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WEB ACCESSIBILITY: ENSURING ACCESS TO ONLINE
COURSE INSTRUCTION FOR STUDENTS
WITH DISABILITIES

A Project
Presented to the
Faculty of
California State University,
San Bernardino

In Partial Fulfillment
of the Requirements for the Degree
Master of Arts
in
Education:
Instructional Technology

by
Inez Celeste Everett

December 2003

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ABSTRACT

This project illustrated how a centralized web site at California State University, San Bernardino containing web accessibility information could support course developers in designing accessible online course material and web-based course instruction. The project identified how students afflicted by varying types of disabilities can be adversely impacted by poor web design. It alerted on-line course developers to the need and the importance of initiating the design process with accessibility in mind. It supplied web designers with universal guidelines, repair and evaluation tools and other resources. References to online and web-based courses, which are easy to navigate, were provided.

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I would like to express my appreciation to the following individuals whose steadfast support made this project possible:

To the many students registered with the Office of Services to Students with Disabilities who have encountered challenges with online course instruction and inspired me to develop this project.

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To my children, Riley and Hannah who endured countless evenings without a mom to help out with homework or give an extra hug and who sacrificed so much so that I could pursue a dream.

And finally, to my husband, Scott, whose unwavering love, patience, and support guided me through the process of earning a graduate degree.

DEDICATION

This project is dedicated to my wonderful children,
Riley and Hannah and to my husband, Scott Everett.

TABLE OF CONTENTS

ABSTRACT	iii
ACKNOWLEDGMENTS	iv
LIST OF FIGURES	vii
CHAPTER ONE: BACKGROUND	
Introduction	1
Statement of the Problem	2
Purpose of the Project	3
Questions	4
Hypotheses	4
Significance of the Project	4
Limitations	5
Definition of Terms	6
CHAPTER TWO: REVIEW OF THE LITERATURE	
Introduction	8
Web Accessibility	10
Categories of Disabilities	13
Blind or Visually Impaired	13
Deaf and Hard of Hearing	15
Learning Disabilities	15
Psychiatric Disabilities	16
Methods of Accessible Design	16
Evaluation Software Tools	18
Gratuitous Software	20
Software for a Fee	21

Summary	22
CHAPTER THREE: DESIGN	
Introduction	24
Analysis	24
Design	27
Development	31
Implementation	32
Evaluation	35
Summary	38
CHAPTER FOUR: CONCLUSIONS AND RECOMMENDATIONS	
Introduction	40
Conclusions	40
Recommendations	41
Summary	42
APPENDIX A: CD OF PROJECT	44
APPENDIX B: SUMMATIVE EVALUATION SURVEY	46
APPENDIX C: INTERVIEW QUESTIONS (WEB ACCESSIBILITY)	49
APPENDIX D: ACCESSIBILITY TRAINING FLYER FOR FACULTY/STAFF	51
APPENDIX E: UNI PHI CLUB FLYER	53
APPENDIX F: IRB APPROVAL LETTER	55
REFERENCES	57

LIST OF FIGURES

Figure 1. Flow Chart of Web Content Structure 43

CHAPTER ONE

BACKGROUND

Introduction

Prior to the enactment of the Individuals with Disabilities Education Act of 1975 (IDEA), students with physical, learning and psychiatric disabilities were barred from receiving a suitable education in the public school system. Many students with disabilities were deemed incapable of learning, incorrectly designated to special education classes, and were regarded as mentally retarded or physically incapacitated (Rubenfeld, 1996). In 1975, the Individuals with Disabilities Education Act (IDEA) was passed to address the topic of the educational needs of students with disabilities in the primary grades. Since then, various pieces of legislation, such as The Americans with Disabilities Act of 1990, Section 504 and 508 of the Rehabilitation Act and the Technology-Related Assistance for Individuals Act (Tech Act) of 1988 have been enacted to ensure equal educational opportunity for individuals with disabilities. Specific laws such as the Tech Act of 1988 confront the issue of inclusion of assistive technology devices and electronic information technology within the academic curriculum. While state universities

receive Federal funds to eliminate electronic barriers and ensure information technology is accessible to students with disabilities, few universities generate web page accessibilities policies or adhere to the law. Therefore, it is imperative that educational institutions implement a process and produce university resource to ensure all students have access to online course information.

Statement of the Problem

In the past decade online course instruction has gained momentum in supporting or replacing face-to-face course offerings. While colleges and universities traditionally focus on making assistive technology and other special devices available to students with disabilities, post-secondary institutions do little to ensure online course material and instruction meet the needs of learners with diverse needs (Kessler & Keefe, 1999). This can be attributed to the fact that faculty who are unfamiliar with web accessibility guidelines and practices are often tasked with designing their own online course materials. There are often no uniform design standards, resources or specialized online instructional training for course developers to follow.

While online courses provide learning opportunities for many students, online instruction can impede the learning process for students with disabilities. Current research indicates that twenty-one percent of college courses make use of web-based course management tools (Guenther, 2002). This is up from about fifteen percent in 2000. Although web-based course instruction has great potential to assist and enhance learning for students with disabilities, universities often fall short of achieving this potential.

Purpose of the Project

This development project reviewed past and current research in the area of accessible web-based course material and online course instruction in a university setting, specifically California State University, San Bernardino (CSUSB). The project endeavored to provide a web-based resource site, which includes pertinent information on accessibility issues and universally accepted design standards. The website presented online course developers, particularly faculty, with a) information on mandates and laws, b) guidelines to utilize when developing accessible online course instruction, c) strategies on how to increase web accessibility, d) and

links to commercial evaluation tools and services to e) other accessibility resources. Through this project, online course developers were provided access to a centralized electronic repository in which to check their online course material for accessibility.

Questions

In response to the need for an efficient means by which to design accessible course material, this project examines how an accessibility web site will aid course designers in increasing access of online course material? What assessment tools and resources are readily available for evaluation of course web sites. What department or individual is responsible for, evaluating course sites, and maintaining and updating the accessibility website.

Hypotheses

An accessibility website will equip course developers with the fundamental knowledge needed to design accessible online course material. This will assure an increase in accessibility and equal access in the virtual classroom for all students.

Significance of the Project

Online course instruction and web-based course material are rapidly being incorporated in the

school-learning environment. These new technologies have tremendous potential to provide alternatives for learning or to supplement or supplant traditional approaches to learning. The use of web-based course instruction can place students with disabilities on a level educational playing field. However, the move toward distributing instruction by way of the virtual classroom remains a hindrance for students with disabilities.

Few online course designers ever consider accessibility issue when devising their web materials. Often they are unaware of the laws that dictate compliance in providing students with disabilities equal access to the classroom.

Limitations

During the development of the project, a number of limitations were noted. This project considers five to be relevant:

1. The project examines the views of students with disabilities in a post secondary educational setting only.
2. This project does not examine the needs of students with disabilities who are not

registered within the Office of Services to Students with Disabilities.

3. Acquisition of a variety of software evaluation tools may prove too costly to obtain.
4. Participation may be limited due to time of year.
5. Participation maybe limited due to length of time to conduct the project.

Definition of Terms

The following terms are defined as they apply to the project.

Accessibility means easy to approach, reach, enter, speak with or use.

Assistive technology device means any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve functional capabilities of an individual with a disability.

Disability shall mean a physical or mental impairment of an individual that limits one or more of the major life activities and requires either a record of such impairment, or documentation of being regarded as having such as impairment.

Individual with a Disability shall refer to:
any person who has a physical or mental impairment that
limits one or more of the major life activities of such
individual, any person who has a record of such
impairment, or any person who is regarded as having such
impairment.

CHAPTER TWO

REVIEW OF THE LITERATURE

Introduction

Students with disabilities have been and continue to be the fastest growing segment of students attending postsecondary educational institutions (Weiss, 1997). As the number of students with disabilities increases so does the promise for technology. In the last decade there have been monumental changes in the types of course delivery tools that are available to students enrolled in colleges and universities across the country. It is now a common occurrence for students to learn beyond the confines of a traditional classroom. Because the delivery of online course instruction is a rapidly growing area of practice in the field of education, it has the potential to support the diverse needs of students attending college.

As postsecondary institutions offer advanced technological learning opportunities over the internet, many of these new learning opportunities create barriers for students with disabilities. Harrison and Bergen (2000) reported that while universities allow students to complete entire programs or degree requirements working exclusively through web-based courses, little attention is

being paid to making web-based course instruction accessible to students with disabilities.

While colleges and universities have traditionally focused on making hardware and assistive devices available to learners with differing abilities, institutions have had less experience with designing and delivering online courseware that can be interpreted for the disabled student population (Roach 2002). Although virtually all of the nation's colleges and universities are required to adhere to the six standards of technology contained in Section 508 of the Rehabilitation Act of 1973, few are aware that the rule applies to them (Foster, 2001).

Many universities and colleges presume an individualized approach in making course instruction accessible to students with disabilities. Faculty and departments are frequently tasked with designing their own web-based course and are unaware of accessibility issues until a student with a disability enrolls in their class. There are often no accessible design standards, handbooks, resources or other guidelines for course developers to follow.

Furthermore, many universities struggle to determine exactly what the law requires and lack the impetus to act in accordance with the spirit of the law. While for the

most part the law remains unheeded and ambiguous, many universities assure accessibility on a case-by-case basis. Consequently, the virtual classroom is not held to the same accessibility standards as the conventional classroom (Carnevale, 1999).

Web Accessibility

Little research in the area of web accessibility has been conducted. Few studies available through the database-ERIC, EBSCOHOST revealed that usability and accessibility of the internet is a growing issue. Studies have touched on the call for greater education for course designers in this area. Yet modest progress has been made in the development and implementation of universal accessibility guidelines. The gap widens, as web technology becomes the mainstream in college course offerings.

The growth of the internet since 1992 has been significant. Fourteen million people using the internet in 1997 were students in the public school system (Weiss, 1997). With the innumerable types of technology tools available today, college professors strive to expand the delivery of course instruction in new and innovative ways.

Although web-based learning is becoming a standard in the academic learning community, the quality of most web-based course instruction is less than standard and bequeaths a weak point in the learning process for special needs learners to conquer.

Professors authoring their own online classroom instruction and material are typically ignorant of accessibility issues, or the negative impact an inaccessible site has on special needs learners. As such, faculty commonly find themselves learning about online accessibility as they go (Carnevale, 1999).

Rowland and Smith (1999) recommend novices web designers to familiarize themselves with and embed in the web design process two universally accepted web design standards. The first universal design standard comes from the Web Accessibility Initiative (WAI). WAI provides essential resource and guides for creating web sites and software applications that are user-friendly and accessible to all people. It is a summary of fourteen guidelines and principles of acceptable design that encourage content developers to properly use images, video, etc. For clarity, the guidelines are broken into three priority groups. Within the priority groups there are checkpoints that must be satisfied in order to achieve

accessibility. The primary purpose of the guidelines is to highlight the specification and to promote its widespread use. This will ultimately enhance the functionality and universality of the web.

In her article, "Getting Two for the Price of One: Accessibility and Usability," Kirkpatrick (2003) supplies recommendations, examples, scenarios, and techniques based on WAI's principles. Kirkpatrick also provides recommendations, examples, scenarios and techniques based on Section 508 of the Rehabilitation Act, the second acceptable design standard.

Section 508 of the Rehabilitation Act found at <http://www.section508.gov/law.html> and enforced by the law, was originally intended to apply specifically to federal employees using federal websites. However, the law has been broadly interpreted to apply to all state agencies receiving money from the federal government (Guenther, 2002). Section 508 consists of 16 guidelines derived from WAI. The idea is that site designers prescribe to the standards and requirements of these guidelines so as to make their web content more available to all users. Web page authors unsure of accessibility standards and requirements are advised to follow the practice of utilizing these simple guidelines.

Implementing the principles of accessible design during the design phase of the web page will make the instruction usable and help students with disabilities overcome the limitations imposed by inadequate web design.

Categories of Disabilities

Students attending college have a wide range of functional limitations affecting their physical, sensory and cognitive abilities. About twenty-five percent of students attending college have mobility problems (Edmunds, 2001). Some cases are so severe that students have difficulty leaving their home without assistance. Another twenty percent of college students are affected by mental-health or psychiatric problems. Many find it impossible to leave their home, and are unable to integrate into the traditional classroom (Edmunds, 2001). Participating in conventional ways of learning is also difficult for students with sensory limitations. Appropriate online technological support for students suffering various infirmities has for the most part been inconsistent and overlooked.

Blind or Visually Impaired

Blind students often use assistive technology devices to help them gain access into the online course. They

commonly use speech output system or text-to-speech synthesizers such as Jaws to read online text aloud or construct Braille messages for the student to follow. However, assistive technology translates web content by "what you see is what you get (wyswyg)." For example, a blind student entering an online class might encounter an introductory message from his screen reader such as: "[image], [image].../syl/info/info.html,../wkgps /ctlg.html,../asmt/asmt.html,.online/crs.html." Sites developed and guided by accessibility standards would provide more meaning to posted messages and allow students to hear what others see.

Other commonly used features on the internet makes it difficult for assistive technology to translate information embedded in the frames and tables of a site. Assistive translator often are confused by frames and table because the programs read text from left to right one frame at a time (Carnevale, 1999).

Students with limited vision struggle to comprehend electronic pictures and graphs. This is due to the fact that page authors often create eye catching colorful, internet sites for their classes but fail to understand the ramifications it has for the visually disabled student. Well-designed websites translated by assistive

technology tools level the academic playing field for students with disabilities.

Deaf and Hard of Hearing

Additionally, streaming audio material on an internet based course is meaningless to a deaf student. In other words, a deaf student encountering the use of audio files, or multimedia components (with audio) as part the course instruction would have difficulty with the course unless the files were captioned or a transcription existed on the site. A student in this situation with a hearing impairment would not benefit from the content, experience, or intent of the activity. Rowland and Smith (1999) clearly, believe if these items were captioned the student could "listen" to the course content like their classmates and have a more rewarding learning experience.

Learning Disabilities

Similarly, the classroom student with a learning disability, such as attention deficit disorder or dyslexia often has difficulty navigating through the web-based material that contain a large amount of animated graphics or courses with many links and search options. While online courses are being constructed daily by the college professor, few think about making course material and syllabi accessible online (Carnevale, 1999). For other

students who have impairments in motor skills or cognition, sites may not be designed with their needs in mind either. Poorly designed sites require inordinate amounts of persistence and physical effort to navigate, as can be the case with students who use single switch access to browse the Internet.

Psychiatric Disabilities

Furthermore, students with psychiatric, mental health or emotional impairments often have trouble focusing on materials on a website. Obstructions for these students include flickering or distracting visual displays, animated graphic, and unalterable small font sizes. Rowland and Smith (1999) contend that a course developer's failure to anticipate the differing needs of students results in insufficient support to the widest audience of students. The unfortunate result of this negligence would be a students' inability to use web based course material in their educational experiences. Even worse, the student might ultimately avoid the use of the Web, or require substantial help to glean any benefit from it.

Methods of Accessible Design

Although two universally accepted web accessibility guidelines are now in place, page designers still

encounter problems in interpreting and applying the standards. So how can course developers truly judge the accessibility of their site?

According to May (1994) the fact that each individual user has the ability to select how content is rendered has a significant impact on accessibility. W3C Web Accessible Content Guidelines found at <http://www.w3.org/TR/WCAG20> provide the following common attributes as outlined in the Web Accessibility Initiative (WAI).

- Use of consistent wording, images, and fonts across the site.
- Use of Style Sheets to help maintain consistency throughout the site.
- Control color-convey information with and without color.
- User override of author style sheets- allows the user to configure foreground and background color of all text.
- Full keyboard support
- Use of access keys for shortcuts-provide keyboard shortcuts to important links.
- Accessible multimedia- text equivalent for every non-text element.

- Use of column and row headers in tables
- Labeling of frames
- Expanded abbreviations and acronyms
- Text supplemented with graphic or auditory presentations
- No auto-refreshing pages
- No pop up windows
- Clear and consistent navigation methods
- Use of simple language
- Clear plan and layout for your site

There are a number of ways to improve the usability and accessibility of a website. While this is not a comprehensive list of methods by which to design, the methods catalogued serve as a starting point for the contentious site developer.

Evaluation Software Tools

Although a handful of educational institutions seek to be proactive in delivering accessible online course instruction, many run into problems of finding suitable software solutions that remedy the accessibility issues. Obtaining software solutions is difficult. Software and hardware producers find the accessibility market much too small to justify the effort in developing solutions

(Foster, 2001). Moreover, the extreme cost to procure the software further hamper the efforts to ensure accessibility and usability of online academic information.

Few companies, though, have responded to this growing market. Many universities and community colleges are using a variety of resource technology to overcome technological barriers.

Although there are drawbacks in using web-based technology for course instruction for students with disabilities, the overall benefits of using technology to deliver instruction far outweigh the limitations. Hickman (1997) notes that for students with disabilities, web course instruction provides new methods to class interactions that would have previously been nonexistent. As online courseware gains popularity as a highly effective and informative communication tool to meet the diverse needs of today's busy student, it plays a vital role in academic access of students with disabilities.

The use and availability of web-based course instruction extends beyond equity of access to education for students with disabilities. It has tremendous potential for creating, changing and redefining the meanings of gaining knowledge and intelligence in our

society (Rankin, 2000). Even though accessible online courseware may not be a high priority item for educational institutions (Carnevale, 1999), several studies confirm the assertion that technology has the promise of enhancing academic achievement for students with disabilities.

Hickman (1997) recommends "its use must not become a fault line in American education, dividing the haves and have-nots."

Gratuitous Software

For many educational institutions, observing the disability laws can be costly (Carnevale, 1999). There are though, inexpensive measures schools can take to ensure accessibility. One entry-level tool that is gaining recognition is WAVE 3.0. It is a good starting point in providing novice users exposure to accessible design. WAVE 3.0 is a free and easy to use online evaluation tool that facilitates human judgment in the accessible design process. The drawback in using this evaluation tool is the amount of time it takes to check one web page. WAVE 3.0 was a project initially sponsored by the Pennsylvania Initiative on Assistive Technology. Development of the latest product is currently sponsored by (Web Accessibility in Mind), a project at the Center for Persons with Disabilities at Utah State University.

Other well-know products exist in the market. In 1996, The Center for Applied Special Technology (CAST), a non-profit group based in Massachusetts, developed a software product called BOBBY. The basic version of the software is free. It diagnoses individual web pages and points out potential access problems. It supplies suggestion, which include such items as adding alternate text under graphics and details ways in which to improve the overall accessibility of the site (Cornfield, 2002). More sophisticated versions of the software checks your entire website and allows the user to display the BOBBY icon on his site to affirm it is accessible.

Although this software is widely available, Rowland and Smith reported in their 1999 study of 400 prominent colleges and universities that fewer than 1 in 4 postsecondary institutions had home pages that would receive BOBBY approval. Private and public educational institutions that used BOBBY reported the software was relatively easy to use and had a positive influence on detecting, and correcting web accessible issues.

Software for a Fee

With the accessibility market on the rise, software vendors are seeking means by which to provide post-secondary education clients with solutions to upgrade

their web sites for accessibility (Roach, 2002). SSB Technologies, a San Francisco based software company, has developed two reputable products that address accessibility issues. The first product, InSight, scans web sites and flags problem areas. The second product, InFocus not only scans a website and identifies the problem areas, but it also fixes the problems.

While many of these products are not economical and slow, they do provide an alternative for universities seeking to be proactive in complying with technology standards outlined in Section 508 of the Rehabilitation Act. While these products are available little research has been conducted to validate their success.

Summary

As educational institutions enthusiastically embrace technology as a sound means to advance the field of education, the needs of students with disabilities are not being addressed with the same enthusiasm. As the growing trend of the last few years has been for teachers to publish their own web-based course material, universities must proactively seek ways to educate course developers on web access guidelines, policies and mandates. Educational institutions must employ outreach strategies to ensure

technology is within reach and useful to all students with varying needs.

CHAPTER THREE

DESIGN

Introduction

This project was designed for faculty and staff who design web based course instruction. Its primary intent is to foster understanding of web accessibility issues faced by people with disabilities. Its purpose is to serve as an outreach tool to aid in the delivery of accessible online course material. It will be proposed that the accessibility website be linked to the main campus web page for flexibility of use by the end-user. This will allow for a web development tool that is readily available in an easy to use format. Page designers will become familiar with the two main standards for web accessibility, the W3C Web Content Accessibility Standards and Section 508 requirements. The following are the steps used in developing the project.

Analysis

Participants of the study include college students and course designers who are staff and faculty, at California State University, San Bernardino, a Hispanic Serving Institution of Higher Education. The students participating in this study consisted of a mix of genders

and ethnicities and have a verified disability. In addition, the students are registered with the Office of Services to Students with Disabilities. The majority of those surveyed and interviewed are undergraduate students who have attained either freshman or senior class standing.

The task of ensuring the information contained on the site meets the needs and skill level of the end-user was simplified by carefully analyzing their needs through informal interviews. The course designers were expected to have designed their own online course or web based course materials and needed to be familiar with basic html code and terminology.

Various evaluation software solutions such as Bobby, WAVE, InFocus and Insight were presented on the accessibility web site to help course developers understand the repair tools. Participants learned about federal mandates which ensure equal access to education for students with differing abilities, the categories of disabilities that are affected by inaccessible website, common HTML accessibility problems, and HTML techniques that can be used to increase accessibility. Participation from students with disabilities to discuss challenges encountered when enrolled in a web-based course was

solicited by conducting face to face interviews and through use of a survey (see Appendix B & C).

Participation from online course developers, was solicited through informal interviews. Select faculty from CSUSB were asked to assess the strengths and weaknesses of the accessibility website and to authenticate their online course materials with information contained within the site. Feedback obtained from the interviews conducted from June 23, 2003 through July 25, 2003 indicated a lack of understanding regarding accessibility of electronic media.

Two main themes of accessibility were addressed in the surveys and interviews: attitude and necessity. The perception or attitude toward accessibility was low. The majority of respondents professed modest to zero consideration for accessibility when developing web based course material. Additionally, most did not believe modification to inaccessible pages were necessary if no one in the class had any disabilities that requires such modifications. Every web designer interviewed felt they were not equipped or comfortable using web evaluation tools. They estimated that a major burden would be placed on them and that regular updating of pages would hinder the process of keeping their course material current.

While they affirmed web accessibility is a necessary component in gaining access to learning for students with disabilities, they expressed uncertainty as to why they are obligated to ensure their web course material is evaluated. The accessibility web site was therefore developed with the intermediary web developer in mind.

Design

The primary goal of the design was to facilitate understanding of accessible design for online web course developers. More importantly, the design was intended to eliminate electronic barriers in the classroom. A well-constructed instructional design for intergrating accessibility into the creation phase of web design of online course material matched the expressed needs of the campus community.

Review of the Web Accessibility Initiative served as the foundation for outlining guidelines, and provided support for the resource directory. The web evaluation proces was self-directed and self-paced so as the end user maintained authority, power and control in this learning process. Therefore, acquisition of web accessibility evaluation skills and knowledge varied. Cultivating accessibility in the design phase of internet based

material remained consistent throughout the self-guided overview.

Web-based instruction was determined to be the most fitting method by which to deliver the concepts of web accessibility. Utilizing web based learning material would serve to enact a more pluralistic learning pedagogy, while offering multiple learning paths for active learner. Due to environmental constraints, it was assumed that web based digital technology would enhance the learning process for this particular material.

The needs of the recipients of usable web design were successively reflected in the "Web Accessibility" learning environment. Attainment of web accessibility concepts, guidelines, and strategies were highlighted in each section of the site to impart requisite skills for accessibility and usability.

The instructional features of the "Web Accessibility" site was formulated using a backward design approach to instructional planning. The design structure reflected a sequential learning hierarchy with the end goal of equipping the user with an understanding of accessibility issues. Similarly, the instruction mirrored globular application as the end user progressed through the

learning environment, while gaining understanding of the material by increments of task complexity.

The navigational structure emulated a natural process of intelligent inquiry and learning. It was organized with the scaffolding of web accessibility information and tools. Facts and concepts were initially introduced, with examples of accessibility issues as they pertain to differing abilities given. Links to market tested evaluation tools were provided along with a myriad of references to web accessibility resources.

The introductory page exhibits a general overview of accessibility ideals. Its content expresses the motivation for the project. The underlying purpose is conveyed along with options for providing feedback. The content of each page thereafter is arranged by six related categories which illustrate a scaffolding approach to understanding accessibility. Mandates and Laws, Types of Disabilities and Web Access, W3C Accessibility Initiative, Design Tips, Web Evaluation Tools and Web Accessibility Resources are the major content areas. The content page for "Mandates and Laws" outlines existing laws and mandates and provides a background of the conditions that led to the inception of these laws. The "Types of Disabilities and Web Access" page focuses on the range of limitations that

hampers a student's ability to use the web effectively for classroom instruction. In the next section, W3C Accessibility Initiative, fourteen basic principles for compliance to accessibility are supplied. These serve to provide a basis for easy to construct accessible design and increase the accessibility of data on the web.

The content in the Design Tips page demonstrates samples of acceptable design. This area highlights proper use of animated pictures, graphics, and other multimedia options within a web site.

The Evaluation Tools sections served to engage the user to progressively increase their web design skills with accessibility in mind. These advanced activities presumed prerequisite web design skills. The evaluation process presupposed advanced proficiency of the web designer. Participating in the evaluation process altered the learner's perception of web usability and accessibility. The learner was challenged with integrating complex accessibility concepts with creating accessible online course material or an accessible class site. This module provided the most insight for developing and coordinating an accessible site.

Furthermore, the learner gained awareness of evaluation tools and a confidence in using these evaluation tools.

The concluding portion provided resources for designers regarding the development of accessible sites. Resources, references and recommendations for further usage are included to facilitate designer's investigation of this emerging topic.

Development

The project was developed using software evaluation tools, literature reviews, and information and links from agencies advocating for people with disabilities. The learning tool Inspiration was used to plan and diagram the site. Inspiration served as an organizational tool to contemplate the logical layout of the modules see figure 1. Inspiration functioned as a graphical tool to clearly envision the web accessibility environment before completion.

Microsoft Front Page was the primary software tool used to build the site. Other special fonts and graphics were used from word processing programs and clip art to embellish the appearance of the site and to present the text information in a variety of ways. Powerpoint was used

to highlight key ideas of accessibility before the end user was introduced to the site. Handouts were generated from the Powerpoint presentation. Activities within the site required the user to practice evaluation of accessibility by operating software such as Bobby and Insight.

Survey tools and interview questions were generated using Microsoft Word. Handouts with accessibility information included lined space for note taking.

Implementation

Before the actual accessibility web site was produced all learning tools were put in place. Accessibility website and links were tested to ensure they were up to date and active. New accessibility guidelines, mandates, and policies, were tracked to ensure the latest information was provided on the accessibility web site. Samples of inaccessible online courses and online course material was furnished. Categorization of disabilities, related terminology and scenarios of students with disabilities facing challenges with inaccessible online courseware were made available. A resource directory was compiled, and links to free software and software for a fee was included to help course developers authenticate their online web course.

On Wednesday, July 23, 2003 the interviews were conducted in the Services to Students with Disabilities Office at California State University San Bernardino. Participants for the interviews were solicited from various Departments on campus and from students registered with the office. Flyer were posted in the Office of Services to Students with Disabilities one month prior to the interviews. Additionally, flyers were distributed in faculty mailboxes to announce the project and to request participation (see Appendix D). Twenty-four students, nine faculty members and one campus webmaster responded to the flyer and committed to participate in the project.

The interviews commenced on Wednesday, July 23, 2003 through July 25, 2003. The interviews were scheduled in one hour increments and were conducted in University Hall 183. During these interviews, participants were asked about their knowledge and attitude toward accessibility. Information contained within the web site was then discussed in scaffolded order as they appear on the web site. A computer with a powerpoint presentation of key points was presented and handouts were provided to illustrate the concepts of accessibility.

First, a history of accessibility was discussed. Users perused existing law to gain a understanding of the

origin of the electronic access issue. Various types of disabilities were discussed and the limitations that inaccessible electronic media creates. Users then brainstormed and jotted down terms, reasons and ideas they felt reflect the accessibility cause.

Next, web accessibility guidelines were discussed. Users worked through the fourteen common attributes of accessible design. The user was given an opportunity to view samples of accessible and inaccessible sites. After observing these samples a discussion was initiated and the end user was encouraged to synthesize this new knowledge with their personal web development experience. The end user engaged in discussion of commonalities and differing elements with regard to the guidelines and their existing web-based class material.

Finally, the web evaluation software was discussed. A general discussion of the process and procedure for use of each piece of software ensued, including a cursory discussion of differing features, amount of time required to evaluate multiple pages versus a single page and computer system requirements. The end user visited and investigated the evaluation tool sites independently.

The interview culminated with an open and honest discussion of consistencies and contradictions of

accessible design. In order to improve the intent and content of this project, users were encouraged to provide sincere feedback, whether it was negative or positive. At the end of the interview session, each participant was asked to respond to a brief survey involving the utility of the material presented.

Evaluation

Survey instruments and informal interviews were the primary means of data collection for this study. The survey was developed to examine the views and perceptions of two different groups: 1) students with disabilities who have used online course instruction or web-based course material 2) course developers, specifically faculty who develop their own web based course material.

All survey and interview questions were submitted to the Institutional Research Board (IRB) at California State University, San Bernardino, for approval. Surveys and interviews were conducted with a sample population of student who encompass a variety of disabilities and a small population of faculty who develop their own online course material.

Ongoing (formative) evaluation was performed throughout the development of the project to determine

usability. Summative evaluation of the accessibility website was conducted beginning July 23, 2003 and lasted until July 25, 2003 by means of six informal and open-ended interview questions. This format was selected to elicit data regarding accessible online course material.

Feedback was solicited through surveys, direct comments and user observation in the interview sessions. Many participant did not understand the need to design with accessibility in mind. Comments included statements such as "if a disabled student is not registered in my class, then why would I need to make the web material accessible?" Many participants also voiced concerns with the amount of time required to make a web page accessible. They indicated many of the class changes are made to the web page minutes before the course begins and they do not have time to go through this cumbersome evaluation process.

Other concerns noted were that some of the evaluation tool links were no longer valid. Content of "Accessibility" website was modified to reflect the concerns and needs of users and developers. Structure and links were reevaluated, added and deleted as needed.

Participation from Uni Phi Club members was solicited (see Appendix E). On May 29, 2003 the project was

presented to the Uni Phi Club, an academically diverse student club at California State University, San Bernardino that celebrates differing abilities and promotes student unity. At the end of the presentation, attendees were asked to respond to a Likert-scale survey composed of twelve questions with space provided at the end for comments and suggestions. The Likert scale survey was conducted anonymously and was designed to measure attitudes toward accessible online course instruction. Respondents answered questions according to the following scale:

- 1 = Strongly agree
- 2 = Agree
- 3 = Neutral
- 4 = Disagree
- 5 = Strongly disagree

An overwhelming majority of the respondents Agreed or Strongly agreed that they have enrolled in courses, which use web based course material. Of those, 83 percent agreed that web material is not accessible. Comments added suggested that little is done to ensure web material is accessible and most instructors do not know how to tackle the issue. Moreover, 100% of students with mobility,

hearing, visual and psychiatric impairments asserted that there are barriers to online course materials.

Of those 4.6 percent claimed they had no or a neutral opinion that accessible web base course material was available. While the other 12.4 percent agreed that web based course material was accessible.

Comments and suggestions were provided on 100% of the surveys, which attest to the importance of this topic. Comments and suggestions were predominately positive and all respondents provided information regarding their impairment. Many respondents expressed an interest in participating further in research regarding accessibility.

All survey and interview questions were submitted to the Institutional Research Board (IRB) at California State University, San Bernardino, for approval. Surveys and interviews were conducted with a sample population of student who encompass a variety of disabilities and a small population of faculty who develop their own online course material.

Summary

The web based course material survey revealed a need for electronic access to academic course materials. The implementation phase affirmed the lack of knowledge and

uncertainty of the course developer's role in ensuring course material is accessible.

The Web Accessibility site was developed in response to this need. It was designed to facilitate understanding of the electronic access needs of students with disabilities. The layout was selected to facilitate ease of use by the intermediate web designer through scaffolding of skill development. The informal interview process ensured genuine and accurate feedback was obtained. Use of the online evaluation tools revealed their ease of use and access. The overall design model aided in gathering sources for a comprehensive multimedia project. The accessible web site served to aid course developers' in providing a technological sound classroom.

CHAPTER FOUR

CONCLUSIONS AND RECOMMENDATIONS

Introduction

Online course developers need to rethink the way they design their online course material. It is vital that faculty and staff who develop their own online course material be educated on accessibility guidelines so that internet based academic material is reachable by all students. Poor design of online course material puts up needless barriers for students with disabilities. For web based course developer compliance to accessibility mandates is a required part of the planning stage beginning with the inception of constructing online academic material.

Further studies on this topic will provide information on how effective a centralized web accessibility site might be in helping ensure online course material is available for students with disabilities.

Conclusions

The conclusions extracted from the project follows.

1. Review of the literature validates the belief that inaccessible online instruction builds a

barrier to educational access for students with disabilities.

2. An accessibility website can provide strategies for course developers to follow when generating their online course.
3. A website which offers accessibility tools is an effective method of increasing web accessibility to all students.

Recommendations

The recommendations resulting from the project follows.

1. Further research should be conducted to determine the impact that inaccessible web-based material has on the students with disabilities.
2. Implement a centralized approach to designing web accessible online material.
3. Conduct a comparison of the impact of accessible and non-accessible online courses on the CSUSB campus.
4. Study the impact of accessible online course instruction on students' with disabilities academic achievement.

Summary

Today, the number of instructors introducing web-based elements in the course curriculum is growing and students need to be able to progress with such growth. As such, a campus website with accessibility design standard for course developers at California State University, showed potential to greatly assist in equalizing the educational playing field for students with disabilities. Although the website does not claim to remedy each and every access and compliance issues encountered by students with disabilities, it does serve as an entry point for awareness to accessibility to the novice course designer. As online accessibility becomes a major concern in the field of education, it is of utmost importance for the university campus to provide course developers with a valuable resource to tackle these issues.

The project achieved its goal of providing a centralized resource for course developers to become enlightened about accessibility issues as they pertain to electronic information. However, further inquiry is necessary to determine the utility of the Accessibility web site.

Content Structure of Accessibility Web Page

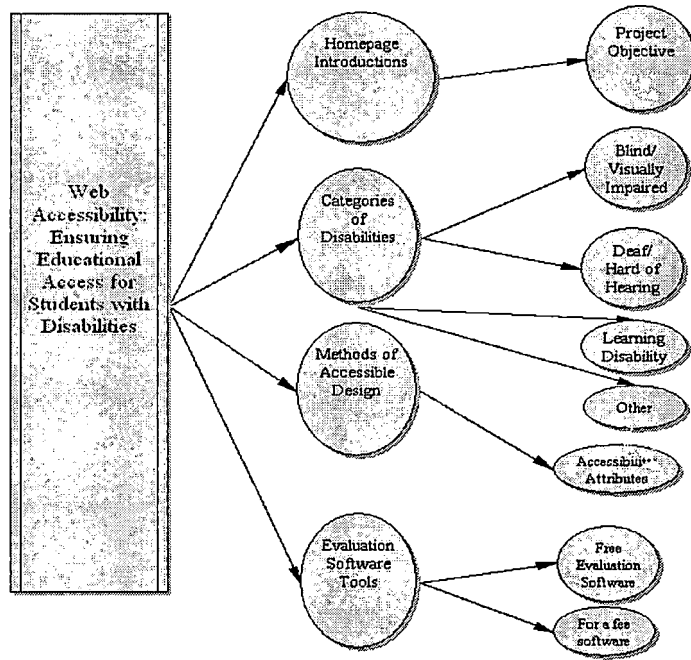


Figure 1. Flow Chart of Web Content Structure

APPENDIX A
CD OF PROJECT

APPENDIX B
SUMMATIVE EVALUATION SURVEY

Accessible Web-Based Course Material Survey

Please circle the number that best reflects your experience and attitude towards web-based course instruction at California State University, San Bernardino (CSUSB).

1 = Strongly agree 2 = Agree 3 = Neutral
4 = Disagree 5 = Strongly disagree

- 1) I have used web-based course material at CSUSB
1 2 3 4 5
- 2) I have participated in a course at CSUSB which web-based material was used.
1 2 3 4 5
- 3) I am comfortable using web-based course material.
1 2 3 4 5
- 4) I would prefer to enroll in web-based course instruction.
1 2 3 4 5
- 5) Web-based course instruction is always accessible to me.
1 2 3 4 5
- 6) Accessible web-based course instruction enhances my academic performance.
1 2 3 4 5
- 7) Non-accessible web-based course instruction has caused a delay in achieving my academic goal.
1 2 3 4 5
- 8) My professor is receptive to my need for web accessible course material.
1 2 3 4 5
- 9) My professor is receptive to my request for web accessible course instruction.
1 2 3 4 5

10) Accessible web based course material is available within a week of my request.

1 2 3 4 5

11) There is a need for accessible web based training for web course designers.

1 2 3 4 5

12) Translation of inaccessible web based course material is often the responsibility of the student.

1 2 3 4 5

Comments/Suggestions: _____

Your participation in the following section is optional. The information will be used confidentially and will serve to assess and analyze the web accessibility needs of students with disabilities.

Please circle the option that best describes your impairment:

Mobility Visual Learning Deaf Psychiatric Other

APPENDIX C
INTERVIEW QUESTIONS (WEB ACCESSIBILITY)

Interview Questions (Web Accessibility)

Only faculty at California State University, San Bernardino, who design their own web material were interviewed. The interview protocol included six preliminary questions with open-ended follow up questions to the initial response.

1. What percentage of your courses work is offered online or via the internet?
2. Are you familiar with web accessibility trends and standard as they pertain to web development?
3. Does the campus or your department ensure accessibility resources and software tools are readily available for your use?
4. Do you believe the responsibility for accessible design should lie with the individual course designer, campus web master or with other university personnel?
5. Are you concerned that students with disabilities may not be able to participate in your course if the online material is not accessible?
6. Do you believe accessibility training would provide you with the knowledge you need to develop online course material that could be used by all students?

APPENDIX D
ACCESSIBILITY TRAINING FLYER FOR
FACULTY/STAFF

WEB ACCESSIBILITY

Do You Design Your Own Web Based Course Material?

Interested in Maximizing Accessibility and Usability Of Your Course Material?

Learn How to Use Software Tools to Develop Accessible On-line Course Material

It's Quick, Easy and Fun

And Most Important, Your Students Will be Forever Grateful to Your Commitment to

Providing Access to Class Instruction

Discussion Topics Include:

- Disability Laws and Mandates
- Design Guidelines and Tips
- Evaluation Software Tools
- Accessibility Resources

Looking for fifteen faculty and/or staff to participate in one-hour training sessions in University Hall-183 to be scheduled from July 23 to July 25, 2003. Space is limited so don't delay in signing up for this important training. If you are interested, please reserve a space or respond by July 11, 2003.

For further information, contact:

Inez Everett at

everett_i@msn.com or by phone

(909) 880-5238 ext. 3367

(909) 236-8243

APPENDIX E
UNI PHI CLUB FLYER

To: Uni Phi Club

Access to Web Based Course Instruction

Have you ever enrolled in a course where the online material was not accessible?
Did your professor know how to accommodate your need for accessible Web Based
course material?

Where you frustrated with the length of time it took to get your course material in an
accessible format?

If you answered yes to any of these questions, then your voice needs to be heard!

If you are interested in participating in discussion of this topic or know others who are,
Please attend the Uni Phi Club Meeting on Thursday, May 29, 2003 from 2:00 p.m. to
4:00 p.m. in University Hall Room 107.

Discussion Topics

- Who do I report the problem to?
- What is the process of requesting an Accommodation from SSD?
 - How long should I expect to wait for the accommodation?
 - Accessibility Resources

For further information, contact:
Inez Everett at
everett_i@msn.com or by phone
(909) 880-5238 ext. 3367
(909) 236-8243

APPENDIX F
IRB APPROVAL LETTER



**CALIFORNIA STATE UNIVERSITY
SAN BERNARDINO**

5500 University Parkway, San Bernardino, CA 92407-2397

09/08/2003

Ms. Inez Everett
c/o: Prof. Eun-Ok Baek
Department of Science, Math, & Technology
California State University
5500 University Parkway
San Bernardino, California 92407

**CSUSB
INSTITUTIONAL
REVIEW BOARD**
Exempt Review
IRB# 02108
Status
APPROVED

Dear Ms. Everett:

Your application to use human subjects, titled, "Web Accessibility: Ensuring Educational Access for Students with Disabilities" has been reviewed and approved by the Institutional Review Board (IRB). Your informed consent document is attached. This consent document has been stamped and signed by the IRB chairperson. All subsequent copies used must be this officially approved version. A change in your informed consent requires resubmission of your protocol as amended.

You are required to notify the IRB if any substantive changes are made in your research prospectus/protocol, if any unanticipated adverse events are experienced by subjects during your research, and when your project has ended. If your project lasts longer than one year, you (the investigator/researcher) are required to notify the IRB by email or correspondence of *Notice of Project Ending* or *Request for Continuation* at the end of each year. Failure to notify the IRB of the above may result in disciplinary action. You are required to keep copies of the informed consent forms and data for at least three years.

If you have any questions regarding the IRB decision, please contact Michael Gillespie, IRB Secretary. Mr. Gillespie can be reached by phone at (909) 880-5027, by fax at (909) 880-7028, or by email at mgillesp@csusb.edu. Please include your application identification number (above) in all correspondence.

Best of luck with your research.

Sincerely, 

Joseph Lovett, Chair
Institutional Review Board

JL/mg

cc: Prof. Eun-Ok Baek, Department of Science, Math, & Technology

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<http://www.section508.gov/law.html>.

WC3 Web Accessible Content Guidelines.
<http://www.w3.org/TR/WCAG20>.

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