videotape.

Upon entry to the SLIS program, all students receive an email account and space on the School's server. The School also maintains a mandatory electronic mailing list whereby students are informed as to administrative changes, upcoming events of academic interest, job listings, practicums and the like. The School has a Web page, accessible to students, faculty, and any interested persons. This page, located at <http://witloof.sjsu.edu>, contains

general information about the SLIS program including admissions information, program tracks, courses, and schedules.

Many of the faculty use the World Wide Web extensively for distribution of course information, syllabi, assignments, class readings, and other communications. It is also common for individual instructors to construct reflector lists, a type of mailing list open only to students enrolled in a particular course. These lists are most frequently used for announcements, electronic distribution of materials, and class discussion.

Students admitted to the School of Library and Information Science are required to take the Electronic Communications Workshop. The purpose of this workshop is to ensure each student's ability for effective online communication prior to beginning their coursework. Initially, all new students were assigned to a full day, on-campus communications workshop. Now, the workshop itself is conducted online through the World Wide Web.

As the original printed workshop handbook states, "In this Information Age, the world is your window. You are no longer restricted to paper formats or geographical location. You will be able to access information all over the globe, share ideas with peers and colleagues, and build on what you learn in a variety of disciplines" (Duval, 1996, p. v). The workshop is intended to help incoming students gain an understanding of the SJSU/CSUF electronic environment and to familiarize them with some of the basic communication

tools necessary for success in the program. Among these tools are those which provide access to email, telnet, ftp, and the World Wide Web.

Each semester, more and more students arrive with increased levels of computer competency. For these students, the workshop as it currently exists appears to be sufficient, and many of them are able to complete the entire workshop with little difficulty. However, for the student who has not yet developed this level of competency, the workshop can be a frustrating experience and an unpleasant introduction to the program. Some of these students attempt to complete the workshop from home, while others choose to attend the on-campus sessions that are available in the computer labs. It is clear from their comments that for the novice, the electronic workshop is not a user-friendly environment.

Additionally, the workshop as it now stands requires a significant amount of staff time. The Fall 1997 workshop had 222 students with an average of 40 messages each between student and proctor and an estimated total of 8880 messages processed. A student familiar with the Internet could finish the workshop with 20-some messages in 5 or 6 hours. A student unaccustomed to electronic communications might require 80+ messages and several days of constant work (McCoy, S., personal communication, November 13, 1997).

This demonstration Web-based training module for the Electronic Communications Workshop has been constructed in an effort to ameliorate some of these problems. This particular example of Web-based training is at the further end of the distance education spectrum. Not only are the teacher and student in different venues at different times, in all likelihood the student will never know who the “teacher” is. The goal is to present the necessary information with increased clarity, to provide additional hands-on opportunity, and to regulate progress incrementally. The creation of an alternative method for presentation of this information will increase the options available to incoming students and serve as a framework for the design of future Web-based training modules.

DESIGN CONSIDERATIONS

Assumptions

Crucial to the creation of any new resource is an understanding of the audience for which it is designed. Additionally, it is necessary to establish the platform on which the resource will reside, and the platforms, software, and equipment necessary for students to access the program. For purposes of this project, the following assumptions were made:

The audience will consist of students admitted to the graduate program in Library and Information Science at San José State University. By definition then, all will be adults who have completed the requirements

necessary for admission to this program. The students' level of experience with computers is unknown, but the assumption is that they will be able to access the SLIS Web site and will have completed the first five sections of the currently existing Electronic Communications Workshop.

The student may be accessing the program from home, school, work, or any remote location by using a computer that runs on a Windows 95 platform and using either Netscape 4.0 or higher or Internet Explorer 4.0 or higher. The connection to the Internet may be made via a modem with a speed of 28.8 bps or higher, or through an ISDN, ADSL, or T1 connection. The screen resolution of the monitor will optimally be set to 800 x 600, although the module will function properly at higher resolution. The program itself will reside on a server that is part of the SLIS computing environment and can be found on the Web at *<http://maple.sjsu.edu:4040/ECW>*.

Browsers

Inconsistencies between the two major Web browsers, Netscape Navigator and Internet Explorer, have wreaked havoc upon designers. The lack of uniform standards has made using and developing Web-based technologies unnecessarily difficult and expensive. Creating multiple versions of the same Web site due to browser incompatibility is wasteful, frustrating, and time-consuming. The alternative is to try to resolve these incompatibilities by creating one site with complicated workarounds.

The greatest problem lies with the differences in the Document Object Model, the structure through which elements are accessed on a Web page. Internet Explorer 4.0 gives scripting access to all HTML page elements, whereas Netscape's model provides access to specific collections of page elements. To access objects in either browser, it is necessary to create a reference variable that encapsulates the syntax for whichever browser the reader is using when the page is loaded. By building references to objects in this way, it is possible to use one script in both browsers. However, the series of "if this, then this; else if this, then this" statements can quickly become extremely convoluted and is far from the ideal way to write code.

Given the current state of development in Web technology, where the rules, the code, and the opportunities can change on an almost daily basis, it is possible that these work-arounds will soon be a thing of the past. The recently formed Web Standards Project has brought together a collection of Web developers and users committed to persuading browser makers to adhere to a common standard. Information about this project may be found at: <<http://www.webstandards.org>>.

However, the choices at this point in time were to a) design the module solely for either Netscape or Internet Explorer; b) to design two separate modules, one to run on Netscape and one to run on Internet Explorer; or c) to design a cross-browser implementation that would run properly on both

Netscape and Internet Explorer. Although option c) presented the greater challenge, it was decided that this was the best solution at this time.

However, no attempt was made to make the implementation downwardly compatible, i.e., to run on browsers below the 4.0 level. As the purpose of this module is to demonstrate the value of the interactivity made possible through the application of the newer technologies, there was little benefit in the additional coding necessary to degrade gracefully to older browsers.

However, if at some point in the future it is decided to create an entire instructional application for Web-based training, it may be desirable to incorporate degradation in order to allow for the widest possible user base.

Real Estate

As soon as the module is begun, a new browser window is created and opened for the tutorial. The screen size (in pixels) is forced to 636 x 550, and the window is placed in the upper left corner of the student's screen. All of the navigational toolbars that are built into the browser are removed, accomplishing two purposes: navigational control is now provided only through the tutorial itself, and extra space is made available to the screen display. Under normal circumstances a screen height of 550 would lose 70 to 90 pixels to the browser toolbars, resulting in an available height of 460 - 480 pixels. By removing the toolbars this area is reclaimed, returning the effective screen display to 636 x 550. Of this, two pixels on each side are lost

to the framing bars, the top twenty pixels are reserved for the tutorial header frame and the lowest 40 pixels are reserved for the tutorial footer frame.

This results in a screen area of 632 x 490 that is available for content.

File Size and Download Time

In an effort to minimize the download time, each graphic was reduced to the smallest possible file size. All of the graphics are less than 20 kilobytes, with only five that exceed 10 kilobytes. The majority range between 1 and 3 kilobytes. All images are preloaded at the beginning of the tutorial, so that once the initial download is accomplished the student never has to wait for an individual graphic to download on any page. Javascript programming and functions were placed in an external .js file and called from within a document as needed. All of the formatting was provided using cascading style sheets, and the code resides in a single external .css file.

Navigation

Because this is a highly structured and directed interaction, almost all navigational control has been removed from the student. What is possible is to linger on any page for as long as desired and to move to the immediately following or preceding pages with ease. A table of contents is provided which allows the student to jump to any page within the tutorial, but the preferred and most obvious method of navigation is through the directed page arrows. Hypertext links, hallmarks of the World Wide Web, are seldom used here.

Rather, it is desirable to have the student proceed through the tutorial in a linear manner, as the content for each page is built upon a foundation of all of the preceding pages. Enabling the student to move in and out at will via hypertext links counters the effectiveness of this process and they are therefore used cautiously and only when necessary.

The header frame contains information as to the section currently being displayed. This frame is purely informative and is not used for navigation per se, but rather as a location and section identifier for purposes of orientation.

The footer, under most circumstances, contains the following navigational buttons:

- A link to the table of contents
- A link to the glossary
- A link to the tutorial exit
- A link to the previous page in the sequence
- A link to the next page in the sequence

Any button whose function is not available to the student at a given point in the tutorial is removed from the display. Although a consistent page display is important, it is far more important to avoid providing opportunity for confusion by implying that a function is available when it is not.

The student has control of the pace of the tutorial and may begin and end at will. Provision is made for a return to the point of departure, and occasional hypertext links are provided to enable the student to omit an entire section. This is available, for example, if the student is working from a computer which has the program already installed and therefore has no need to progress through the "download" and "install" sections.

Presentation

Colors. The color scheme was chosen in harmony with the San José State University colors of blue and gold. The header and footer background colors that frame the page are dark blue, and the navigational buttons are gold. The basic text color is dark blue, while gold type is used for direction of immediate actions to be taken. The deep red used for page titles was chosen to complement and stand out from the other colors, while the consistent white page background was used to avoid distraction from the content. Color is information, as well as aesthetics, and the deliberate and uniform use of color here is intended to keep the user informed and oriented.

Font face and size. The various font faces and sizes were chosen for readability and emphasis. The use of identical type face, size, and color for the various page divisions and subdivisions is intended to provide a familiar interface that presents a consistent look for each type of information presented.

Scrolling. An important principle of instructional design is that the information needed to make a decision must be available when the decision needs to be made. In an effort to make this as easy as possible, the use of scroll bars was deliberately avoided and the content explicitly designed to fit within the given page area.

Consistency. Consistency is a particularly important aspect of Web page design. The student should be able to expect that things that look the same will behave the same and things that look different will behave differently. The student will quickly learn to anticipate what a page title, instruction, or button will look like and how interactive portions of the module will respond. Once a behavior or mode is taught, it is reinforced and will not appear differently in subsequent pages. The first section of the tutorial is devoted to indoctrination in its use, look, and feel, and succeeding sections do not deviate from this instruction.

Organization

The tutorial is organized in a linear fashion. It is intended to be followed from one page to the next, from start to finish. The content is organized into brief chunks, usually only a paragraph or two, with each chunk aimed at teaching one step or concept at a time. Sections are clearly titled so that the user can easily tell what information will be presented, and important points in the text are highlighted. Structured collections of items

with a common theme, such as tables and lists, have been used when appropriate. The content is in a logical order, and when information presented is crucial to understanding a particular idea, it is frequently repeated elsewhere or reinforced with a quiz.

Interactivity

Providing activities for the student focuses attention and enhances retention. It is all too easy to scan or even ignore text-based content, but when interaction is required, the student must attend to content and recall previous instruction. The path through the content becomes more interesting, and the student is motivated to pay closer attention when it is clear that questions will be asked and answers required.

A variety of opportunities for interaction have been built into this module. The student quickly learns how to move from one page to the next, and no particular thought is required to click through these controls. Simple interactions, such as expanding the size of a graphic or highlighting an area to obtain additional information, are provided frequently and serve to further engage the student's attention. The exercises and quizzes require a higher level of concentration and focus. Multiple opportunities are provided for the student to enter information, make choices, or move pieces.

There are important considerations in developing and this type of interactive instructional module. It must not only meet the goals of a well-

developed presentation and appropriately designed instruction, but has to function properly on the platforms for which it is designed. Each type of interaction added to the module increases the difficulties of coding and the potential for problems. Additionally, while the technology behind many of the interactions is often quite sophisticated, the foremost goal is always to present an appearance to the student of clarity, simplicity, and ease of use.

CONTENT

The purpose of this module is to instruct students beginning the program in Library and Information Science at San Jose State University in the use of file transfer protocol through the WS_FTP client program. The delivery of content is through the World Wide Web, and this format necessarily influences the way the information is represented, accessed, and manipulated.

To set the stage and provide a sense of orientation, the first section is devoted to an understanding of the physical layout and framework of the tutorial. A brief overview of the module as a whole is provided, followed by a detailed presentation of information necessary to successfully navigate the course. The page format and syntax is explained, and the navigational icons are presented with full descriptions. Instruction is provided for stopping and restarting the tutorial, and a sample quiz is supplied both to reinforce the content and to provide familiarity with one type of quiz structure. There is a

page that lists the course contents, and a glossary with definitions of potentially unfamiliar terms.

The second section offers a presentation of the nature of file transfer protocol, giving the student an idea of the basic concept of the process and how and why it is accomplished. The next two sections are optional and deal with obtaining the WS_FTP program and installing it on the student's computer. If this program is already resident, these sections may easily be omitted.

A detailed look at the WS_FTP interface is the focus of the next section. Through the use of interactive graphical displays, the student is instructed in the essential elements of the program, including both appearance and function. The student is taught how to make an Internet connection between their computer and one of the SLIS computers and an explanation of each component is presented.

The student is then led through the step-by-step process of actually making a remote connection and transferring files between local and remote computers. Instruction is provided for beginning the WS_FTP program while continuing to proceed through the tutorial. The student is taught to alternate between the tutorial window and the WS_FTP program window and how to determine which screen window is active. The student connects to the SLIS computer through the WS_FTP client, navigates the file

structure, and downloads a file. The file is then modified locally and the new file is uploaded to the remote computer. The student is then given the opportunity to view the modified file on the World Wide Web.

In the final section, a second exercise is required where the student is simply given an assignment and expected to carry it out without detailed instruction for each step. It is always possible for the student to return to any of the previous sections for review or if they have forgotten any of the important steps in the process. After this exercise is completed, optional information regarding additional capabilities of the WS_FTP program is presented for the interested student.

FURTHER DEVELOPMENT

Several aspects of the design of the current module might be worthy of improvement in future versions. The greatest difficulty encountered in the execution of the project was the necessity for cross-browser programming. This alone made an already complex endeavour significantly more difficult. However, it is quite likely that this issue will be resolved in the near future, as both major browser companies have pledged their support to uniform standards.

The use of a frame-based navigation system may not continue to be the most efficient. Using CSS and DHTML, it would be interesting to explore other navigational options, including more extensive use of the show-hide

option for putting a large amount of content on a single page. The use of java applets for both navigation and display of content would be a different, but worthwhile direction to explore.

An effort was made to reduce the content in the module to manageable chunks of information on each page. It might, however, be useful to break the presentation of information down further, perhaps even doubling the number of pages while presenting the same amount of information. The problem here is audience, as there is a risk of over-simplifying the presentation for a more advanced student in an attempt to enhance the presentation for a novice.

Another area of development might be the inclusion of this and other modules into an entire Web-based training system. Such a system could enable course registration, password-protection, progress-tracking, record-keeping, and even payment options if so desired. It could be automatically configured to re-start the system at whatever point the student returned after an absence. It is also possible to develop a Web-based performance support system that can integrate Web-based training, databases, instructional aids, and other components into unified systems that are available on demand.

SUMMARY AND CONCLUSION

In your own place, at your own pace -- this is the essence of Web-based training. In particular, the incorporation of interactive programming for the exposition, demonstration, and reinforcement of course material is what separates Web-based training from other distance learning modalities. The purpose of this project has been to demonstrate a number of the unique aspects of this form of distance learning.

A review of the literature provided guidelines that proved invaluable in the design and execution of the project. The admonitions regarding the necessity of focusing on sound instructional design aided greatly in resisting the temptation to become carried away with technological enhancements. Each interaction was specifically designed to either engage attention, activate additional information, or reinforce content. The emphasis is on experiential learning, with active participation being a core component of the tutorial.

The guiding principle behind the design of the interface was the challenge to create a feeling of engagement and maximize the effectiveness and efficiency of the student's interaction. A simple layout and highly organized structure were implemented with the goal of ensuring a sense of place, navigation, and orientation. The color palette was kept to a minimum, and the background, graphic elements, and navigational icons were designed

to establish a consistent look and feel for all sections. All components were designed for clarity and consistency in both appearance and placement.

The design of the module takes an objectivist approach, with the instruction directed and highly structured. The format is linear, with the information logically organized and provided in a sequential fashion. The pages were designed to minimize the cognitive load by keeping presentations short, chunking information, and creating spaced practice. The task structure was simplified, and it is clear what actions are possible at any given point.

The material was deliberately organized and presented with the end goal of promoting specific learning. There was a particular attempt to focus the student's attention on the content of the lesson rather than on the structure of the module itself. In addition to the careful design of the interface, the first section of the tutorial is devoted entirely to familiarizing the student with the layout, components, and syntax used in the lessons.

Mandel's (1997) principle of consistency in presentation, behavior, and context served as a guideline for usability. Shneiderman's (1998) caveats regarding excessive complexity, incomprehensible terminology, and chaotic layouts were taken seriously and were an important organizing principle. Finally, Nielsen's (Oct. 1997) findings on the differences in how people read

on the Web and the importance of employing scannable text proved extremely useful in the design of the project.

In today's educational market, instructional institutions are being compelled to become actively involved in distance education. Among the factors influencing this transition are the need to provide cost-effective, high-quality education to greater numbers of students, an increase in public access to technology, government funding priorities for distributed learning networks, and more intensive competition for students. Web-based instruction provides an opportunity to introduce sophisticated interactive technologies into the traditional instructional setting. These technologies allow for greater dissemination of information and access to knowledge and are an important and effective means of providing high-quality instruction to larger numbers of students without a commensurate increase in personnel or physical resources.

The integration of print, image, audio, video, and interactivity makes possible a quality of instruction unknown to date. Currently, the greatest drawback is the lack of reliable, interactive, high-bandwidth multimedia capability. New developments will likely remove some of these technical roadblocks and create opportunities for highly dynamic training systems. However, as with all other innovations in educational technology, the Web should not be seen as a panacea for the problems afflicting traditional

education, but rather as an alternative whose utility and value is dependent upon the educational context. The most realistic format for the future is a combination of the best elements of computer-based and instructor-led education.

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Title page

Non-interactive graphic

Drag and Drop Quiz

Interactive graphic

IMAGE EVALUATION TEST TARGET (QA-3)

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