According to Dr. Cyndi Rowland, director of the higher education Web Accessibility In Mind (WebAIM) project, the rationale for developing accessible Internet-based materials is founded on three simple principles.

First, providing equal access to educational opportunities is simply the right thing to do. Vast amounts of valuable educational material are being gleaned from the Internet every day by students and professors alike. Just as physical accessibility is routine across campuses, virtual accommodations
are just as necessary across the Internet. From this ethical perspective most individuals agree that education should be made accessible to everyone.

Second, creating accessible formats for education is smart from an economic standpoint. When Internet courses are accessible to individuals with disabilities the institution will see an increase in the number of learners registering and paying tuition.

If you are not compelled to want to provide accessible Internet sites by the first two reasons, you may be by the third. It is the law in the United States. Federal statutes guarantee that learners with disabilities will not be discriminated against based on their disability status, and that they will not be “excluded from the participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving federal financial assistance . . .” (Section 504 of the Rehab Act; 29 U.S.C. Section 749).

This issue is devoted to electronic accessibility: to assist individuals to seek personal understanding, to promote the application of legal mandates, and to encourage readers to help disseminate accessibility information to groups outside the “disability field.”

The five papers in this issue provide a foundation for understanding the issues. The first paper, “Electronic Accessibility: United States and International Perspectives,” is a descriptive study which helps explain the who, why, and how of accessibility. This paper contains key information about US and international laws and policies. The second paper, "The Need for Assistive Technology in Educational Technology," addresses definitions, services, levels of technology, and the application of assistive technology concepts as they relate to education. The third paper, "Distance Learning Universal Design, Universal Access," discusses access, legal and policy issues, and it presents an overview of design considerations for assuring that a distance learning course is accessible. The fourth paper, "Web Design for Accessibility: Policies and Practice," outlines a process-based approach to accessibility policy implementation. And the fifth paper, "Online Course Accessibility: A Call for Responsibility and Necessity," discusses the essential components of a web-based course, the learning advantages that arise from equal access web formatting, and design strategies that lead to creating accessible, online materials.

Dr. Gary Marks, AACE Executive Director, notes that "it is essential that accessibility is regarded as an integrated part of on-line learning/teaching and not as an after thought or separate component. Thus, an important and primary goal of AACE is to disseminate information on accessibility as integral to online learning."

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Electronic Accessibility:
United States and International Perspectives

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ABSTRACT
Bruce Coonce, shown above, is a visually impaired Student Development Specialist employed at Southwest Texas State University. In the link given below his photo, Bruce presents several audio clips describing typical problems encountered by people who use a machine reader to provide voice descriptions from web sites. When reading an inaccessible site, a machine reader rapidly sounds out the complete web site address (the URL) repeatedly before stating the file name for each graphic image. In contrast, on an accessible site, the machine reader states the URL only once and then reads aloud the alternative text descriptions of the images (supplied by the web designer). For example, the file name of Bruce’s photo above is Bruce.jpg. Since this site is designed to be accessible, the machine reader will state the URL only once and then sound out the descriptive title - a blind man. Note that when you place your cursor on Bruce’s picture, the words "a blind man" appear. If this were an inaccessible site, Bruce.jpg, would have appeared instead.

Introduction

This article provides guidance on the issue of universal web accessibility. Lack of information concerning web accessibility not only contributes to the digital divide, but can lead to serious legal problems as well. Lawsuits can arise because of U.S. legislation that required all web sites receiving federal funds to meet accessibility directives by the spring of 2001. The goal of this paper is to provide clarification of the accessibility statutes and offer resources and information to assist in successfully developing accessible web sites.

The circular process of comparing and contrasting information from the Internet, expert testimony and personal expertise were the primary components fueling the engine of this qualitative inquiry. It goes without saying that constant and rapid change makes it extremely difficult to study any phenomenon on the Internet.

Early efforts in this study to understand accessibility issues began with telephone interviews. One of the first people contacted was Martin Bayne, who has the moniker, Mr. Long-Term Care. He is an international expert and advocate for quality health care for seniors who face physical challenges (http://216.150.16.116/about/about.cfm). Bayne frequently works long days in spite of his own battle with Parkinson's disease. He stated that only about 1% of all web sites are universally accessible, including health care sites (Bayne, 1999). Bayne recommended that our next source be Kynn Bartlett for additional historical information.

Kynn Bartlett, a leader in the field of web accessibility, advocates quality web design to build an effective World Wide Web that can be used by everyone (Barlett, 1999). As president of the HTML Writers Guild (http://www.hwg.org/), he directed the growth of the Guild from a collection of mailing lists into an effective, active organization with more than 117,000 members from 150 nations. He continues to teach the Guild's online course, Designing for Universal Accessibility (http://www.hwg.org/services/classes/). Bartlett also volunteers as the director of the Guild's Accessible Web Authoring Resources and Education (Aware http://www.awarecenter.org/community/). He heralded the seminal work done by the World Wide Web Consortium (W3C).

In October 1994, Tim Berners-Lee, originator of the Web (1989) founded the World Wide Web Consortium (W3C) in collaboration with CERN (European Organization for Nuclear Research http://www.cern.ch/). The World Wide Web Consortium was created to provide leadership for the Web by developing common protocols that promote its evolution and ensure its interoperability. W3C has a
membership of more than 500 member organizations from around the world and has earned international recognition for its contributions to the development of the Web.

W3C’s commitment to lead the Web includes promoting a high degree of usability for people with disabilities. The W3C Web Accessibility Initiative (WAI), in coordination with global organizations, is pursuing accessibility of the Web through five primary areas: technology, guidelines, tools, education and outreach, and research and development.

Nearly one out of five individuals has a disability. (Waddell & Thomason, K., 1998.) Many web developers are ignoring the accessibility issue or just do not know how to make their sites universally accessible. They are bewildered in the face of the vast amount of information available on applying accessibility techniques to the design of their web sites.

Four categories of information facilitate understanding the complexity of the issues. These categories are:

- U.S. legal mandates;
- International accessibility policy and legislation;
- Resources and information; and
- Web site accessibility validation

These four areas provide the tools for meeting today’s challenges. As the Web evolves, new accessibility issues will emerge. Once you think you have it figured out, it will change, requiring continual self-study to keep abreast of the how these changes effect your situation.

The Legal Mandates for Accessible Internet Sites

The Americans and Disability Act (ADA), which was signed in 1990, prohibits discrimination “on the basis of disability in employment, programs and services provided by state and local governments, goods and services provided by private companies and in commercial facilities.” However, the ADA doesn’t just apply to the physical world. Waddell (1998) points out that according to the Justice Department, the ADA also applies to cyberspace. In an opinion letter dated September 9, 1996, The Justice Department stressed that covered entities under the ADA are required to provide effective communication, regardless of whether they generally communicate through print media, audio media or computerized media such as the Internet. Covered entities that use the Internet for communications regarding their programs, goods or services must be prepared to offer those communications through accessible means as well.

Section 508 of the Rehabilitation Act Amendments of 1999 provided the basis for the Electronic and Information Technology Accessibility Standards, enacted August 7, 1998. "Effective (two) years after the date of enactment, any individual with a disability may file a complaint alleging that a federal agency fails to comply with section 508 in providing accessible electronic and information technology."

Public Law 106-246, signed by President Clinton on July 13, 2000, defers the effective date for enforcement of Section 508. As originally enacted in 1998, the provisions of Section 508 relating to enforcement were to go into effect on August 7, 2000. The new amendment (H.R. 4425, Section 2405) changes the effective date to six months after the Access Board publishes its final standards under Section 50 (McDunn, R. 2001).
On June 25, 2001, the accessibility requirements for United States electronic and information technology took effect under Section 508. This law mandates that this technology be accessible according to standards developed by the Access Board, which are now part of the federal government’s procurement regulations. Section 508 and its enforcement provisions apply to products procured by United States federal agencies after the June 25th. This law relies heavily on the procurement process to make sure there is compliance with the new standards. Compliance with the standards is required unless it would pose an "undue burden"—as defined in the standards—or if no complying product is commercially available. The law permits individuals with disabilities to file a complaint with the appropriate federal agency concerning access to products procured after the effective date.

"Although the rule was written primarily to aid federal employees and those who use federal web sites, state institutions are also required to comply with Section 508, because all states receive money under the Assistive Technology Act. “Section 508 is the A.D.A. of cyberspace,” says Cynthia Waddell, an expert on disability law and information technology. In 1998, Waddell cautioned that educational institutions are now facing web accessibility issues. "Library reference services are being transformed by the efficiency of Internet access to information systems and search engines. Professors are teaching long-distance learning courses over the Internet and, even if a student is physically in class, homework assignments and resources are being posted on class home pages. Yet, even if a library terminal has assistive computer technology installed for students with disabilities, Internet research by disabled students is not possible with inaccessible web page design" (Waddell, 1998).

Carnevale (1999) adds: "As colleges and universities expand their distance-education programs, they are finding that they must include the virtual equivalent of ramps when building their website. Higher education institutions know they’re obligated. "It's not that web site creators are ignoring the accessibility issue,” says Jane Jarrows, president of Disability Access and Information. “It is that they don't always realize how important accessibility is." While the U.S. Department of Education's Office for Civil Rights (OCR) has specific guidelines for compliance on traditional campuses, the agency has not yet issued accessibility rules for online education.

United States Legal Cases Related to Education

According to Waddell:

Not surprisingly, web accessibility issues are now being faced by educational institutions. Library reference services are being transformed by the efficiency of Internet access to information systems and search engines. Professors are teaching long distance learning courses over the Internet and even if a student is physically in class, homework assignments and resources are being posted on class homepages. Yet, even if a library terminal has assistive computer technology installed for students with disabilities, Internet research by students with disabilities is not possible with inaccessible web page design.

A blind student from Long Beach California filed a complaint to the Office of Civil Rights. In a personal e-mail communication, April, 1999, an attachment of a letter sent from R. Scott, Team, Team Leader, Office of Civil Rights to President, Long Beach California stated:

Long Beach failed to provide a student with the accommodations required by her disability (blindness) to access the college of business curriculum and other educational programs. OCR has jurisdiction over the subject matter of this complaint and over the university under both Section 504 of the Rehabilitation Act of 1973 and Title II of the Americans with Disabilities, which prohibit recipients of
Department of Education funds and/or public institutions, respectively, from discriminating against persons with disabilities. The university provided OCR with a voluntary resolution plan, which resolved the issues raised in this case. The plan included the following commitments:

1.) Develop and implement a systematic method for ensuring that the issue of accessibility to persons with disabilities, particularly blind persons, is taken into account when colleges purchase computer software and hardware.

2.) Develop and implement a systematic method for informing campus employees who design/select web pages for use by students to make sure the web pages are in accordance with principles known to maximize accessibility to users with disabilities, including visual impairments.


“(T)he issue is not whether the student with the disability is merely provided access, but the issue is rather the extent to which the communication is actually as effective as that provided to others. Title II (of the Americans with Disabilities Act of 1990) also strongly affirms the important role that computer technology is expected to play as an auxiliary aid by which communication is made effective for persons with disabilities” (Pages 1-2, 1996 Letter; 28 C.F.R. 35.160(a)) (Waddell, 1998 citing Brummel, 1994).

In further clarifying what is meant by “effective communication,” OCR has held that the three basic components of effective communication are “timeliness of delivery, accuracy of the translation and provision in a manner and medium appropriate to the significance of the message and the abilities of the individual with the disability” (Page 1, 1997 Letter) (Waddell, 1998, citing Brummel, 1994).

Of particular interest is the analogy OCR draws between the rationale for bringing an existing building up to code for access and the purchase of new technology for information systems. For example, buildings built prior to access laws are governed by "program access" requirements, and remodeling triggers the requirement to install certain accessible architectural features (Waddell, 1998, citing Brummel, 1994).

Similarly, the effective communication requirement imposes a duty to solve barriers to information access that the entity's purchasing choices create. Whenever existing technology is "upgraded" by a new technology feature, it is important to ensure that the new technology either improves accessibility or is compatible with existing assistive computer technology. For example, web authoring software programs that erect barriers in their coding of web pages fall under this scrutiny.

Last, OCR states that when an entity selects software programs and/or hardware equipment not adaptable for people with disabilities, "the subsequent substantial expense of providing access is not generally regarded as an undue burden when such cost could have been significantly reduced by considering the issue of accessibility at the time of the initial selection" (Page 2, 1997 Letter). Therefore, all technology improvements must take into account the removal of barriers and prevent new barriers to access. Covered entities preparing to retrofit their web sites need to be aware of this issue. (Waddell, 1998 citing Brummel, 1994)

On June 25, 2001, the accessibility requirements for U.S. electronic and information technology took effect under Section 508. This law mandates that this technology be accessible according to
standards developed by the Access Board, which are now part of the federal government’s procurement regulations.

Section 508 and its enforcement provisions apply to products procured by U.S. federal agencies after June 25, 2001. This law relies heavily on the procurement process to make sure there is compliance with the new standards. Compliance with the standards is required unless it would pose an "undue burden"—as defined in the standards—or if no complying product is commercially available. The law permits individuals with disabilities to file a complaint with the appropriate federal agency concerning access to products procured after the effective date. In June, 2001, President George Bush visited the Pentagon’s Computer/Electronic Accommodations Program Technology Evaluation Center (CAPTEC), which evaluates and demonstrates assistive technology for individuals with disabilities at the Department of Defense and other federal agencies. The President used this visit to call attention to new rules implementing Section 508 and to commit federal leadership in providing greater access for Americans with disabilities.

International Accessibility Policy and Legislation

Accessibility issues are considered to be one of the “target areas for equal participation” at an international level. Late in 1993—at the infancy of the World Wide Web—the United Nations General Assembly adopted the Standard Rules on the Equalisation of Opportunities of Persons with Disabilities [1]. Rule 5 of the Standard Rules addresses accessibility in terms of the physical environment and with reference to information and communications services. Among other points, Rule 5 recommends: "States … develop strategies to make information services and documentation accessible for different groups of persons with disabilities."

Although not a legally binding instrument, the Standard Rules represent a strong moral and political commitment of governments to take action to attain equalization of opportunities for persons with disabilities. The rules serve as an instrument for policy making and as a basis for technical and economic cooperation. In the past few years, a special rapporteur appointed by the U.N. Secretary General to monitor the implementation of the Standard Rules has encouraged governments to consider accessibility of information and communications services within their country’s social development policies.

The unique governance structure of the Internet makes it difficult, if not impossible, for a country to impose accessibility legislation on its own citizens. For example, it is not easy for one government to impose penalties for poor accessibility in a web site of one of its own citizens if the web site is hosted in another country. Governments have used either policy or limited legislation in an effort to ensure that public information is an accessible public good.

Policies that encourage accessibility—stating its benefits to the producers and consumers of information—are used by most of the early adopters of the importance of information accessibility. These policy/guidelines can only implement minor penalties such as the notoriety of non-conformance. Australia, Canada and Portugal have issued policy statements, and have mostly limited policy application to their own federal governments.

A good example of a clear and concise policy statement comes from the "Guide to the Internet" of the Government of Canada. It states:

"Since the end user cannot count on either standard technology or helping devices to ensure access to information on the [World Wide] Web, the onus is on the web page developer to deliver the message in a way that allows everyone to benefit.
"It is every Canadian's right to receive Government information or service in a form that can be used, and it is Government of Canada's obligation to provide it."

Only the U.S. has, so far, turned information accessibility into legislation. It does so using both “push” and “pull” regulations. "Push" regulations—such as Section 255 of the Telecommunications Act of 1996—require industry to consider accessibility. This type of regulation is, however, only effective in production of accessible products such as kneeling buses and accessible teller machines. It is difficult to regulate delivery of online information using “push” regulation because World Wide Web information is available globally, and there are many countries that do not consider information accessibility an issue.

Section 508 of the Rehabilitation Act is an example of "pull" legislation because it requires that the government purchase accessible products, but does not require that industry produce them. This provides a market pull to industry. Obviously, industry prefers pull regulations to push regulations. In practice, Section 508 may also be more effective because suppliers stand to lose major federal contracts if they are perceived not to adopt corporate accessibility policies. By imposing accessibility regulation on its own ranks, the U.S. federal government is hoping that corporations will adopt accessibility policies as a matter of example and as a sign of good corporate citizenship.

The European Union seems convinced that “pull” regulation and standardizing on WAI is their best option. In its Europe Action Plan, the E.U. provides a special section titled “e-accessibility: Participation for all in the knowledge-based economy.” This action plan optimistically targets the year 2002 as the deadline for all member countries to make their federal websites follow the WAI Content Accessibility Guidelines.

In Canada, federal websites have mostly complied with the Treasury Board Secretariat's Common Look and Feel (CLF) Guidelines. The successful implementation probably makes Canada's web sites the most accessible among industrialized nations. But the Treasury Board is not satisfied. The CLF Guidelines are currently being used in the formulation of legislation similar to Section 508, and with a compliance date of December 31, 2002. The difference between U.S. regulations and the Canadian and E.U. regulations is that Canada and the E.U. are adopting the W3C Web Accessibility Initiative as a reference material to keep with new technologies and developments. This move will likely be the same approach as other countries determine how, if ever, they formulate information accessibility policy.

Unfortunately, many countries may never have to deal with web accessibility for mostly economic reasons. One reason is that country priorities for information and communication services will naturally begin with the telecommunications infrastructure and the cost/benefit analysis of various platforms. For example, the e-Mexico project concentrates on making telecommunications facilities available to the rural areas, and the term accessibility is used to refer to the access of these facilities.

Another reason web accessibility might not be adopted is that in countries where labor costs are low, care giving for persons with disabilities is the norm, and independent living is not common. Caregivers can be asked to provide other services such as reading books and online information.

**Resources and Information**

**Accessible e-testing**

Available on this site is a free educator’s test program for online use. Suggestions for improvement are encouraged. Educators are encouraged to utilize the free test program for creating, delivering
grading and reporting tests. Also available is a test profile function that allows test tuning and tweaking.

**Accessibility on the Internet**

This United Nation’s source (Valdes, 2001) contains overviews of information related to the definition of accessibility and issues such as the need for accessibility, e-mail accessibility, adaptive technologies, etc.

**Association for the Advancement of Assistive Technologies in Europe (AAATE)** This group is the largest association on assistive technology outside the U.S.

**Association for the Advancement of Computing in Education (AACE)**

AACE is an international educational and professional organization dedicated to the advancement of knowledge, theory, and quality of learning and educational skills at all levels with information technology. AACE is committed to making Universal Web Accessibility a special strand for major conferences in order to emphasize that accessibility is part of educational practice and not a separate entity. The next two conferences will be: 1.) ED-MEDIA 2002-World Conference on Educational Multimedia, Hypermedia & Telecommunications in Denver, CO, USA, June 24-29, 2002; and 2.) World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education, in Montréal, Canada, Oct. 15-19, 2002. July 15 is the deadline for submission to the E-Learning Conference. If you wish to be considered for the accessibility thread committee, send your vita immediately to the Chair, Deanie French, at dfrench@swt.edu.

**Center for It Accommodation** CITA is a nationally recognized model for influencing accessible information environments, services and management practices. An example of a project is the *Public Information Networks Need Accessible Collaborative Learning Environments*. Content includes an overview of activities from the past year that show progress toward achieving a vision for a Knowledge Age technological infrastructure: an accessible collaborative learning environment.

**Computer/Electronic/Accommodations Program (CAP)** The Computer/Electronic Accommodations Program (CAP) provides assistive technology accommodations and services to people with disabilities at the Department of Defense (DOD), at no cost to individual activities. CAP’s mission is to ensure people with disabilities have equal access to the information environment and opportunities in DOD.

**Disabilities and Computing Program** UCLA's Disabilities and Computing Program mission is to facilitate the integration of adaptive computing technology into the areas of instruction, study, research and employment at UCLA.

**Disabilities, Opportunities, Internet working, and Technology (DO-IT)** DO-IT at the University of Washington includes a listing of Internet resources for accessible web design, as well as other information. DO-IT undertakes activities to increase the participation of individuals with disabilities in academic programs and careers.

**Disability Access Information and Support (DAIS)** This resource for the higher education community provides a range of services for those concerned with disability and access in higher education. The site incorporates all of the components of ADA, which includes building in technology access. Jane Jarrow is President of DAIS and has established a reputation for being knowledgeable about the issues of importance related to disability in the higher education arena.
Electronic Curbcuts: Universal Access for Everyone

This source reviews international events impacting accessibility (Waddell, 1999). Three developments that were reviewed are of particular interest. First, the United Kingdom report entitled, “Boosting the UK Digital Economy-- a Virtual Think-Tank.” Second, in 1999, the country of Portugal enacted a national law mandating accessibility in the design of government websites. Third, the Attorney General for the country of Australia requested that the Human Rights and Equal Opportunity Commission investigate access to electronic commerce and other new service delivery technologies by older Australians and people with disabilities.


The FCC adopted rules and policies to implement Section 255 of the Telecommunications Act of 1996 and Section 251(a)(2) of the Communications Act of 1934. These rules gave people with disabilities access to a broad range of telecommunication products and services including telephones, cell phones, pagers, call-waiting, and operator services, which were generally unavailable for persons with disabilities in 1999. Keep up to date on FCC news through this government Web site.

Five steps to accessible Web sites

This site offers help with the monumental task of creating accessible sites, by providing five basic guidelines (Dahm, 2001). In addition, there are several links to different free testing services, such as Bobby.

Government of Canada Internet Guide

This site provides assistance for universal accessibility design to ensure that sites are developed to serve the largest possible audience using the broadest range of hardware and software platforms, and that the needs of users with disabilities are considered.

HTML Writers Guild (HWG) The Writers Guild provides resources, support, representation and education for web authors at all skill levels. The HTML Writers Guild also has an education component, Accessible Web Authoring Resources and Education (AWARE). The AWARE goal is to serve as a central resource for web authors for learning about web accessibility. Online learning tools are valuable and yet reasonable. The Writers Guild also offers classes to help practitioners develop skills in developing accessible web pages. Membership in the Writers Guild is open to anyone with an interest in the skill of web design. Full membership is only $49 (U.S.) per year, and a free trial membership is available.

Many different types of courses are offered. See http://www.hwrg.org/services/classes/ for current course schedules. Kynn Bartlett will conduct the next available Web accessibility course. This Accessible Web Design online class will start April 22, 2002, and is seven weeks long.

For full members the cost of each course is $50.00 and for trial members the cost is $100.00. Obviously, the better bargain is to join the HTML Writers Guild first. Another perk is that once you are a member of the Guild, you are permitted to place the Guild Icon on your Web site.
IMS. The IMS Global Learning Consortium, Inc., develops and promotes open specifications for facilitating online distributed learning activities such as locating and using educational content, tracking learner progress, reporting learner performance and exchanging student records between administrative systems. IMS has two major goals: a) to define the technical specifications for interoperability of applications and services in distributed learning; and b) to support the incorporation of the IMS specifications into products and services worldwide. IMS hopes that the specifications will provide guidelines for systems to “interoperate.” An international white paper, IMS Guidelines for Developing Accessible Learning Applications was supported by a grant from the Learning Anytime Anywhere Partnerships (LAAP), a program administered by the Fund for the Improvement of Postsecondary Education (FIPSE), U.S. Department of Education

Making Your Web Pages More Accessible

This practical site from the University of York (United Kingdom) contains thirteen pages of guidelines to use in making web pages more accessible. Numerous problems are identified along with practical solutions.

http://www.york.ac.uk/coord/docs/whb/access.htm#forms

Mr. Long Term Care Many adults age 50 years and older often retire and go back to school to seek a degree or fulfill a desired educational goal. Mr. Long Term Care, Martin Bayne, who has Parkinson's disease, stores a lengthy directory for seniors who are concerned about health issues: Alzheimer, depression, diabetes, heart disease, impaired mobility and other disabilities.

Lighthouse International Lighthouse International is a leading resource worldwide on vision impairment and vision rehabilitation.

National Center for Accessible Media NCAM is a research and development facility that works to make media accessible to disabled persons, minority-language users and people with low literacy skills. This site also maintains separate types of disabilities. NCAM promotes the use of a Web Access symbol and provides model examples of accessible pages. Creators of web- and CD-based multimedia projects need an authoring tool to make their materials accessible to persons with disabilities. NCAM meets this need by providing MAGpie, the ideal authoring environment for multimedia providers who want to add captions, subtitles and audio descriptions to their work. The Trace Research and Development Center provide funding for MAGpie.

Trace Research & Development Center The Trace Center is a part of University of Wisconsin-Madison’s College of Engineering. The Trace Center is currently working on ways to make standard information technologies and telecommunications systems more accessible and usable by people with disabilities. Trace Center provides resources for design of accessible web pages including applet and plug-in features.

Universal Design of Consumer Products: Current Industry Practice and Perceptions

This paper provides a historical definition of “Universal Design” and briefly describes research findings (Vanderheiden, G. & Tobias, 2000). Businesses as well as others will find this site helpful in determining why and how some companies successfully practice universal design.

U.S. Access Board The Access Board is an independent federal agency devoted to accessibility for people with disabilities. It operates with about 30 staff members and a governing board of representatives from federal departments and public members appointed by the President. The
Access Board consists of 25 members. The President appoints 13 members from among the public, and a majority of the members is required to be individuals with disabilities. The other 12 members are heads of the following federal agencies or their designees whose positions are Executive Level IV or above: The Departments of Health and Human Services, Education, Transportation, Housing and Urban Development, Labor, Interior, Defense, Justice, Veterans Affairs, and Commerce; the General Services Administration; and the United States Postal Service. Key responsibilities of the Board include: a) developing and maintaining accessibility requirements for the physical environment, transit vehicles, telecommunications equipment, and electronic and information technology, and b) providing technical assistance and training on these guidelines and standards.

**U.S. Department of Justice Americans with Disabilities Act (ADA) Home Page** This legal resource provides links to mandates, laws and amendments concerning Americans with Disabilities Act.

**Web Accessibility in Mind** WebAIM’s goal is to improve accessibility to online learning opportunities for all people, in particular, to improve accessibility for individuals with disabilities who currently may have a difficult time getting access to post-secondary online learning opportunities.

**WorldEnable** is an Internet accessibility initiative in support of the international goals of equalizing opportunities for, by and with persons with disabilities.

**World Wide Web Consortium (W3C)** was created in October 1994 and has lead the World Wide Web to its full potential by developing common protocols to promote its evolution and ensure interoperability. W3C has more than 400 member organizations from around the world and has earned international recognition for its contributions to the growth of the Web.

**W3C Web Accessibility Initiative** (WAI) provides guidelines and resources for establishing accessibility of the Web through five primary areas of work: technology, guidelines, tools, education and outreach, and research & development.

**Verification of Web Site as Universally Accessible and Related Services**

Web pages need to be validated to ensure they meet the minimum requirements for universal accessibility. There are two major validation services—available free online—which evaluate web pages and help identify potential accessibility problems to correct. The first is Bobby, which is part of the Center for Applied Special Technology (CAST), a non-profit organization, whose mission is to expand opportunities for individuals with disabilities through the development of innovative technology. The Bobby validation system is simple to use to validate a web site. The web site URL is submitted by entering the information onto the web page and then clicking a submit button.

The process for obtaining the report is easy. Copy and paste the URL to insert into the verification program. Copying and pasting keeps from making a typing error. Tip: If a Windows-based computer is used, select/highlight the URL and use "Ctrl" and "C" keys to copy the URL and then "Ctrl" and "V" keys to paste the URL to the address box.
Web sites should have at least a *Priority One Accessible* rating. When users get feedback from the site, they will be able to see the entire page. Tiny question marks by the images means for users to check their information manually—this will not stop those from getting validated. If major problems are experienced, a question mark appears by each image.

Differences in the report will be demonstrated using the Southwest Texas State University healthcare human resource student information site: [http://www.swt.edu/healthservicesresearch/student.htm](http://www.swt.edu/healthservicesresearch/student.htm).

**Example**

This site was Bobby approved according to section 508 guidelines. However, it was not approved at the higher-level W3C Web Content Accessibility Guidelines. This level of approval is higher than the U.S. federal statutes. Most educational programs do not need to meet these standards. W3C is helpful to web programmers and is challenging for non-programmers to obtain validation from this service.

If the Section 508 issues listed below do not apply to the page, then it qualifies as *Bobby Section 508 Approved*, and that page is entitled to bear the *Bobby Section 508 Approved* icon. To obtain the icon and learn how to place it in a page, visit the [Icon Guidelines](http://www.cast.org/bobby/icon-guidelines) page on the CAST web site. The report for the example is provided below with the author responses to indicate that the computer generated concerns did not apply.
Section 508 User Checks

User checks are triggered by something specific on the page. However, the web page author must determine whether they apply. Bobby Section 508 Approval requires that none of them apply to the page. Please review these five items:

1. **If style sheets are ignored or unsupported, are pages still readable and usable?**

   Response: The page is readable and usable by both Netscape and Explorer.

   *If color is used to convey information, make sure the information is also represented another way.*  
   *(three instances)*  
   Lines 110, 114, 226

   Response: Color is not used to convey information.

2. **If this is a data table (not used for layout only), identify headers for the table rows and columns.**  
   *(two instances)*  
   Lines 26, 123

   Response: Table is for layout purposes.

3. **Consider specifying a logical tab order among form controls, links and objects.**

   Response: No form controls are used.

4. **If an image conveys important information beyond what is in its alternative text, provide an extended description.**  
   *(two instances)*  
   Lines 110, 226

   Response: Extended description not needed.

The following two items are not triggered by any specific feature on the page, but are still important for accessibility and are required for Bobby Section 508 Approved status.

6. **If you can't make a page accessible, construct an alternate accessible version.**

7. **If a timed process is about to expire, give the user notification and a chance to extend the timeout.**

   Response: Neither item 6 nor 7 apply to this page.

W3C Validation. The second major validation site is [W3C’s HTML validation service](https://validator.w3.org), a free service that checks documents like HTML and XHTML for conformance to W3C recommendations and other standards.

Approval Icon. The NCAM accessibility icon was selected from 17 symbols as a Web Access Symbol for people with disabilities. Web masters can use this to denote their site contains accessibility features for disabled users. The symbol should always be accompanied by its
description—a globe, marked with a grid, tilts at an angle; a keyhole is cut into its surface—and alt-text tag, . This image was created by Stromship Studios of Boston.

There is no charge to use this symbol, and it may be used in electronic or printed form. It can be copied from the NCAM web site and pasted it into a document.
http://ncam.wgbh.org/accessncam.html

Related services:

Lynx Viewer: This link converts web pages into a text-only format. Text only pages easily meet 508 standards. It is not recommended to have a text page and more dynamic page, as keeping both pages current is a daunting task.

Media Access Generator (MAGpie): Allows authors to add captions to three multimedia formats: QuickTime, SMIL, and SAMI. From the National Center for Accessible Media.

Conclusions

"The difficulties of studying the Internet can only be described in the present moment due to the constant state of change on the Internet" (Rizia, 1999). The future will hold many exciting technological innovations, making computers adapt to individuals rather than the reverse. Technology that allows access to computer resources for a person with disabilities is known as adaptive technology. These "electronic curb-cuts" are a combination of hardware and software. The challenge is making adaptive technology part of any base configuration and making all components work in a seamless fashion. This will increase the access to computers and applications without making major modifications.

When designing for the Internet, a global approach needs to be considered. As of now, the U.S. is the only country that mandates accessibility for anyone doing business with the government. Of course, that includes most higher education institutions. Meeting accessibility guidelines for most situations means adding descriptive tags to any image and text links for audio or video files. Anyone, anywhere can use the Bobby site to check for these simple things. Having accessibility sites makes good economic sense as the number of individuals with disabilities on the Net—who could emerge as consumers of vast numbers of products—continues to increase.

... In postsecondary education, we can no longer afford to participate in ad-hoc systems that create individual accommodations for fair and reasonable access. A priori system must be created to optimize the participation of all students... The community of postsecondary education is resourceful group of individuals. It is imperative that we create coordinated systems that enable full access for students... It is important to note systems change is a slow and, at times, painful process. However, the work must be done. The sooner we create and implement sustainable solutions, the sooner ALL students can participate in their right to experience the power of the Internet for lifelong learning.

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The Need for Assistive Technology in Educational Technology

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ABSTRACT

This paper will address definitions, services, levels of technology and application of assistive technology concepts as they relate to education. An overview of the NCATE and ISTE guidelines concerning assistive technology, and the current elements of the graduate educational degrees concerning assistive technology is provided. Federal legislation concerns the application of assistive technology in an educational setting and its possible impact on educational technologists. A model is proposed for a course concerning assistive technology and universal design to better prepare instructional technology graduates to enhance the performance of students with disabilities and design educational material for increased accessibility. This session is intended for educators in instructional technology and exceptional education programs.
The Need for Assistive Technology in Educational Technology

Disabilities rights leaders have said that the application of technology will be the equalizer of the 21st century (Flippo, Inge, & Barcus, 1995). Through the use of assistive technology (AT) devices, many students can decrease their isolation and become an important part of a regular classroom, their least restrictive environment. Assistive technology is a basic tool in the educational process for any individual who may experience a disability. Technology that is used as tool in education is the basic definition of educational technology.

This paper will address assistive technology and services, overview the current elements of the graduate educational degrees, and present a model for including assistive technology to better prepare instructional technologists to participate and enhance the performance of students with disabilities.

What is Assistive Technology?

The Technology-Related Assistance for Individual with Disabilities Act of 1998 (PL 100-407) gave us the first legal definition of assistive technology devices and services. An assistive technology device was defined as "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 individuals with disabilities." An assistive technology service was described as "any service that directly assists an individual with a disability in selection, acquisition or use of an assistive technology service."

What are the Levels of Assistive Technology Use?

In considering assistive technology, you must consider the environment, the individual, and the characteristics and levels of the technology (Gitlow, 2000). Assistive technology may be classified as high-, middle-, or low-tech. The concept of a high technology device usually includes items that require computers, electronics or microchips to perform a function. Low technology usually does not require an outside power source. An example of high technology is a computer. An example of the application of technology could range from having a computer read a book (high tech) to printing out the material in a larger font to the student using a magnifying glass (low tech), to reading the required material.

Along with considering the level of the technology, consider the levels of how the necessary assistive technology item will be applied. The levels in applying the assistive technology application include whether the item is personally, developmentally, or instructionally necessary (Judd-Wall, 1999). Personally necessary refers to assistive technology devices that are for use by an individual student, such as a pair of color-blind glasses to enable learners to more effectively interact with their environment. Developmentally necessary devices may be shared among individuals. These devices help meet an educational need based on a developmental delay, which ideally would be improved, eliminating the need for the item in an individual's future. Lastly, instructionally necessary devices are those that modify the instructional process at a course or grade level, and do not need to be moved with the user as they progress to the next level.

What is Educational Technology?

Educational or instructional technology can be hard to define. At its simplest, it can be the application of technology in teaching or education, but many feel that it is much more than that. Perhaps the most encompassing definition is from University of North Carolina Media Services (1997), which states that
educational technology "is the application of research, learning theory, emergent technologies, and child and adult psychology to solving instructional and performance problems." The Presidential Commission on Instructional Technology highlighted four areas in which educational technologists perform: 1) design of instruction, 2) production of instructional products and services, 3) management of instruction, and 4) evaluation of instruction.

Assistive Technology in the Graduate Educational Technology Program

The National Council for Accreditation of Teacher Education (NCATE) accreditation, in association with the International Society for Technology in Education (ISTE), requires that assistive technology be addressed within such programs as educational computing and technology leadership. The guidelines and standards for those programs state that a graduate of such a program should "demonstrate awareness of resources for adaptive assistive devices for students with special needs." A graduate should also be able to "identify and classify adaptive assistive hardware and software for students and teachers with special needs and locate sources to assist in procurement and implementation" (National Council for Accreditation of Teacher Education [NCATE], 2000).

However, assistive technology is, for the most part, only discussed as a small component of other technology integration classes, or is thought of as being part of the "special education" section. There exists the need for the addition of a course devoted to the application of assistive technologies and awareness of the possible limitations of users and universal design in the design of instruction in a graduate educational or instructional technology program.

A review was conducted of instructional and educational technology programs within the colleges of education across Florida's state university system. According to the published programs of study, none of the state colleges of education were offering a course specifying assistive technology in its title or available description. A similar limited review was conducted of universities nationwide that offered graduate programs in educational or instructional technology. From this survey, it was found that less than 20% of the colleges offered an educational technology degree provide courses focusing on assistive technology.

Impact on Instructional Technologists

As part of the federal IDEA amendments, there are statements that now require assistive technology devices and services to be considered on an individualized basis and become a part of the individual education plan (IEP) if the child needs them to benefit from his educational program. Based on NCATE accreditation requirements, it would be reasonable for a school administrator to expect that an educational or instructional technology graduate from an NCATE accredited program would be able to effectively participate on a student's IEP team. These expectations would include that such a graduate be able to make effective judgments and recommendations concerning assistive technology.

Assistive Technology Course Development

With the rapidly aging population of the United States and their growing need for assistive technology and universal design, along with the concept that to receive federal funding organizations must be IDEA compliant, there exists a need to provide instruction on assistive technologies and methodology to make technology products such as computer programs and web pages handicapped accessible.
To provide more extensive experience and education to instructional and educational technology specialists concerning assistive technology, a course should be devoted to the presentation of the basic concepts and applications of assistive technology. This course could be offered as a required course in the current university master’s instructional technology programs and as an elective in its masters of education or exceptional education programs. The NCATE and ISTE standards state that for initial certification, a teacher should "demonstrate awareness for resources for adaptive assistive devices for students with special needs." These standards would be well met by such a course. The technologies and strategies presented in a course concerning the application of assistive technology would also address many of the other NCATE guidelines associated with such a specialty program as educational computing and technology leadership.

An assistive technology course could be designed as an introductory or survey course in the application of technology as assistive and adaptive devices. This course could present strategies for students who are physically or mentally impaired, and may be in a mainstreamed situation. The purpose of the course material is to learn about and use technologies to overcome handicaps and improve functionality. Course topics could include: basics of assistive technology; legal/ethical issues associated with assistive technology; assistive technology and the individual education plan (IEP); levels of assistive technology; technology adaptations; Windows and Macintosh built-in accessibility tools; text-to-speech and speech-to-text; universal design and the Internet; and physical and learning disabilities. An additional facet of such a course should also be designing material to be universally accessible, covering such topics as making web pages more accessible and designing multimedia to overcome user handicaps. The assessments and activities of the course should include hands-on experiences with assistive technologies.

In preliminary discussions with professionals in the assistive technology community, I found that such a course would be appreciated. Course delivery through distance learning would be preferred. I found many potential students who are interested in taking such a course, but who were unable to travel to a university. As an educational technology program course, it would have an added benefit as a recertification course for ESE professionals and general teachers.

Selected References


Distance Learning 
Universal Design, Universal Access

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ABSTRACT

Distance learning courses offer opportunities for education and career enhancement for those who have access to the technologies they employ. However, many people find themselves on the wrong side of the digital divide that separates those with access to new technologies and those without. Even if they have access to these technologies, some people with disabilities find themselves on the wrong side of a second digital divide that is caused by the inaccessible design of coursework. This paper discusses access, legal and policy issues, and it presents an overview of design considerations for assuring that a distance learning course is accessible to potential instructors and students with a wide range of abilities and disabilities. The field of universal design provides a framework for this discussion. The content of this article can be used to help distance learning programs develop policies, guidelines and procedures for making their courses accessible to everyone.

I proudly submitted my newly punched deck of cards to the computer operator in the sterile computer room at the University of Washington. The next day, I picked up my cards with a printout of the successful run of my first FORTRAN program. It worked! I was a math major. Computers solved math problems. Wasn't that enough?

Not today. Together with networking and other advanced technologies, computers allow us to shop, participate in the community, learn about almost anything and communicate with friends and colleagues anywhere at anytime. We have yet to see a limit to the uses for these ubiquitous tools.

In no area of education do we see a greater impact of technology than in the field of distance learning. Offering instruction at a distance is not new. Correspondence courses using printed material have brought together instructors and students separated by great distances for hundreds of years. Televised courses have been broadcast since the early days of television. Some interactive televised courses now bring instructors at one location together with students in several specially equipped classrooms. Online courses, once delivered using only e-mail, are now dominated by web-based instruction. Today, multiple modes of delivery blur the lines between different types of distance learning. For example, the content of a course may be delivered using printed materials and television; course discussion may occur using e-mail; a weekend retreat may bring participants
together face-to-face, and resources may be provided on the World Wide Web. These options make learning available to anyone, anywhere at anytime. Well, almost anyone.

Some people find themselves on the wrong side of the "digital divide" between the technology "haves" and "have-nots." Computer-based information, communication, services and instruction are less available to those who are poor, live in rural areas, are members of minority racial/ethnic groups, and/or have disabilities (National Telecommunications and Information Administration, 1999; Kaye, 2000). Without access to new technologies, their options for taking courses, teaching courses and pursuing careers are limited. But simple access to technology is not enough. Within the group of "haves," people with disabilities face a "second digital divide." This line separates people who can make full use of the technological tools, services and information to which they have access, from those who cannot. Too often, people with disabilities who are on the right side of the first digital divide, still find themselves on the wrong side of this second digital divide (Waddell, 1999).

ACCESS CHALLENGES FOR PEOPLE WITH DISABILITIES

The rapid development of assistive technology makes it possible for individuals with a wide range of disabilities to gain access to computers, networking and telecommunications technologies and multimedia products (Closing the Gap, 2001). However, barriers to these technologies persist for people with some types of disabilities. The next few paragraphs provide examples of access challenges faced by students and instructors in distance learning courses. It is followed by a summary of legal issues, a discussion of principles of universal design, examples of strategies for making distance learning courses accessible to people with disabilities and a list of policy considerations. The content of this article can be used to help distance learning programs develop policies, guidelines and procedures for making their courses accessible to everyone.

Mobility Impairments

For some people, mobility impairments affect their ability to move their hands. To access a computer and the Internet, they use alternative keyboards and mice, speech control and other input devices to operate navigational tools and access Internet-based course materials. Some students and instructors with mobility impairments do not have the fine motor skills required to select small buttons on the screen. And, if their input method is slow, they cannot effectively participate in real-time "chat" communications. Some students and instructors require wheelchair-accessible locations to attend on-site meetings required in some distance learning courses.

Visual Impairments

Individuals who are blind often use computers equipped with screen reader software and speech synthesizers. With a synthesized voice, this system reads whatever text appears on the computer screen. They may use a browser that only reads text presented on the World Wide Web or they may use a multimedia browser with the graphics-loading feature turned off. This type of system cannot interpret graphics. For example, a speech synthesizer may simply say "image map" at the place where an image map would be displayed to someone using the full features of a multimedia Web browser. Text alternatives to graphic images need to be provided at a web site for blind students and instructors to make sense of the content. Printed materials, videotapes, televised presentations and other visual materials also create access challenges for some students enrolled in distance learning courses; tactile materials, audio presentations and electronic text may be required.

Students who are not blind but have limited vision may use special software to enlarge screen images. They view only a small portion of a standard screen page at a time. Consequently, web
pages that are cluttered and page layouts that are not consistent from page to page can make navigating web sites and understanding content difficult. Printed materials in standard font sizes may also be inaccessible to students with visual impairments. People who are colorblind encounter barriers erected by coursework that requires that they be able to distinguish one color from another to navigate the site or understand the web content.

Learning Disabilities

Some specific learning disabilities impact the ability to read, write and/or process information. Some students with learning disabilities that affect their ability to read use audiotaped books. For some, speech output and/or screen enlargement systems similar to those used by people with visual impairments help them read text on a computer screen. People with some learning disabilities have difficulty understanding web sites when the information is cluttered and the screen layout changes from one page to the next.

Hearing Impairments

Most Internet resources do not require the ability to hear and are, therefore, accessible to people who are deaf or hard of hearing. However, when web sites include audio output without providing text captioning or transcription, individuals with hearing impairments cannot access the content. The audio content of videotapes that are not captioned is also inaccessible to individuals who are deaf. Deaf students may also be unable to participate in audioconferencing—where several individuals communicate using the telephone at the same time—or videoconferencing sessions unless sign language interpreters or other accommodations are provided.

Speech Impairments

E-mail and other modes of communication that do not require the ability to speak are fully accessible to students with speech impairments. However, they may not be able to effectively participate in audioconferences that are part of a distance learning course.

Seizure Disorders

Some attention-grabbing features of web pages include flashes or flickers. Flashes at certain rates (often between 2 to 55 hertz) can induce seizures for people who are susceptible to them (Architectural and Transportation Barriers Compliance Board, 2000).

LEGAL ISSUES

Even assuring that individuals with disabilities can participate in distance learning courses, programs not covered by Section 508 can be argued on ethical grounds (Woodbury, 1998). Many people agree that it is simply the right thing to do. Others are more responsive to legal mandates (Waddell & Thomason, 1998).

Section 504 of the Rehabilitation Act of 1973 (U.S. Department of Education, 1973), although it did not specifically address access to technology-based educational offerings, mandated that qualified people with disabilities have access to programs and services that receive federal funds. The Americans with Disabilities Act (ADA) of 1990 reinforced and extended Section 504, requiring that people with disabilities have access to public programs and services, regardless of whether or not
they are federally funded (U.S. Department of Justice, 1990). According to this law, no otherwise qualified individuals with disabilities shall, solely by reason of their disabilities, be excluded from the participation in, be denied the benefits of or be subjected to discrimination in these programs and services, unless it would pose an undue burden to do so. A United States Department of Justice ruling (ADA accessibility, 1996) clarified that the ADA accessibility requirements apply to programs offered on the Internet. It stated, "Covered entities that use the Internet for communications regarding their programs, goods or services must be prepared to offer those communications through accessible means as well." Specifically, if qualified individuals with disabilities enroll in distance learning courses, these courses must be made accessible to them.

Section 508, which was added in 1986 to the Rehabilitation Act of 1973 and amended in 1998 (U.S. Department of Education, 1998), requires that electronic and information technologies that federal agencies procure, develop, maintain and use are accessible to people with disabilities, both employees and members of the public, unless it would pose an undue burden to do so. The Rehabilitation Act Amendments of 1998 required the U.S. Architectural and Transportation Barriers Compliance Board (Access Board) to develop electronic and information technology accessibility standards to which Federal agencies must comply. The standards provide criteria that determine whether a product is "accessible" (Architectural and Transportation Barriers Compliance Board, 2000). Although the law directly applies to federal agencies, "states which receive federal funds under the Technology Related Assistance for Individuals with Disabilities Act of 1988 are required by that Act to comply with Section 508" (Waddell & Urban, 2001; U.S. Department of Education, 1998).

Even for distance learning programs not strictly required to comply with Section 508, the accessibility standards developed for the federal government can serve as a model as they develop their own policies and guidelines for accessibility. These programs can also benefit from following the leadership of the federal government in being proactive rather than reactive regarding accessibility issues. This is because some people with disabilities, even if they use assistive technology, cannot access the content of electronic and information technology products—World Wide Web pages, video clips—if they are not designed to be accessible to them. "Use of an 'ad hoc' or 'as needed' approach to IT accessibility will result in barriers for persons with disabilities. A much better approach is to integrate accessibility reviews into the earliest stages of design, development and procurement of IT" (U.S. Department of Justice, 2000).

UNIVERSAL DESIGN OF DISTANCE LEARNING COURSES

Potential students and instructors may have mobility, visual, hearing, speech, learning and other types of disabilities that could impact their participation in many distance learning classes as they are currently designed. For example, people who are blind might apply to teach a Web-based writing course that has been developed without text alternatives for critical content displayed using graphics; if one of them is the best candidate for the job, the program will need to be modified for that person to teach it. Clearly, planning for access as courses are being developed is easier—and therefore less expensive—than developing accommodation strategies once a student with a disability enrolls in or a person with a disability applies to teach a course.

Simple design decisions can be made to assure that a course is accessible to students and instructors with a wide range of abilities and disabilities. This process is called "universal design." Universal design is defined by the Center for Universal Design at North Carolina State University as "the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design." (http://www.design.ncsu.edu/cud/univ_design/ud.htm) At the Center, a team of architects, product
designers, engineers and environmental design researchers established a set of principles of universal design to provide guidance in the design of environments, communications and products. General principles include: the design accommodates a wide range of individual preferences and abilities; the design communicates necessary information effectively, regardless of ambient conditions or the user's sensory abilities; the design can be used efficiently and comfortably, and with a minimum of fatigue; and appropriate size and space is provided for approach, reach, manipulation and use regardless of user's body size, posture or mobility (Anders & Fechtner, 1992).

People with a wide variety of characteristics can use the products developed when designers apply universal design principles. These characteristics include height, age, race, ethnicity, gender, native language and level of ability to hear, see, move and speak. When the wide range of characteristics of potential students and instructors is considered, distance learning course designers create learning environments where all qualified individuals can fully participate, just as architects design buildings that can be used by everyone, including those who walk with crutches, push baby strollers and use wheelchairs.

Applications of universal design to instruction in general have recently appeared in traditional print media (Bar & Galluzzo, 1999; Bowe, 2000). Most articles and books about distance learning, however, do not cover universal design principles nor address access issues for students and instructors with disabilities (Schmetzke, 2001). However, there are few exceptions (Burgstahler, 1997). The greatest number of articles that focus on the application of universal design to web pages appear in library publications (Schmetzke, 2001). Only a few published works that discuss access issues for people with disabilities cover a wide range of technologies and strategies currently used in distance learning courses (Burgstahler, 2000; Kessler & Keefe, 1999). Comprehensive policies, such as the mandate that distance learning options offered by California Community Colleges must afford students with disabilities maximum access (California Community Colleges Chancellor’s Office, 1999) are rare. Few colleges and universities have policies and guidelines that specifically address the accessibility of distance learning tools and resources; most who have guidelines at all deal only with the accessibility of web pages. Not surprisingly, many college, university, library, and other educational web pages are not universally accessible (Schmetzke, 2001).

It is unlikely that a distance learning course will be accessible to students and instructors with a broad range of abilities and disabilities unless the universal design of its media and technological tools is considered as the course is being developed. The following sections provide examples of considerations for making distance learning accessible to everyone. They will help distance learning course designers begin to think about access issues as they develop their courses. Policy considerations follow.

**On-Site Instruction**

The weekend retreats, interactive video sessions and proctored examinations required in some distance learning courses demand that students and instructors attend on-site meetings. In these cases, care should be taken to assure that facilities are wheelchair accessible; that furniture is flexible enough to accommodate wheelchair-users; and that nearby restrooms, telephones and parking spaces are accessible to individuals with disabilities. Instructors should speak clearly and face students who might be lip reading. They should read aloud and describe text and other visual materials for students who cannot see them. All other standard accommodations, such as sign language interpreters and printed materials in alternative format, should be provided upon request.

**Electronic Communication**
Text-based resources such as Usenet discussion groups, bulletin boards, e-mail, and distribution lists are fully accessible to students with disabilities, regardless of the assistive technology they use. If a prerequisite to a course is for students to have access to e-mail, then participants can choose to use any software that supports e-mail on the Internet. Therefore, computer access issues that students with disabilities might face have already been resolved before enrolling in the course. Their own computer systems, perhaps including assistive technology, provide whatever accommodations they need to communicate via e-mail. Communication via e-mail between individual students and course administrators, instructors and fellow students is accessible to all parties, regardless of disability. The syllabus, lessons, assignments and announcements can be delivered using e-mail and "guest speakers" with disabilities can join e-mail-based course discussions without concern about disability-related access issues.

Some distance learning programs employ real-time "chat" communication in their courses. In this case, students communicate synchronously—at the same time, as with telephone communication—as compared with asynchronously—not necessarily at the same time, as is the case with e-mail. Synchronous communication imposes scheduling challenges and is difficult or impossible to use by someone whose input method is slow. For example, those with limited hand use who can only type characters slowly or those with a learning disability who take a long time to compose their thoughts may not be fully included in the discussion. Instructors who choose to use a synchronous tool of this type should be prepared to provide an alternative means of participation, such as e-mail, where all students and instructors can fully participate.

Web Pages

When universal design principles are applied in their design, web pages are accessible to students and instructors using a wide variety of assistive technology. The Web Accessibility Initiative (WAI) of the World Wide Web Consortium (W3C), an industry group that develops common protocols that enhance interoperability and guide the evolution of the Web, developed Web Content Accessibility Guidelines (1999) for designing web pages that are accessible to people with disabilities (Chisholm, Vanderheiden, & Jacobs, 1999). More recently, in response to Section 508 legislation, the Access Board created a list of standards for making web pages accessible (Architectural and Transportation Barriers Compliance Board, 2000). Web pages created by and used by the federal government must meet these access requirements. Although not all distance learning programs must comply with these standards, they provide a good model for the design of accessible web-based materials.

To create pages that are accessible to everyone, developers must either avoid certain types of inaccessible features or formats or create alternative methods for carrying out the functions or accessing the content provided through an inaccessible feature or format. For example, providing "alt" tags with descriptive text makes graphics accessible to individuals who are blind. Avoiding page elements that flicker between the 2 and 55 hertz range minimizes the likelihood of inducing seizures (Architectural and Transportation Barriers Compliance Board, 2000). Web pages for a distance learning class should be tested with a variety of monitors, computer platforms and web browsers, including text-only browsers and multi-media browsers with graphics and audio-loading features turned off. If the web pages still make sense, then most people with sensory impairments can read them, too. Another good accessibility test is to determine if all functions at a web site can be accessed using a keyboard alone. Web sites can also be tested for accessibility using HTML validator programs such as Bobby (Center for Applied Special Technology, 2002).

Printed Materials
Students who are blind or who have specific learning disabilities that affect their ability to read may require that printed materials be converted to Braille, large print, audiotape or electronic formats. Making the text of printed materials available online may provide the best solution for students who have access to the Internet. Their computer-based screen enlargement, Braille and speech output systems can then convert the text to their preferred format. Graphics and pictures need to be described using text or presented in tactile form for students who are blind.

**Videotapes, Video Clips, Televised Video, and Interactive Video**

Ideally, whenever videotapes, video clips or televised presentations are used in distance learning courses, captioning or transcription is provided for those who have hearing impairments. Likewise, audio description- aural description of the visual content-should be provided for those who are blind. If the publisher of a videotape does not make these options available, the distance learning program should have a system in place to accommodate students who have sensory impairments. Obtaining a transcript of the content in an accessible format from the publisher is one option that should be considered. This option may be less expensive than hiring someone local to a blind student to describe visual material or arranging for a sign language interpreter to describe audio material for a student who is deaf. Real-time captioning-developed at the time of the presentation-or sign language interpreting should be provided when requested by deaf participants attending videoconferences. Speakers in videoconferences should also be careful to fully describe visual materials for students who cannot see them.

For video and multimedia products, distance learning programs can use the policy of the federal government as a model. Section 508 guidelines state: "All training and informational video and multimedia productions which support the agency's mission, regardless of format, that contain speech or other audio information necessary for the comprehension of the content, shall be open or closed captioned. [Note: Open captioning means the captioning appears on the media at all times; closed captioning requires special equipment that is standard on new televisions.] … All training and informational video and multimedia productions which support the agency's mission, regardless of format, that contain visual information necessary for the comprehension of the content, shall be audio described." (Architectural and Transportation Barriers Compliance Board, 2000)

**Audioconferencing**

Audioconferencing is used in some distance learning courses for communication in small groups. Without accommodation, this mode of communication is inaccessible to students who are deaf. One option for including a deaf student in an audioconference is to provide him with a speakerphone and a sign language interpreter at his location. Using the public relay service-where a hearing person translates voiced content and transmits it to the deaf student via a TTY text device; the student who cannot speak can also submit text for the relay worker to voice to the group-may work in some situations. However, this method is often too slow to allow the student to fully participate. When audioconferencing is available for small group discussions in a distance learning course, it is desirable to give students an alternative method-for example, to conduct the discussion online-that is accessible to everyone in the group.

In all cases, when access barriers occur, an instructor should consult with the student about the best accommodation for him. Students with the same disability may require very different accommodation options.

**Benefits of Accessible Design to People without Disabilities**
People without disabilities may have situational limitations that are similar to the limitations imposed by disabilities. For example, a student for whom English is a second language experiences reading challenges similar to those experienced by people with specific learning disabilities; a distance learning instructor working late at night may prefer a noiseless system while other members of the household are sleeping, creating a situation similar to that experienced by people who are deaf; a student who cannot access graphics because of computer system or Internet connection limitations faces challenges similar to those who are blind.

Applying universal design principles assists many people without disabilities. For example, using clear and simple language and navigational mechanisms on web pages benefits students and whose primary language is not the one in which the course is taught. Captions provided for pictures and video clips on web pages assist people who work in environments that are noisy or noiseless and people for whom English is a second language. People with slow Internet connections, who use older equipment or who have turned off support for images on their browsers to maximize access speed benefit when text alternatives are provided for content presented using multimedia. Similarly, speech output systems benefit people operating computers in the dark and those who cannot view the screen because they must attend to other tasks. Making sure that information conveyed with color is also available without color benefits students who use monochrome monitors. Providing multiple formats to present content addresses the needs of students with a variety of learning styles.

DEVELOPING A DISTANCE LEARNING ACCESSIBILITY POLICY

Programs that offer distance learning options should develop policies and procedures that assure that their offerings are, as legally required, accessible to individuals with disabilities. Libraries, university departments, museums and other groups who offer content used in instruction should take steps to assure that their materials are accessible. It is difficult to develop policies in an area where technological changes occur constantly. How can an organization begin the process of developing its policies, procedures and guidelines? Considerations should include the following.

- Make sure that all stakeholders, including potential students and instructors with disabilities, are represented as accessibility policies, procedures and guidelines are being developed.
- Review policies and guidelines that have been created by other organizations, such as the California Community Colleges.
- Develop a policy statement that commits the organization to making programs, services and resources accessible to people with disabilities.
- Articulate access challenges that may face potential participants with disabilities in the context of the programs, services and/or resources offered and the tools used for their delivery.
- Consult with legal experts to fully understand the requirements for program, information, and service accessibility mandated by the ADA and other legislation relevant to your organization.
- Develop guidelines for all media, tools and strategies used in the distance learning courses; consider Section 508 standards as a model as appropriate.
- Assign a person or a department within the organization to be responsible for updating disability-related program access policies and guidelines and assuring compliance throughout the organization.
- Disseminate accessibility policy, guidelines and procedures throughout the organization.
- Provide regular training and support regarding accessibility issues.
- Consider developing a plan to phase in compliance with program accessibility guidelines for previously developed courses, with a date at which all programs will be compliant.
- Regularly evaluate progress toward accessibility.
- Besides taking proactive steps to assure accessibility, develop procedures for responding quickly to requests for disability-related accommodations.
CONCLUSION

Punch cards are long gone. Computers still solve math problems. But they do so much more. Let's make sure that they do as much for people with disabilities as they do for others. Designed correctly, distance education options create learning opportunities for everyone. Designed poorly, they erect barriers to equal participation in academics and careers for potential students and instructors with disabilities. Employing universal design principles as we create technology-based distance learning courses can bring us closer to making learning accessible to everyone, everywhere, at any time. Together, we can eliminate the second digital divide.

REFERENCES


**RESOURCES**

To learn more about creating accessible distance learning courses, the following resources provide a good place to start.
Americans with Disabilities Act ADA Home Page
http://www.usdoj.gov/crt/ada/adahom1.htm

Captioned Media Program
www.cfv.org

Center for Applied Special Technology (CAST) Universal Design for Learning
http://www.cast.org/udl/

The Center for Universal Design
http://www.design.ncsu.edu/cud/index.html

Closing the Gap
http://www.closingthegap.com

DO-IT
http://www.washington.edu/doit

EASI (Equal Access to Software and Information)
http://www.rit.edu/~easi

Falling Through the Net
http://www.digitaldivide.gov

International Center for Disability Resources on the Internet
http://www.icdri.org

The Internet Lawyer
http://www.internetlawyer.com/

National Center for Accessible Media (NCAM)
http://main.wgbh.org/wgbh/pages/ncam/

National Center for the Dissemination of Disability Research
http://www.ncddr.org/

Recordings for the Blind and Dyslexic
http://www.rfbd.org/

Trace Research and Development Center
http://www.trace.wisc.edu/world/

Web Accessibility Initiative of the World Wide Web Consortium
http://www.w3.org/WAI/

WebABLE
http://www.webable.com/

Section 504 of the Rehabilitation Act
http://www.ed.gov/offices/OCR/docs/auxaids.html
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Author Bio

Dr. Sheryl Burgstahler directs project DO-IT (Disabilities, Opportunities, Internetworking and Technology) at the University of Washington. DO-IT promotes the success of students with disabilities in postsecondary programs and careers. DO-IT employs technology to help young people with disabilities achieve success in postsecondary education and careers. It sponsors programs that increase the use of assistive technology and promote the development of accessible facilities, computer labs, electronic resources in libraries, Web pages, educational multi-media and Internet-based distance learning programs. DO-IT has been the recipient of many awards, including the National Information Infrastructure Award in Education, The President's Award for Mentoring, the Golden Apple Award in Education, and the AHEAD Program Recognition award. DO-IT is funded by the National Science Foundation, the U.S. Department of Education, the State of Washington, corporations, foundations and private donors.

Dr. Burgstahler has published dozens of articles and delivered presentations at national and international conferences that focus on the full inclusion of individuals with disabilities in postsecondary education, distance learning, work-based learning, and electronic communities. She is the author or co-author of six books on using the Internet with pre-college students. Dr. Burgstahler has extensive experience teaching at the pre-college, community college, and university levels. She is Assistant Director of Information Systems and Affiliate Associate Professor in Education at the University of Washington. Her Ph.D. Dissertation was on computing services for students with disabilities in higher education.

Web Design for Accessibility: Policies and Practice

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An essential part of web design today is designing for individuals with disabilities. Many government and educational institutions now require that all web pages follow accessibility guidelines established by the World Wide Web Consortium (http://www.w3.org/WAI/wcag-curric) and specified in Section 508 of the Federal Rehabilitation Act (http://www.section508.gov). As more and more facets of our lives become tied to Internet technologies, it is important that those involved with the placement of
information on the Internet consider the obstacles faced online by individuals with disabilities and design with those obstacles in mind.

This article outlines a process-based approach to accessibility policy implementation. This process consists of several steps ranging from identification of applicable standards to final implementation. Identification and adoption of accessibility standards involves determining which standards apply to a given organization and adopting those standards, organization-wide. Validation is the evaluation of the site in terms of the standards adopted. Establishing an approach involves selecting the tools and techniques necessary given the needs and experience in the organization. Implementation is the final step integrating standards, tools and training.

**Accessibility: A Broad View**

An essential component to any accessibility plan is an understanding of the issues relevant to individuals with disabilities, the benefits of accessible design and the importance of accessibility. This section is intended to provide a brief overview of the challenges faced by individuals with disabilities using the Web and designers striving to create more accessible pages.

The definition of accessibility used in this article has three parts: access to electronic information; the nature and scope of disabilities that affect individuals accessing web content; and a brief description of the assistive technologies used by individuals with disabilities.

Accessibility simultaneously describes two processes: first, the ability of the user to access information electronically; and second, the efforts made by the designer to enable a page to function with the assistive devices used by individuals with disabilities.

For the user, the challenge of accessibility is to identify the tools that will provide the most convenient access to web-based and other electronic information. For the designer, the challenge of accessibility is to remove the obstacles that prevent these tools from functioning properly. In many cases, these challenges are relatively simple to overcome; others require a bit more thought and effort.

Disabilities are broad and difficult to categorize. However, it is important to provide some sense of the scope of the issue. A 1997 report by the U.S. Census Bureau ([http://www.census.gov/hhes/www/disable/sipp/disab97/ds97t1.html](http://www.census.gov/hhes/www/disable/sipp/disab97/ds97t1.html)) categorized 19.6% of the U.S. population as having some sort of disability. Within that group are individuals with visual impairments, hearing impairments, cognitive impairments and motor impairments. Each category describes a much wider range of conditions. For example, vision impairments include limited vision, color blindness, and blindness. These categories may also describe temporary disabilities. For example someone with a broken wrist may have difficulty using a mouse, but still needs access to the Web to meet the day-to-day requirements of their job. At the same time, statistics about individuals with disabilities may be misleading. As we get older, most of us will face a disability of some kind. While on the whole, nearly 20% of the U.S. population has a disability, these numbers get higher as the population ages (see Table 1). For example, almost 75% of the population over 80 years old has a disability. Thus, accessibility is about more than just opening doors, it is also about keeping them open. Accessibility allows us to maintain a level of independence that age and disability would likely otherwise make difficult.

**PREVALENCE OF DISABILITY BY AGE: 1997**

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Number w/ Disability</th>
<th>Percent w/Disability</th>
</tr>
</thead>
<tbody>
<tr>
<td>All ages</td>
<td>267,665,000</td>
<td>52,596,000</td>
<td>19.60%</td>
</tr>
<tr>
<td>Under 15 years</td>
<td>59,606,000</td>
<td>4,661,000</td>
<td>7.80%</td>
</tr>
</tbody>
</table>
Users with disabilities frequently rely on hardware and software to successfully interact with web content. These tools, otherwise known as assistive technologies, range from screen readers to touch screens and head pointers.

Blind users of the Web frequently use software called a screen reader to read the contents of a web page out loud. Screen readers allow users to hear the contents of a web page rather than read them. However, a screen reader can only read text, not images or animations. Thus, it is important that images and animations have text descriptions associated with them for a screen reader to use. This text is called alternative text, or "alt" text. Two common screen readers are JAWS from Freedom Scientific and Home Page Reader from IBM.

Touch screens and head pointers replace the functionality of a mouse for users with mobility issues. These tools allow users with little or no use of their hands to interact with the computer. A user operates a stick or other implement to activate links, complete forms or write e-mail on the keyboard or touch screen. In these cases, it is very important that essential components of the page work without a mouse. Rollovers, dropdown menus and interactive simulations are all examples of elements that are typically dependent on the mouse for user interaction. Testing a page for use without a mouse is quite simple. In Internet Explorer, pressing the Tab key moves the focus of the browser between links on the page. Pressing the Enter key activates links much like clicking a mouse. Testing a page with these two keystrokes provides a quick and easy test of a page's reliance on a mouse.

Accessibility Standards

Accessibility standards help web designers identify and address these issues. The World Wide Web Consortium's (W3C) Web Content Accessibility Guidelines (WCAG: http://www.w3.org/TR/WCAG10) were the first major effort to establish guidelines for design. This standard consists of 14 guidelines, each with three levels of checkpoints. Priority One checkpoints are those that the web developer must satisfy to insure that the page itself is accessible. Priority Two checkpoints are those that the web developer should satisfy to ensure that certain groups will be able to access information on the web page. Priority Three checkpoints are those the web developer may do to ensure that all content on the page is completely accessible.

National standards to emerge later include Section 508 of the Federal Rehabilitation Act in the U.S., Common Look and Feel in Canada and Guidelines for UK Government Websites in the United Kingdom (http://www.nics.gov.uk/bds/isservices/wads/pubs). The U.S. standard is based on Priority One Checkpoints from the WCAG. The Canadian and UK standards are based on Priorities One and Two from the WCAG.

The Importance of Accessibility

Accessibility is an immensely important effort for a number of reasons. First, accessibility is the right thing to do. It serves to open doors for individuals with disabilities in ways that were not previously possible. Second, it is the law in many institutions. Third, accessibility offers benefits for all users by
creating more usable web sites. Fourth, accessible design is based on more contemporary architecture and design that allow for greater flexibility across a site. Fifth and finally, accessibility represents a growing market in need of software, hardware and design.

**Accessibility is the right thing to do**

Accessibility represents an important step toward independence for individuals with disabilities. Accessible web pages provide access to fundamental government services and information such as tax forms, social programs and legislative representatives. Accessible web pages provide access to a broader range of employment and educational opportunities by providing individuals with other means of communicating via distance or face-to-face. Accessible web pages allow users with disabilities to participate in day-to-day activities many of us take for granted, such as reading a newspaper or buying a gift for a loved one.

**Legal and policy mandates**

With new federal requirements in the U.S, Canada, the European Union and more to come in the near future, there are numerous legal mandates for accessibility. Over time, these policies are sure to expand in scope. In the United States, for example, Section 508 of the Federal Rehabilitation Act sets standards for web pages designed or maintained by federal agencies (http://www.section508.gov). State and local governments, as well as educational and non-profit institutions around the country, are contemplating accessibility policies of their own. For example, in January of 2001, the University of Wisconsin-Madison adopted an Accessibility Policy (Vanderheiden, 1990) that requires all pages published or hosted by the University conform to all Priority One and Two checkpoints of the WCAG.

**Accessibility benefits all**

As with many improvements intended for individuals with disabilities, the enhancements of accessible design offer benefits for all users of the Web. Anyone who has pushed a shopping cart out of a grocery store can attest to the value of automatic doors and ramps cut into curbs. Similarly, accessible Web design creates pages that are often easier more readable, easier to navigate and faster to download. This allows for a larger participating audience of more people in more situations.

**Innovative technology**

Accessible design is based on the premise that pages must work with browsers other than Netscape Navigator or Internet Explorer. A page must be accessible whether using a screen reader, refreshable Braille display or a head pointer. At the same time, this often makes the same pages available to other consumer Internet devices such as WAP-enabled phones or hand held PDAs.

The techniques of accessibility are based on more contemporary technologies and design strategies. Older, static HTML designs often intermix the content on pages with the formatting. Accessibility guidelines encourage formatting to be separated from content using Cascading Style Sheets (CSS). This allows more flexible uses of content and easier implementation of more powerful dynamic models.

**Identification and Adoption**

The identification and adoption phase is a first step in the larger process of implementing an accessibility policy. In this phase, the process includes determining what standards and guidelines
govern the organization, developing local and subjective standards, and identifying individuals to coordinate compliance efforts within the organization.

To begin this process, one should identify the standard that will need to be met. In some cases this standard may be legislative, and in other cases the standard may be developed locally in advance of any legislative or organizational mandate.

**Federal Standards - Section 508**

The regulations referred to as Section 508 are actually an amendment to the Workforce Rehabilitation Act of 1973. Section 508 requires that electronic and information technology that is developed or purchased by the federal government is accessible by people with disabilities.

All federal agencies are required to comply with Section 508. Of course there are exceptions to these standards. Exemptions may include small purchases of less than $3,000, national security systems, and situations where conformance to the law would impose an 'undue burden.' It should be noted that it is typically very difficult to qualify for one of these exemptions.

Section 508 does not directly apply to the private sector. While many institutions have adopted the standard outlined in Section 508 as part of their accessibility policy, they are not required to do so under the current law. However, there is widespread expectation that similar laws may be passed in the future regarding the publication of web sites in organizations that receive federal funds. Predicting future legislation is a tricky endeavor at best, though it seems inevitable that accessibility will reach the public sector at some point in the future.

**State, Local, and Organizational Standards**

Increasingly, states, localities, and educational institutions are developing their own accessibility standards. The University of Wisconsin system, for example, recently implemented a policy based on Priority One guidelines from the WAI. Other institutions often adopt standards are based on Section 508. This allows them to take advantage of the numerous training and support resources developed by the U.S. government and its vendors.

**Other Standards**

The W3C WAI is the basis for web accessibility standards for governmental agencies in the UK and Canada. These standards incorporate all Priority One and Priority Two checkpoints from the WCAG. While these standard raise the bar in terms of design and support, they allow sites to take advantage of the benefits of CSS and the separation of presentation from structure within the HTML code. If knowledge within the organization is available supporting the addition of standards for CSS, XHTML or even XML, additional standards regarding the formatting of text may want to be considered. Even if immediate use is not made of dynamic architecture, a site incorporating Priority Two checkpoints from the WCAG will have greater flexibility in adopting these models in the future.

**Adopt Local Standards**

After determining which if any federal, state or organizational standards apply, local standards should be developed. These are particularly helpful in contexts where standards are more subjective. For example, there is no formal accessibility policy in Australia as of this writing. However, there are court rulings in areas of accessibility that mandate the government not to discriminate on the basis of disability. In this instance, it would be advisable to set a local standard for web design. This provides some measure of accountability on the part of an agency that efforts were made to comply with the
court's order. At the same time, it provides a concrete target for designers to incorporate into their work.

**Identify a local person**

It is important to identify a person within an organization to coordinate accessibility efforts. This person is responsible for communicating standards to web developers, connecting developers to resources for learning standards and standardizing local techniques and interpretations of standards. In addition, this person should work to maintain the organization's focus on the issue of accessibility as the initial enthusiasm as momentum begins to fade.

**Validation**

Once an accessibility standard has been identified and adopted, a measure needs to be made of the site against the identified standard. Using automated and application-based tools, a site should be carefully checked against the adopted standard. This will provide a sense of the issues to be addressed in the implementation process.

Perhaps the easiest way to begin the process of validation is to use one of the numerous free online validation tools. In most circumstances, these tools will provide a quick, if cursory, glance at the accessibility issues on a page. The oldest and perhaps most famous of these tools is Bobby.

**Bobby**

To use Bobby ([http://www.cast.org/bobby](http://www.cast.org/bobby)), the URL of the page to be checked is entered in the form on the Bobby page. Bobby returns the page with a report of obvious issues on the page. Forgotten alt text, missing frame titles, or absent CSS are easy to catch using a tool like Bobby. If there is a disadvantage to Bobby, it is that it does not look at more complex and subjective problems such as tables used for data or the type of alt text used. However, Bobby was not intended to analyze these complex issues. Bobby's strength is in its ease and simplicity.

**LIFT Online**

A much more powerful online tool available from UsableNet is called LIFT Online ([http://www.usablenet.com/lift_online/index.htm](http://www.usablenet.com/lift_online/index.htm)). LIFT Online is a fee-based service that provides a much more comprehensive evaluation of pages. While evaluations of five pages are free of charge, LIFT offers the ability to evaluate an entire site all at once. This is particularly helpful when attempting to get an overall sense of the issues facing an entire site.

The tools provided within LIFT are significantly more powerful. LIFT is able to detect when specific alt tags are called for, as with spacer images. LIFT is able to detect when a table is used for data and evaluate the markup. LIFT is also able to evaluate a page using more general usability rules. These rules are not based on issues specifically for individuals with disabilities, but common issues across all segments of web users.

**HTML and CSS Validator**

HTML Validator ([http://validator.w3.org](http://validator.w3.org)) and CSS Validator ([http://jigsaw.w3.org/css-validator](http://jigsaw.w3.org/css-validator)) are particularly helpful for advanced users. These free tools do not check for accessibility issues, rather they check for the proper use of HTML and CSS. This is particularly helpful for users who may understand coding in HTML and CSS, but not be familiar with the techniques of accessibility. The
HTML and CSS validators can identify incorrect coding and point to a solution. For advanced users, these tools are an important part of any validation process.

**Application based tools**

Application-based tools generally offer more comprehensive tools for validation. An excellent example is the 508 Accessibility Suite for Macromedia Dreamweaver (http://www.macromedia.com/exchange/dreamweaver). This free extension from UsableNet offers the ability to check individual pages or even an entire site against a customizable set of accessibility guidelines. The extension offers a comprehensive set of tests similar to those available from LIFT online. In addition, the extension also takes advantage of Dreamweaver's authoring environment to point the designer to specific places on the page in need of repair.

**Checking Dynamic Pages**

A common question that arises during the process of validation and repair relates to the validation of dynamic pages. Testing a dynamic page is quite similar to testing a static page. The primary difference is that one does not test the page itself, but the output of that page. In most cases, making the necessary adjustments is comparable to making changes in HTML.

Dynamic design techniques related to accessibility are more complex. However, these techniques are more often intended to improve the process of accessible design rather than directly affecting the user's experience of a page. This is still an emerging but very promising area of accessible design.

**Establish an Approach**

The next step in implementing accessibility policy is establishing an approach to accessible design with respect to both architecture and techniques. The goal is to standardize site structure and page creation in a way that streamlines workflow and limits common mistakes made by designers. Establishing standards for site architecture and design techniques provides designers a common starting point for their designs as well as a common language to discuss the issues involved.

As an approach is being developed, two groups need to be considered: novice designers and advanced designers. For novices, it is important that the approach make accessibility easy to achieve. Providing designers with templates, library objects and other shortcuts for creating accessible pages are just a few of the strategies that may be used here. For advanced designers, the selected approach should take advantage of their skill set, but streamline the process of accessible design. Using CSS, XHTML and data-driven models, advanced designers may offer a rich and more customizable feature set to users.

**Architecture**

There are multiple site architectures appropriate for helping to foster accessible design. It is crucial that the architecture implemented reflects the capabilities of the organization. The staff's level of expertise, the availability of hardware and software and the availability of staff for maintenance will all be fundamental variables in this decision.

The following three models of site design are offered as examples. These examples represent points on a continuum of site architecture from completely dynamic models to completely static sites. As organizational expertise and experience with accessibility and data driven design grows, each organization will find the model that best fits its needs.
**Data-driven Model**

Data-driven sites are those in which the contents of the site are stored in a database. Web pages are then generated from the contents of the database. A data-driven model allows the process of accessible design to be streamlined in two ways. First, a designer may enter content into the database using a form on a web page. This allows an individual within the organization to add content to the database without learning HTML or an authoring tool. This is an ideal solution when there are numerous designers with little or no experience designing web pages.

Second, a data driven model automates the process of page creation and allows the users to select the format of the content that best serves their needs. Thus, the same page can be delivered dynamically in a text-only format, full-graphics HTML version or in a rich media format like Macromedia Flash. The problem with multiple site versions in static HTML is that typically only one version is actively maintained and others are not maintained as well. If the multiple versions in a static site are actively maintained, it usually results in much more work for the webmaster or page designers. In dynamic sites, all versions are dynamically updated to reflect latest content.

A data-driven model should only be selected if an organization has the hardware and software infrastructure to support it. This infrastructure would include a server running ColdFusion, PHP or other dynamic server applications. In addition, sufficient expertise must exist within the organization to adequately maintain the server, as well as to develop dynamic pages. If this expertise does not exist, then training should be arranged for the webmaster and designers alike.

It is particularly important for the webmaster to not only be able to maintain the web server, but also to support designers until a sufficient level of expertise is developed within the organization.

**Static Model**

A static model is appropriate when infrastructure or expertise within the organization cannot support a data-driven model. Instead, the site consists of a set of static, unchanging HTML pages. In these situations, it is helpful to use templates and server-side includes or application-specific tools and library objects features in Dreamweaver to streamline the process of accessible design.

Utilizing templates involves creating a set of templates that account for common types of pages within the site and incorporate accessibility features. Novice designers are then able to create consistent and accessible pages.

In these situations, it is particularly important to provide accessibility training for the front-end designers who will develop the templates to limit potential across the site.

The advantage to using templates as opposed to static pages is that a webmaster may adjust a problem across an entire site by fixing only the template itself. At the same time, templates limit the areas of a page that the designer may edit, thus standardizing site design.

Library objects allow frequently used elements within a site to be developed with a full range of accessibility features and then be placed on a page by dragging and dropping particular elements into a page. For example, a navigation bar used in several templates and individual pages may be marked up with all of the alt text and a skip to content mechanism and then quickly and easily used on a page.
A designer can expend a lot of effort marking up a navigation bar for each page the navigation bar appears. If this navigation bar is developed as a library object, it can be reused without duplicating these efforts each time it is used.

**Combined Model**

In circumstances where knowledge or experience with dynamic design is limited but the hardware and software are available, an approach combining data driven and static elements may be appropriate. In these circumstances, it is wise to start with a single instance of dynamic design. A single page that needs to be frequently updated by a novice or inexperienced designer would serve as a prime candidate. As organizational expertise with data driven models grows, so would the site's reliance on dynamic pages. Additionally, the sophistication and maturity of the dynamic techniques used in a site may grow as well. Ongoing training for both the webmaster and designer are essential to the success of these models.

**Tool & Techniques**

In addition to standardizing architecture, it is also important to standardize techniques. This provides designers consistency in their approach to common issues. The following list comprises a list of common issues benefiting from standardization. This list is not exhaustive, but should serve as a valuable starting point in this process.

**Tools**

As part of implementing an accessibility policy, it is essential to ensure that designers and developers have the appropriate tools to implement the policy. In addition, these tools should support novice designers in creating accessible pages. At the same time, these tools must support the more sophisticated techniques of advanced users.

Another important reason for standardizing tools across an organization is that it simplifies training related to accessibility. Training on accessibility should connect an issue with the related technique, and a set of step-by-step instructions employing this technique. Using a single application across an organization limits the number of explanations necessary allowing the materials to cover a greater number of issues rather than a greater number of applications. Time is a limited resource and is particularly valuable when it comes to accessibility given the range of issues and techniques that merit attention.

**Techniques**

In addition to standardizing tools, it also wise to standardize techniques across an organization. This provides designers with a concrete and consistent approach to some of the more subjective accessibility issues. The following is not intended to be an exhaustive list, but to provide a starting point for an organizational approach to accessibility.

**Navigation**

Navigation poses a number of issues related to accessibility. Two issues, in particular, require a consistent approach. The first issue is related to the use of a skip navigation mechanism. Section 508 states, "A method shall be provided that permits users to skip repetitive navigation links." This mechanism prevents screen reader users from having to listen to every link in the navigation bar before the main content of each page. Typically, this is accomplished by linking a small, transparent
image at the top of a page to an anchor just before the main content. The Alt tag for this image should read "skip to content" or "skip navigation." Designers who do not rely on screen readers often have little experience with these mechanisms. Thus, it is helpful to provide a clear strategy for implementation.

A second issue with navigation relates to the use of JavaScript rollovers. Rollovers that bring up drop-down menus or disjointed images elsewhere on the page pose particular challenges for accessibility. While some screen readers are now able to read JavaScript, the majority still cannot. Thus the links and content from a JavaScript rollover are unavailable to screen reader users. Pull down menus are still possible but would require use of CSS layers with JavaScript rather than JavaScript alone. These techniques are complex and require significant planning. In addition, these tools may benefit from use of multiple skip navigation mechanisms. Standardizing the use of JavaScript rollovers in navigation significantly simplifies their implementation and may enhance accessibility.

Images

Images require special consideration when it comes to accessibility. First, it is helpful to standardize and centrally store alt tags for commonly used images across the site. Using library objects in Dreamweaver, images can be associated with the appropriate alt text in advance. A user may then place an image on a page with proper alt text already in place.

Second, images requiring alt text of longer than 50 characters should use a long description. There are multiple strategies for adding long description to images. The first is based on the use of the LONGDESC attribute. The LONGDESC attribute provides a screen reader user with a link to the long description on a separate page. However, support for the LONGDESC attribute is very limited at this time. A second method for adding long descriptions relies on the use of what is called the d-link. The d-link places a letter d (for description) next to the image. See example below:

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COAST
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The letter d is linked to a separate page with a longer description of the image.

A third method of providing long descriptions is similar to the d-link. This method places a caption next to the image and links the caption to the descriptive page. Standardizing the use of long descriptions is helpful since the use of long descriptions is one of the most common questions related to the techniques of accessibility.

Cascading Style Sheets (CSS)

The use of CSS offers significant benefits for accessibility. While CSS are not mandated by section 508, national standards in the UK and Canada do require the use of CSS.

Formatting text using CSS allows the user to override styles to format text, itself. This allows a user with limited vision or colorblindness to format the text in a way that meets their needs. However, the use of HTML for formatting text overrides all CSS styles, including user-defined styles. Thus, it is important to standardize the use of CSS in HTML for formatting text across a site.

Use of Plug-ins
Each plug-in requires its own distinct strategy for accessibility. Under Section 508, the use of plug-ins is required to comply with standards for software. Similar to standards for web content, the software standards also require that the plug-in can function without a mouse.

Flash-based content poses two issues related to accessibility. First, a text equivalent for Flash animation needs to be provided since there is no alt attribute for the object element used to place Flash on a page. Because of this, the alt text needs to be placed elsewhere. A second issue related to Flash is that of device-independence. The movie must support keyboard-based as well as mouse-based interaction. In many cases, this will require some guidance for novice developers of Flash content.

Use of video and audio require a synchronized text alternative typically in the form of closed-captioning. Video in QuickTime, Real and Windows Media formats need to be appropriately captioned. If multimedia is frequently used across a site, the organization should ensure hardware and software tools are available to support closed-captioning.

Design Support Mechanisms

Even the best and most thorough accessibility plan may not be able to accommodate all users. As a final measure, it is advisable to add an e-mail link to an individual so that users with disabilities who are having difficulty accessing resources may directly request the information they need. This resource should be prepared for questions from users with disabilities and be able to direct these individuals to resources within the organization.

Implementation

The keys to success in a successful accessibility policy are tools and training. Accessibility must be seen as an integral aspect of the design process, not an add-on or separate activity. The tools and training for novice and advanced users alike should reflect this. The tools should directly integrate accessibility into page construction and architecture. Training for designers and developers should integrate accessibility principles directly into explanation of the tools and design concepts used site-wide.

The more transparent accessibility is within the design process, the more likely the policy is to succeed.

Training for developers

Training for all designers should cover the general issues and challenges faced by users with disabilities. This may include discussion of assistive devices such as screen readers, individual disabilities and relevant accessibility policy. This will provide designers with a context in which to evaluate their designs.

Again, training should directly integrate the techniques of accessible design with training in use of the appropriate tools. This is particularly true for novice users. For advanced designers, training may not be available. Instead it may be valuable to seek out other opportunities to discuss advanced accessibility techniques. These opportunities take the form of face-to-face meetings, user groups, e-mail listservs, or bulletin board discussions. Providing the time and the expectation for these discussions is crucial if organizational knowledge of accessibility is to expand.

Staged Rollout
Another key to successful implementation of an accessibility policy is an incrementally staged rollout. Given the complexity of accessibility issues, it is wise to spread training and implementation out over a period of time. Six months to a year is generally an appropriate scope to think of when implementing an accessibility plan.

In that time frame, one strategy is to select a start date for an accessibility policy. From that point forward, new pages created within a limited area of the site should adhere to the standard. It is better to limit the scope of the pages rather than scope of the standard. The W3C standards are created in such a way to serve users with a wide range of disabilities. Choosing only some of the standards from the set of Priority One checkpoints invariably risks isolated users with a specific disability. Instead, it is wise to narrow the number of pages affected. This allows training to be targeted to a specific group. The scope of the policy may be expanded from that point forward to include all areas of a site.

Perhaps the most difficult decision is when to include existing pages under accessibility guidelines. Retrofitting pages for accessibility is more challenging than designing from scratch, nonetheless policy should apply to the entire site.

**Conclusion**

Accessibility is an important and timely issue. Any organization with a web site, from government agencies, to educational institutions, to businesses of all kinds, should consider adopting an accessibility policy.

The approach offered here is multi-faceted and touches on all aspects of the web design process from identification of standards to the implementation of an organization's site. It is important for organizational standards to be consistent and thorough, integrating training and resources for those involved with web design. Additionally, accessibility policy must take into account the needs of the organization and the varying levels of web design knowledge and experience within the organization.

There are no quick fixes for accessibility, but careful and thoughtful planning can minimize many of the challenges of accessible design.

**Reference**


**Resources**

W3C Web Content Accessibility Guidelines Curriculum
[http://www.w3.org/WAI/wcag-curric/](http://www.w3.org/WAI/wcag-curric/)

Adaptive Computer Technology Training Centre (Canada)

Introduction to Web Accessibility
[http://www.webaim.org/info/intro](http://www.webaim.org/info/intro)
Online Course Accessibility:
A Call for Responsibility and Necessity

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ABSTRACT

There is becoming an increasing population of online learners with disabilities worldwide; a large percentage of the online learners reside within the United States. In addition to revised legal mandates stipulating equal access to education and the surge of assistive technologies available to individuals with disabilities, distance education institutions are facing the call for action to provide accessible online content. This article discusses the essential components of a web-based course, the learning advantages that arise from equal access web formatting, and design strategies that leads to creating accessible, online materials.

Samantha is faced with the task of writing a 10-page research paper for her online political science class. She must cite at least 10 resources and is encouraged to use the Internet to obtain the information. Since Samantha is a distance student, the only means she has of contacting other students within the class—or her instructor for assistance—is by e-mail or phone. One would think this a common task to fulfill within a distance education setting, one in which a web-based class is offered online for those students who cannot attend class during the day or who reside in other geographic locations and want to progress their education. However, Samantha’s situation is different in that she is also blind. Although she has a computer equipped with a screenreader, the content
Has technology become so advanced that we have forgotten to make the latest trend in distance education accessible to persons with disabilities? Has the educational community simply focused on promoting classes in a distance setting for those learners without disabilities in order to capitalize on the financial success and prestige of the event? Educational personnel must be educated about web accessibility issues and how they pertain to distance learners, and what implications can be recommended for make online education more accessible to all. This article presents historical, current and plausible future proposals for promoting equal access of educational content via the Web. As individuals with disabilities continue to promote and advocate web resources, equalization of an accessible playing field is a critical component in an online learning environment.

Increasing Population of Learners with Disabilities

Samantha is not alone in her ambitions to take advantage of online learning, nor is she the only one taking classes via the Internet who has a disability that incurs difficulty in obtaining the presented material. Approximately 20 percent of the U.S. population has some kind of disability, with one in 10 having a severe disability (US Census Bureau, 1997). In postsecondary education, the percent of full-time, freshmen that have disabilities has increased dramatically since the 1970s. In 1988, 16 percent of all college freshmen reported having some type of disability, and by 2000, the percentage rose to 40 percent (Henderson, 2001). This presents itself as a serious concern for making education available to this population, especially since the percentage is increasing.

Legal Mandates: Americans with Disabilities Act

To understand this issue in its entirety, it is essential to become familiar with what has been legally mandated for learning institutions to provide all students with equal access to education, and how this has reflected in today’s educational environment. Established in 1990, the American Disabilities Act, ADA, was designed give equal access to people with disabilities (Department of Justice, 1994). It was created to remove barriers that prevent all individuals with disabilities from accessing opportunities that are available to people who are not disabled. The ADA was also established to provide legal resources to those who have experienced discrimination on the basis of disability. Every employer and labor organization—educational institutions included—is required to post information in accessible format to applicants, employees and members describing the applicable provisions of the ADA. The mandate was also created to ensure that the federal government played a central role in enforcing these standards by providing the authority to regulate commerce addressing the issues concerned with discrimination issues encountered by people with disabilities, which prompted the “Tech Act” and Section 508 of the Rehabilitation Act.

Technology-Related Assistance for Individuals with Disabilities Act

In the United States, the Technology-Related Assistance for Individuals with Disabilities Act (PL 100-407)—otherwise referred to as the Tech Act—was established in 1988, eventually evolving into the Assistive Technology Act in 1998. It was designed to provide funding to develop statewide information and training programs designed to meet the assistive technology needs of individuals with disabilities (Architectural and Transportation Barriers Compliance Board, 2000). The Department of Education interprets the Assistive Technology Act (AT Act) as requiring states receiving assistance under the AT Act State Grant program to comply with Section 508 of the Rehabilitation Act. In 1998, the Workforce Investment Act was invoked to include an updated edition of Section 508 of the Rehabilitation Act of 1973. The standards promoted by the revised version of Section 508 imposed
stringent requirements on federal agencies to promote access to electronic information and technology to all persons with disabilities. Federal organizations were targeted as a platform to raise the awareness about the many disabled, long-time employees in the workforce. Responsible accommodations for implementation in accordance with Section 508 include hardware, software and Internet/Intranet usage that may require adaptive components to be available for those with multiple disabilities. Also included are web designs that would offer unlimited access either as stand-alone components or connective appliances.

Assistive Devices for Learners with Special Needs

It is an educational institution's responsibility to provide auxiliary aids and services in a timely manner for students with disabilities. The purpose of assistive technologies is to equalize the opportunity for a student with a disability to participate in a program or activity. Assistive technologies specifically designed for those persons requiring additional help in performing tasks on the Web have also enabled learners with disabilities to adapt to difficult navigation and information retrieval situations. Some examples of the various types additional aids and assistive technologies may include:

- taped texts
- note takers
- interpreters
- screen readers
- video text displays
- television enlargers
- talking calculators
- electronic readers
- Braille calculators, printers or typewriters
- telephone handset amplifiers
- closed-caption decoders
- open and closed captioning
- voice synthesizers

Assistive technologies often have unforeseen benefits for those without disabilities. For instance, voice recognition software allows persons with motor disabilities to access computers, but also permits non-disabled persons with carpal tunnel syndrome limited keyboard usage. Screen readers give blind persons access to the Internet, but also help children read and write by mimicking the sounds of words. Providing accessible information targets the needs of all users rather than forcing them to conform to advancing technology's limitations. The question of whether educational communities need a federal mandate to make education available to those who require special assistance has spurred particular interest. Equal access to education is mandated to serve not only for those with disabilities, but for an aging society as well. Assistive technologies such as magnification devices, alternative keyboards and web pages created using a broader screen width and larger fonts will be tremendous assets not only for individuals with disabilities, but also for aging learners who may incur disabilities later in life.

Although laws and mandates concerning individuals with disabilities have been enacted, accessibility concerning the Web only recently became a concern in online learning environments. Today, there are more than 168 million people in the United States—60 percent of the total American population—who use the Internet, 10 percent of whom have disabilities and who may be using the Internet to fulfill postsecondary education requirements for obtaining and researching information through online resources (Nua, 2001).
Distance Education and the Internet

Distance education has welcomed web-based, online courses. The “sage on the stage” concept has been replaced with the “guide on the side,” in which instruction has shifted from an instructor-facilitated interaction, to more complex interactions. Learning is paced by the student’s ability and capacity to acquire material. Moore and Kearsley (1996) detail learner-content, learner-instructor, and learner-learner interactions as the essential types of interactions that distance teachers must foster. This is especially so within online learning environments. An asynchronous, collaborative environment is typically established when the learner can communicate with the content, instructor and other learners within the class. Experts available asynchronously are able to discuss issues and interpretations, provide an opportunity for the distance learners that the traditional students would not have, and are able to bring about a higher level of understanding and analysis (Holland, 2000).

Some have expressed the concern that students taking online courses are not getting the education they pay for. In response to this criticism, higher education organizations such as the Western Cooperative for Education Telecommunications’ “Principles of Good Practice for Electronically Offered Academic Degree and Certificate Programs” have been endorsed by many higher education entities within the U.S. and the regional accrediting communities (Western Cooperative for Educational Telecommunications [WCET], 1999). The accepted definition of quality education, according to WCET, ensures that any program of study reflects appropriate learning outcomes for the degree, instructed by qualified faculty. It mandates that all electronic degree or certificate programs are lucid, and that each program accounts for the amount of real and delayed time incurred for both faculty and students. As the standards for accountable curricula become clearer, technology can maximize the benefits of the distance-learning domain. The Internet promotes effective communication, availability of resources 24 hours a day and unlimited use, which students can utilize in a successful manner for them. Learners are able to work at their own pace, at any given time, and locate themselves in an environment that is flexible and conducive to their learning style and employment setting.

Career Integration

Online education also supports flexible scheduling to accommodate career needs. Jobs now require employees to use the Internet and mention computer skills to survive and climb the ladder to financial success (Denning, 1997). As non-traditional students are usually more dedicated to both family and career, they are the most in need of a flexible, convenient learning environment such as that fostered by distance learning. As technology continues to transform the global economy into a more knowledge-based economy, the role of higher education plays a vital role in developing the economic potential of employees and employers all over the world. Web-delivered courses enable learners to interact more with the Internet to obtain resources and practice their Internet skills, which can be invaluable tools both in the educational and corporate realm (Simonson, Smaldino, Albright, & Zvacek, 2000).

Essential Components of a Web-based Course

The essential components of a web-based course determine the degree of the learners' success in understanding, communicating and synthesizing the content that is presented. Klass (2001) compares Plato’s publication of Socrates’ Dialogues to that of the interaction of online education—interactive, dynamic dialogue amongst seekers of knowledge. Mediocrity is apparent if the user is restricted to simply memorizing the information for short-term recall instead of utilizing the material presented in a class to further educate oneself and apply it to a realistic setting. Yet, more technology does not, by itself, make education more efficient (Janicki & Liegle, 2001). A key element in creating a
web-based course is to engage students in active learning experiences. Active learning strategies are needed to motivate students to participate in course activities. A virtual community provides support and encouragement; emphasis on sharing among the learners enrolled helps to overcome inherent and literal isolation. Another successful component is setting guidelines for student accountability. As the instructor is not present in a face-to-face format to monitor and evaluate progress, methods must be in place within the class format to establish accountability for the learner. Communication is critical for students to understand the content and expectations of the class, which reinforces the necessity for clarity of course guidelines. Finally, distance education enables dynamic changes to take place in instructor roles from providers of content to designers of learning. The teacher evolves from strictly controlling the teaching environment to sharing and experiencing the learning environment with the students as fellow learners. Within this environment, learners not only process information, but also take active roles in creating meaning and understanding.

Learning Advantages

Online courses also provide students with the benefits of viewing topics from multiple perspectives. The online format permits learners to have the independence of managing their own time and learning processes, allowing them to become complex problem-solvers instead of passive students who memorize factual data to pass assessments targeting static concepts (Collins & Berge, 1996). For students who are isolated due to financial, demographic or disabling limitations, the online course becomes a lifeline to the outer world. It is a doorway enabling them to interact and learn with experts in the field and other students who may be in the same predicament. Activities such as virtual chats, discussion forums and collaborative projects require learner participation and evoke communication of information throughout the class. Procedures for submitting assignments and assessing learning are also crucial components that make a course easy to conduct in a distance setting. Online help or technical assistance can help aid the student in difficult endeavors, and the instructor can also clarify these procedures within the course syllabus.

As more and more people utilize e-mail to communicate, it can also be a useful tool in eliciting feedback from the instructor and other learners (Heinich, Molenda, Russell, & Smaldino, 1999). Documented feedback can be provided by the instructor using e-mail, relative to a specific document to notify the learner of suggested improvements within the assignment. Personal attention achieved from e-mailed feedback or online responses is critically important in that it reaffirms that the students are important, what they do does matter and that they are able to perform a task well enough to receive feedback and praise (Kilian, 1997). Learners also make use of e-mail correspondence in collaborating with other students in designing and completing group assignments. Listservs and user groups also use e-mail to promote understanding and share information postings for a large community of users. Previously, distance learning may have been conceived to be prepackaged text, audio, and video courses taken by learners who received mailed or phoned feedback from the instructor, when in fact distance learning far surpasses the interactivity of the traditional classroom. Distance learning can allow student interaction with other students, other faculty and area experts from around the world, and resources like books, journals and other dynamic electronic resources. Yet, to avail these types of resources to students, the Internet needs to be accessible to all learners.

Web Accessibility and the Distance Learner

Before the 1980s, computers were fairly easy to use and existed as a piece of equipment that presented material on a global scale. As technology offered more innovative design and differing methods of presentation, changes made it easier for those without disabilities to use the Web, yet created barriers for those with persons with disabilities. Such features as point-and-click, mouseover events that change images, and animated graphics that deliver sound have made navigating through
the Web a series of obstacles in a landmine of information for the user with disabilities. Web-based courses incorporating these features may limit the progress of distance learners with disabilities and further segregate them from utilizing the innovations produced by technology and education.

A divide exists between learners who do and do not have access to the Internet for means of education (Rowland, 1999). The intent of postsecondary education is to assist in preparing students to become participating and active members of the workforce and society. Although the Internet has the ability to provide even greater independence for individuals with disabilities, it can often exclude the audience that can benefit the most. Students use the Web as a fundamental tool to gather course information, conduct research, submit assignments and participate in collaborative interaction with other students. Inaccessibility restricts the educational experience provided for non-disabled learners and inhibits their success in learning how to efficiently gather information via the Web. Most of the access problems incurred in web courses can be alleviated or remedied by support from technical staff or instructor assistance. However, one aspect that does segregate those who can use the Web to obtain instruction from those that are at a severe disadvantage when it comes to navigation and information retrieval are those persons with disabilities, who may find a website and its corresponding pages inaccessible to the assistive technologies that they require to operate the Internet. This concern has become more pronounced as the increased use of the Web has led to innovative technologies aimed at those without disabilities, which have created a minefield of obstacles for those with handicapping conditions. The web pages, essential for effective presentation and communication of the course content, are the very components of distance learning that restrict those persons with disabilities in performing any or all of the tasks required of them in an online course. Web accessibility has not only been targeted as a limitation of distance learning but has limited overall web usage by all that use the Internet. Educational institutions are required by law to provide reasonable accommodations and ensure equal access for educational opportunities to students with disabilities. Various governmental agencies and non-profit organizations have made web accessibility their primary target in their plight to provide equality of web access.

**Ramifications for Online Courses**

The General Services Administration Center for Information Technology Accommodation, CITA, and the Federal Access Board have provided assistance to federal agencies in making their hardware, software and web resources accessible for persons with disabilities. Various organizations like the Federal Information Technology Accessibility Initiative and the World Wide Web Consortium (W3C) have launched awareness campaigns to educate the general public about web accessibility. WebAim and other associations have offered classes, often free of charge, to web developers, educators and employers about the benefits of designing web pages that are accessible (Access Board, 2000). The W3C has also implemented the Web Accessibility Initiative (WAI) to assist various users and developers for creating accessible websites by publishing a listing of recommended guidelines specifically pertaining to user agents that present the Web (Chisholm, White, & Vanderheiden, 2001). Although these guidelines were constructed for web developers of governmental sites, they can be synthesized and applied to presentation format useful for instructors to follow in creating their web-based content.

**Validation Practices**

Validation tools developed by the W3C, CAST, and The Special Needs Opportunities Windows, or SNOW Initiative, have also aided developers in checking their markup language for accessible compliance (Chisholm et. al, 2001; Rose, 2000; Harrison, 2000). These tools, also free to download from the Internet, scan the web page or website for components that could make a page inaccessible for persons with multiple disabilities. Problems such as not providing alternative text tags that
describe images for a screenreader to read for persons with visual disabilities, and audio files not containing captioning, are targeted by these validation tools. The tool typically specifies a line number within the programming code for the developer to remedy, after which the validation exercise can again be executed to ensure compliance with accessibility guidelines.

BOBBY is a validation tool that checks a site’s webpages for accessibility for persons with disabilities. It rates a page as ‘approved’ or ‘not approved’ based on accessibility and browser compatibility. In a study conducted by Flowers, Bray, and Algozzine (1999), 73 percent of the 89 special education home pages from national universities with special education departments had accessibility problems. Seventy-one percent of these errors severely restricted access for individuals with disabilities. Further studies conducted by the National Center for the Dissemination of Disability Research (1998), an organization dedicated to the promotion of content for persons with disabilities, indicate that 43 percent of its grantees had front pages that receive BOBBY approval. Schmetzke (2000) reported similar in a study conducted on web pages from 24 departments at the University of Wisconsin. Findings revealed that 59 percent of the library pages and 50 percent of general campus pages were BOBBY approved, that is, only half of the resources available to those with disabilities. Although BOBBY reports conservative ratings, and is not infallible, it is a common tool used globally to measure the accessibility of a website (Rowland & Smith, 1999).

The Center for Applied Special Technology, CAST, has also launched groundbreaking efforts in promoting what is referred to as Universal Design strategies for presenting content via the Web (Rose, 2000). These efforts target not only elemental design layout of a website, but also emphasize versatility and flexibility of content and presentation for individuals with specific learning needs. The fundamental methods of Universal Design are achieved by promoting the idea that students with disabilities fall along a continuum of learner differences rather than constituting a separate category. To accommodate for this continuum, the instructor is to make adjustments for learner differences, not only for those with disabilities, but also for all learners. In this manner, curriculum materials are varied, diverse and flexible to accommodate the many learner differences. Considering all that has been facilitated on the implementation of distance education and granting access for person with disabilities, what can be done to alleviate the limitations caused by inaccessible design features of online learning?

**Design Implications for Post Secondary Institutions**

Today, at least two-thirds of America’s four-year degree instructions offer online courses (McMurray & Dunlop, 1999). The Internet offers lifelong learning; web-based education can be disseminated to individuals who could not previously consider a college education due to demographic, time and career-related circumstances. Learning institutions that do not capitalize on the use of the Internet to offer educational opportunities are often viewed as provincial and lacking in innovation. Stakeholders within the distance setting are the students, faculty, web developers and administrators. Within the next decade, two million teachers will be hired due to increasing student enrollments and an aging teaching force (Wright & Custer, 1998). As postsecondary education institutions are offering more online courses to meet the needs of a fast-paced, computer literate society, more instructors are being faced with designing online materials to either supplement or represent their traditional classes. Cooper (2000) offers several ways for instructors to increase interaction among their students, increase their students' opportunities for learning and improve the learners' satisfaction with the class. Offering an initial class meeting, promoting online communication through e-mail and discussion forums, and promoting diverse instructional materials are some of the key elements she emphasizes as essentials in online classes. Because students have different learning styles and abilities, and respond in different manners to activities offered, it is useful to offer instruction in a variety of formats to appeal to the entire learning audience. In this way, the chances of reaching each and every student are increased, as well as the chances for learning.
As Kilian (1997) states, “Technology should offer them (learners) choices, not requirements” (p. 34). Findings from the recent Harris Poll indicate that people with disabilities spend twice as much time on the Internet as people without disabilities (Taylor, 2000). Ignoring accessibility issues can cause many businesses to miss out on the financial and legal advantages of creating pages that appeal to the largest audience: both those with and without disabilities. Granting equal access also allows persons with older technologies as much access to the Internet as those with cutting-edge devices. Sites can be incompatible with specific browsers or older versions of the browsers in question. Although hardware and software adaptations have been implemented, a learner with a disability cannot access the material due to the site’s design.

**Accessible Design Strategies**

For all learners to fully utilize the Internet and web-based materials, a web site will need to grant equal access to all its users. Although students may have preferred learning styles and needs that require adaptations, utilizing a range of processes will appeal and apply to more students than a single process that may exclude a large population of learners. Students typically prefer clear, precise, focused curriculum so that they can learn quickly within the constraints of their lifestyles and career schedules. Design strategies employing the Active, Collaborative, Customized, Excellent quality and Lifestyle-fitted techniques are summarized in the ACCEL model (Boettcher & Fell, 1997). This model, implemented to build on learning principles and characteristics, was designed to be facilitated in an assistive environment in which the instructor builds a mentoring relationship within a learning community of students. A development team focused on creating an asynchronous, online, distance learning course typically consists of a project manager, faculty serving as content experts, instructional designer, web developer and graphic designer. As advanced courseware becomes more available, faculty members may find themselves in a multifunctional role, wearing hats of all the participants within a design team.

In determining the content to be included within a class, the instructor must consider the different types of knowledge encountered on the Internet: technological and procedural knowledge (Williams, 2000). Technological knowledge is divided into knowledge that relates to an activity and that which relates to the body of content, referred to as procedural or conceptual knowledge. Procedural knowledge is developed when a solution to problem is deducted. Visual mapping strategies and flow-block diagrams help to emphasize the knowledge process to distance learners involved in problem-solving procedures. Although these processes are not always linear, sitemapping or the visual diagramming of topics help learners to view their path through the content in arriving at a final conceptual understanding of the material. However, in an online learning environment, the instructor and instructional designer—as one transparent component—should deliver both procedural and conceptual knowledge to the student. Verbal and visual demonstrations should be available for information that was only previously available in text. Presentation media are active tools to deliver content in a stimulating, encouraging and motivating setting in which the learner can interact and take a more active approach to learning. Multimedia, streaming video and simultaneous web casts enable the learner to dynamically interact with the content and provide alternative formats for learning that can capture the capabilities and interests of learners with disabilities as well. Although simulations exist, they are not to be the focal point, but used as a peripheral of an online course. Often, simulations are distracting if presented on a continuum and are more appropriately suited for advanced, specialized courses and experiments (Hannafin & Peck, 1988). In addition to providing a well rounded knowledge base, a web page or site can present concise material using various dynamic elements.

**Accessible Web Page Format**
Key Elements

A variety of design elements can be incorporated into the page to display information that is accessible to all learners. Siegal (1997) emphasizes that sites do not have to be intellectually static to be accessible. Images can be effective in providing alternative examples or explanations of content. The addition of an alternate text tag to the image enables a screen reader used by a visually disabled person to read the textual description to the learner, describing the attributes of the image. Adding a title representative of a description of an image also allows learners without disabilities a more detailed explanation of the image. Sounds can also be used, but captions or alternative text benefit the deaf and those with hearing by providing a written script to follow and to refer back to at a later date. Easy-to-read content benefits all learners by ‘chunking’ the information into blocks of important information that can be easily read and understood by any audience. By providing high contrast in color, for text, images, tables, and so forth, the delivery can be more effective and distinguished for all people to read. Last, alternative formats such as plug-ins or HTML versions available for Adobe PDF documents—often hard to read by persons with normal vision and inaccessible for those without vision—can provide alternative means to attain the presented material.

Navigation

Homepages or default entry pages should serve as navigation pages and not a means to achieve a static destination. Developers of a successful site consider who their customers are and what their needs are. In the case of distance education, the learners are the customers. If the learners’ needs are not of paramount concern in the design phase, the occurrence of a user checking out a site once or twice, and never returning is heightened. This type of scanning through the course and its content may hinder motivation for the learners to continue and prevent them from attaining full understanding and procedure through the course. Lastly, user testing is necessary to ensure appropriate relevance to the content and delivery method. Nielson (2000) also emphasizes user testing before the final product is released to properly evaluate its intent, content and delivery.

Design Checklist

As a result of the need to provide some sort of template for designers and instructors to make their course sites accessible for persons with disabilities, guidelines have been adapted from the formalized standards of Section 508 delivered by the Access board. This type of checklist gives course developers an outline to follow in creating accessible content on the Web, as illustrated in the following text (Shuman, 1998). Although more technical criteria exist, the following pertain to presentation and organization of content directly applicable to online course presentations:

- Implement maximum use of white space—keep information and display simplistic.
- Design to inform, not entertain—make content readable and legible.
- Limit the number of colors on the screen.
- Use larger lettering and bulleted lists to separate information.
- Organize according to similar content by consistency and close proximal placement; this provides a cognitive advantage to learning.
- Provide top and bottom navigation to promote consistency.
- Utilize the 'less is more' approach when it incorporates images and text. Messages derived from the content should be clearly obtained within three seconds upon first sighting.
- Test design on users before final product is complete. Redesign is much easier and adaptable when the process is actively continuing.
- Reduce effort required to interpret message—use alignment, common shapes and asymmetrical positioning to make it easy for the reader to focus and understand relationships.
Conclusion

The power of accessibility lies within hands of the individuals, just as the power of the Internet lies within the empowerment of the individual. As developers and educators, alike, reflect on the capabilities and purpose of the Internet, the objective for obtaining information and utilizing it as an effective means of communication pertains to its entire audience. Users of all levels will need accessibility to its offerings, especially online education made available by web-based, distance courses. The widespread use of the Internet in distance courses has originated from the need to pursue further education for career enhancement. It can provide available and flexible learning environments to persons who would not normally be able to attend a traditional class. With the increase in universities addressing the need of learners of a growing distance population, equal access to online courses becomes paramount. Web accessibility has become a primary concern for instructors and developers in creating attainable, accessible and available online courses. Learners, faculty and administrators express the call for instructional guidelines for more accessible offerings. United with courseware developers, instructors can utilize these guidelines to effectively deliver the content that may have once been inaccessible, and create a more conducive, successful learning environment in which all learners have equal access to achieving an education.

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References


Book Review:
Trends and Issues in Instructional Design and Technology


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To purchase this book online

Reiser and Dempsey's book, Trends and Issues in Instructional Design and Technology, is reviewed and deemed as an excellent text in the field of instructional technology. It provides those who plan to enter the field with an overview of the profession and helps those already in the field to keep up with the latest trends. The book covers a comprehensive range of topics: from the fundamentals to the trends and issues and from theories to practices. It captures the recent interests in the field and helps readers construct a vision for the future. This book is succinct and easy to read. Its pedagogical
features, such as reflection and application questions, promote both instructivist and constructivist learning.

Many graduate programs in the field of Instructional Technology offer a "foundation" or "trends and issues" class to provide students with an overview of the field. These classes aim to help students understand what our profession is, where we were from, where we are now, and what the current issues and trends are. Anglin's book, *Instructional technology: Past, present, and future* (1995), has been an excellent text used for such classes in many programs. However, it has been almost seven years since the 2nd edition of Anglin's book was published. During the last seven years, exponential growth in technology has had great impact on society as a whole and on our field, in particular. Our profession has grown and evolved. New knowledge has been developed and new directions found. We, as a field, have been in a constant process of redefining our profession. Reiser and Dempsey's book, *Trends and Issues in Instructional Design and Technology* (2002), captures many of the new ideas and directions in the field and can be ranked with Anglin's book as another excellent text. It provides those who plan to enter the field with an overview of the profession and helps those already in the field keep up with the latest developments.

*Trends and Issues in Instructional Design and Technology* consists of 29 chapters contributed by many leading figures in the field. These chapters are organized into six sections, ranging from the fundamentals to the trends and issues and from theories to practices.

The first section, titled *Defining the Field*, discusses the different labels and definitions for the profession, sketches the historical evolution of the field and highlights the foundational issue of instructional design process. The second section, *Learning: Foundations and Trends*, examines the theoretical foundations and trends related to learning and instruction, including topics such as psychological theories, epistemological perspectives, motivation, instructional strategies, learning styles, and the role problem solving plays in instructional design. The third section, *Performance Technology*, focuses on the performance technology movement and its related issues, such as the shift from training to performance, electronic performance support systems, knowledge management systems, return on investment, project management, and diffusion and innovation. The fourth section, *Trends and Issues in Various Settings*, presents the diverse practices that professionals in our field are engaged in under various work environments, including business and industry, the military, health care, public schools, higher education, and the international settings. The fifth section, titled *New Directions in Instructional Design and Technology*, discusses the recent interests in the field, including online learning, object-oriented distributed learning environment, artificial intelligence, cognitive science and neuroscience, as well as the future of instructional design as predicted from political, economic, social, and technological trends. The last section, *Getting an IDT Position and Succeeding at IT*, is the most practical part of the whole book. It provides lessons and guidelines on how to secure a position in the field, lists the competencies required of our professions, and describes the professional organizations and publications that help keep us abreast with the development in the field.

*Trends and Issues in Instructional Design and Technology* is an informative and well-written book. It is comprehensive, but succinct and easy-to-read. Its nice pedagogical features render it particularly suitable as a textbook.

The book has extensive coverage when it addresses issues and trends in different settings. I used to dichotomize the practice of Instructional Technology as either in education or business and industry. The book provides a more complete view in this regard. For the first time, I realized instructional design and development has a role in health care in addition to other areas. A whole section of the book is devoted to the practices of the field in multiple settings. It helps the reader understand the professional identity of the field and all the possible career paths for us.
As mentioned at the beginning of the review, this book captures some of the most significant new directions in the field. Technological developments in artificial intelligence, information technology and neuroscience—as well as their possible impact on the field—are described. These perspectives help readers build a vision for the future of the field.

Practical issues in the field are usually not addressed in textbooks. This book, however, has a whole section dealing with the practical issues of getting a job in the field, the skills and competencies required, and the professional organizations and publications. As a graduate student in the field, I found this section especially helpful.

This is a comprehensive book. It is a challenge to cover all the major trends and issues of the field in 400 pages. Many chapters did a good job presenting the content in a concise and easy-to-read manner. For example, Gustafson and Branch's chapter on What is Instructional Design explains the topic by focusing on the systematic instructional design process as represented by the ADDIE model. Other ID models—such as the Dick & Carey model—are briefly discussed as elaboration and variation of the ADDIE model. Six characteristics of instructional design are presented. This chapter is less than 10 pages, but it provides readers with all the fundamentals of instructional design.

The editors claimed that the book has some pedagogical features, including book introduction, epilogue, section overview, chapter introduction, knowledge and comprehension questions, and application questions. The first several features are common in books, but the reflection and application questions are not found very often in most of the books in our field. These questions are very useful in helping me understand the topic and digest the content. The questions promote both instructivist and constructivist learning on the part of the reader. Some of the questions simply draw the reader's attention to facts, such as "listing the definition of the field at different time in history." Some other questions, on the other hand, encourage the reader to explore and construct his/her own learning. For example, some questions ask the reader to compare and contrast competitive theories, and some other questions ask them to explore and research on the topics mentioned but not elaborated in the chapter. With these questions, the power of the book goes beyond its content. It serves as the starting point for the reader to investigate various topics.

I would recommend this excellent book as a text or reference book for the "foundations" or "trends and issues" class in graduate programs in the field, but I would like to see the following improvements in future editions of the book:

- The chapters on project management, evaluation, and diffusion were organized into the Performance Technology section. They do not seem to fit there and it would be better if they are taken out as another section.
- It would help us to better understand what our field is, if a chapter can be devoted to explaining what our field is not and how our field is related to other fields.

References

