As colleges and universities put resources and services online, access by users with disabilities becomes increasingly vital

ELECTRONIC RAMP TO SUCCESS:
Designing Campus Web Pages for Users with Disabilities

By **Norman Coombs**

Overview

More than 50 percent of the U.S. population accessed the Web during 2001, and the number of Web users expanded by 2 million every month. Fortunately, along with this growth, the digital divide has begun to shrink, with Hispanics and African Americans connecting to the Internet at increasing rates.[1] People with disabilities, however, are also on the other side of the divide, and the ability for information technology to radically inform and empower them is greater than for any other minority population. Many of us believe that the computer, when properly adapted for our special needs, is the most liberating technological breakthrough of modern times. As colleges and universities increasingly integrate information technology—particularly the Web—into the presentation of course material, the exciting potential exists for it to create a more level playing field for students with disabilities. Unfortunately, failure to integrate the necessary design principles is causing new and needless barriers to educational success for this population.

The Department of Education Office of Civil Rights has compared providing access to information through adaptive computer technology with the need to provide ramps on buildings for physical access to students with mobility impairments. This was spelled out clearly in Case Docket No. 09-97-2002:

The magnitude of the task public entities now face in developing systems for becoming accessible to individuals with disabilities ... is comparable to the task previously undertaken in developing a process by which buildings were to be brought up to specific architectural standards for access.

The importance of giving students with disabilities full access to information technology is reflected in the employment statistics of this population. The 1990 census found that employment of those with less than a high school diploma was 15.6 percent, and 30.2 percent for those with a high school diploma. Those who completed at least four years of college were employed at a rate of 50.3 percent. By facilitating the access of people with disabilities to education, colleges and universities can significantly impact these employment statistics.

Besides empowering students with disabilities, information technology, interfaced with special adaptive com-

puter technology, opens similar opportunities for faculty with disabilities. I was a successful professor of history for more than 20 years despite my being blind; then I obtained a computer that catapulted me into new challenges and opportunities. Empowering people changes them. Besides transforming my personal and professional life, having and using a computer gave me new enthusiasm and confidence. It gave me the opportunity to be a pioneer in distance learning in the 1980s and to win national awards for this work.

This Research Bulletin focuses on discussions of information technology and the accessibility of Web pages by students and faculty with disabilities.[2]

Highlights of Accessibility Issues

Addressing the challenge of Web accessibility requires an understanding of a number of key issues. Knowing whether or not a Web site is accessible by those with a disability is the first step. Developers must understand the tools and techniques that can be used to design accessible sites and to retrofit existing sites that present accessibility problems. Colleges and universities should also have a strong understanding of legislation that governs accessibility and the legal implications for higher education.

Web Accessibility

Before considering Web accessibility in a formal manner, try the following experiment to get an idea of a non-technical, more "human" perspective on Web pages.

Be sure your computer shows a Web page. Use the browser's Internet option settings to turn off the display of images and pictures. Refresh the page, and the graphics should all disappear. Move your mouse out of reach and use the tab key to move from link to link on the page. If the Web page is relatively accessible, when you tab to a link where there had been a graphic, there will now be a text label that explains the graphic. For example, where there had been a picture of the library acting as a link to library information, the word "library" should now appear.

If the page was not designed and built with accommodations for users with disabilities, much of the information and many of the hyperlinks will no longer be accessible. Screen readers, which help visually impaired users "read" what is on a computer screen, can only read text, not images. Hyperlinks that are graphics or icons, for example, will become "black holes" if they do not have appropriate text tags included. Some words that appear on the Web are in fact graphics of words rather than text that a screen reader can interpret. Without text tags, these elements can also be lost to users with disabilities. Consider a Web page that is crammed with information, requiring you to look at it a second or third time to understand it. Imagine the problems this sort of page presents for someone with low vision, poor color perception, or a learning disability.

The solution to providing access to the Web is not to make boring Web pages, but to learn how to use Web design tools to make attractive pages while still providing maximum accessibility for users with a wide range of disabilities. For example, if you have audio on your Web site, are transcriptions or captions available for students and faculty with hearing impairments? When institutions address accessibility concerns for their Web sites and other technical resources, campus information technology programs will contribute to the education of all students, including those with disabilities.

Accessibility of Higher Education Web Sites

Institutions can take advantage of several tools and sets of published standards to ensure their Web pages are accessible. One option is a set of guidelines produced by the Web Accessibility Initiative (WAI). [See the sidebar "World Wide Web Consortium's Web Accessibility Initiative Guidelines."] In 1997 the World Wide Web Consortium (W3C), the international body that oversees the protocols and operations of the Internet, created the WAI. With visible and enthusiastic support from the White House, it received
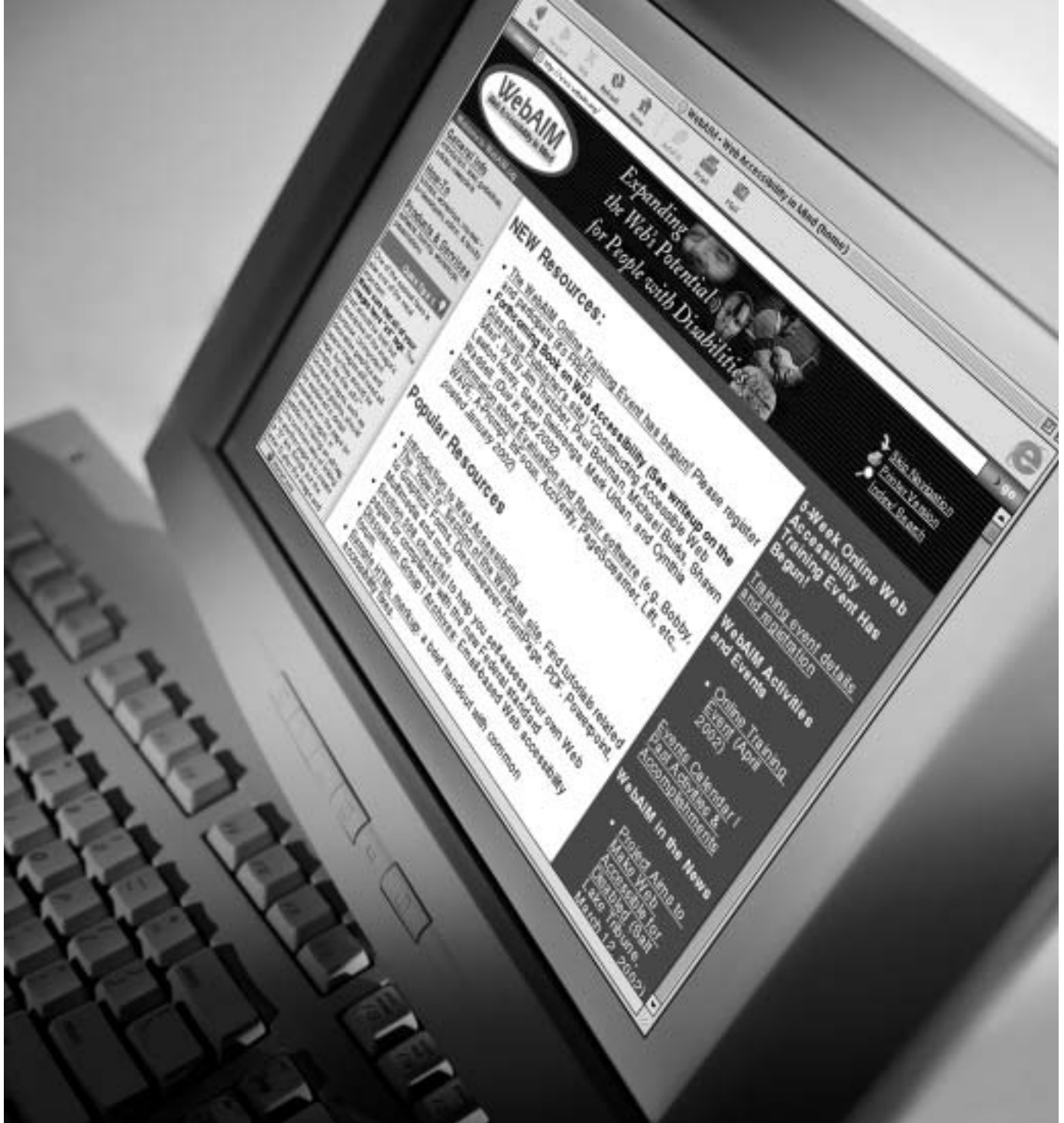
financial support from the Department of Education, the National Science Foundation, and several large computer-related corporations in the United States and overseas. The accessibility guidelines[3] established by the WAI are strong and thoughtful recommendations, widely supported by many organizations and agencies, both public and private. The guidelines are not, however, mandated standards.

Newly released Section 508 standards [see the sidebar "Section 508 Standards"], set forth by the Federal Access Board, offer an alternative for addressing accessibility of Web pages. The standards of Section 508 went into effect in June 2001 and are a federal mandate for "covered entities." Although colleges and universities may not be legally bound to adhere to these standards, using them does assure some level of accessibility and measure of compliance.

Appendix 1 [see the sidebar] provides a list of the standards included in Section 508, as excerpted from the Access Board's Web site. Appendix 2 [see the sidebar] lists the 16 guidelines that constitute the WAI standards for accessibility, from the W3C Web site.

One quantitative way to apply either the WAI guidelines or the Section 508 standards is to use an accessibility checker called Bobby,[4] developed by the Center on Accessible Special Technology (CAST). Bobby only evaluates objective elements of a site and therefore typically returns conservative assessments of full accessibility. A sampling of results from evaluations of campus Web sites, however, hints at the extent of the problem of accessibility:

- In a random sample of 400 prominent colleges, universities, and online learning institutions, only 22 percent had home pages that would receive Bobby approval.
- Looking one level below the home page for those universities whose home page was accessible, just 3 percent received Bobby approval.
- A similar study one year later found 24 percent of these university home pages were accessible.
- When the Web sites of 89 depart-

ments of Special Education were studied, only 27 percent received Bobby approval.

- Other studies found that only 59 percent of library pages and 50 percent of general campus pages surveyed would receive Bobby approval.[5]
- The departments of Library and Information Science surveyed had only a 23 percent Bobby approval rating.

The Web has become such a vital part of institutional information dissemination that not providing effective access to the Web for students and faculty with disabilities denies them access to countless important resources. For example, prospective students are limited in their ability to learn about your campus and its facilities. Universities and colleges increasingly use their Web interfaces for course descriptions, schedules, and registration, avoiding the annoyingly long lines of the past. Students in most institutions can now access their grades and other records online. More and more campus libraries have put resources on the Web, including the catalogue, reserve desk, and an online help desk. The campus IT organization usually has an online help desk to assist with login, software, and even virus information. The campus Web site may be the means for disseminating announcements about special events, campus closings in severe weather, and so on. Go to your cam-

Appendix 1: Section 508 Standards

(a) A text equivalent shall be provided for every non-text element (using "alt" or "longdesc", or in element content).

(b) Equivalent alternatives for any multimedia presentation shall be synchronized with the presentation.

(c) Web pages shall be designed so that all information conveyed with color is also available without color, for example from context or markup.

(d) Documents shall be organized so they are readable without requiring an associated style sheet.

(e) Redundant text links shall be provided for each active region of a server-side image map.

(f) Client-side image maps shall be provided instead of server-side image maps except where the regions cannot be defined with an available geometric shape.

(g) Row and column headers shall be identified for data tables.

(h) Markup shall be used to associate data cells and header cells for data tables that have two or more logical levels of row or column headers.

(i) Frames shall be titled with text that facilitates frame identification and navigation.

(j) Pages shall be designed to avoid causing the screen to flicker with a frequency greater than 2 Hz and lower than 55 Hz.

(k) A text-only page, with equivalent information or functionality, shall be provided to make a Web site comply with the provisions of this part, when compliance cannot be accomplished in any other way. The content of the text-only page shall be updated whenever the primary page changes.

(l) When pages utilize scripting languages to display content, or to create interface elements, the information provided by the script shall be identified with functional text that can be read by assistive technology.

(m) When a Web page requires that an applet, plug-in, or other application be present on the client system to interpret page content, the page must provide a link to a plug-in or applet that complies with §1194.21(a) through (l).

(n) When electronic forms are designed to be completed online, the form shall allow people using assistive technology to access the information, field elements, and functionality required for completion and submission of the form, including all directions and cues.

(o) A method shall be provided that permits users to skip repetitive navigation links.

(p) When a timed response is required, the user shall be alerted and given sufficient time to indicate more time is required.

---

pus home page and scroll through all the resources there. Are you putting resources out of reach for students with disabilities?

Many of us are gratified at the growing awareness of this problem by colleges and universities, and their actions to change this dismal picture. Even so, the figures indicate that significant numbers of students with disabilities face increasing difficulty with their work because course material is being put online at an increasingly rapid rate. Colleges and universities need to develop institution-wide policies about putting information on the Web in an accessible manner.

Web Authoring, Repairing, and Accessibility-Validation Tools

Web pages are written in hypertext mark-up language (HTML). Some Web page designers use a simple text editor and enter all the HTML coding by hand. Most use one of a variety of authoring tools to make the task easier. Some authoring tools display both the content being entered into the Web page and the special code. Other authoring tools let the user see what the page will look like while adding the code out of view. These are "what you see is what you get" (WYSIWYG) editors. Institutions sometimes adopt a specific authoring program for campus-wide use to facilitate consistency.

Designing and checking for accessibility is an added task in the design process. Accessibility is often neglected, though well-designed authoring tools can help. Macromedia's Dreamweaver has a plug-in extension that enables it to check for a page's accessibility as defined by Section 508. The WAI supports a working group developing guidelines for the creators of authoring tools. The more the tool can facilitate the creation of Web pages accessible for users with disabilities, the more likely it is that significant improvement will occur.

Multimedia on the Web provides both opportunities and challenges. Because it provides the ability to output information in multiple sensory modes, it can be used to reach different disability groups simultaneously. Frequently, multimedia switches between modes, alternately including those who are blind or those who are deaf, but blocking the other group from the information.

Streaming audio and video over the Web offers a better option in terms of accessibility, providing both captions for the deaf and supplementary audio descriptions of the video for the blind. This approach requires synchronizing several streams of information so that the video, captions, and descriptions

Appendix 2: World Wide Web Consortium's Web Accessibility Initiative Guidelines

(1) Provide text equivalents for visual information. Provide text equivalents for all images, applets, and image maps. A text equivalent describes the purpose or function of an image, applet, image map, or other visual information. For example, the text equivalent for a company logo image in a link might be "Return to home page."

(2) Provide descriptions of important visual information. Provide descriptions of important information in graphics, scripts, applets, videos, or animations if it is not fully described through text equivalents or in the document's content.

(3) Provide text equivalents for audio information. Provide text transcripts, text descriptions, or captions of auditory events that occur in audio and video.

(4) Don't rely on color alone. Ensure that text and graphics are perceivable and understandable when viewed without color.

(5) Use markup and style sheets properly. Mark up documents with the proper structural elements. Control presentation with style sheets rather than with presentation elements and attributes.

(6) Supplement markup to aid interpretation of text. Provide supplemental information to facilitate pronunciation or interpretation of abbreviated or foreign text.

(7) Create tables that transform gracefully. Ensure that tables have necessary markup to be properly restructured or presented by accessible browsers and other user agents.

(8) Ensure that pages featuring new technologies transform gracefully. Ensure that pages are accessible even when newer technologies are not supported or are turned off.

(9) Ensure user control of time-sensitive content changes. Ensure that moving, blinking, scrolling, or auto-updating objects or pages may be paused or stopped.

(10) Ensure direct accessibility of embedded user interfaces. Ensure that the user interface follows principles of accessible design: device-independent access to functionality, keyboard operability, self-voicing, and so on.

(11) Design for device independence. Use features that enable activation of page elements via input devices other than a pointing device (for example, a keyboard, voice, and others).

(12) Consider interim solutions. Use interim accessibility solutions so that assistive technologies and older browsers will operate correctly.

(13) Use W3C technologies (according to specification) and follow guidelines. Where it is not possible to use a W3C technology, or doing so results in material that does not transform gracefully, provide an alternative version of the content that is accessible.

(14) Supply context and orientation information to help users understand complex pages or elements.

(15) Design clear navigation structures. Use clear navigation structures, navigation bars, and so on to increase the likelihood that users will find what they are looking for at a site.

(16) Design for consistency and simplicity to promote comprehension.

---

mesh together. The CPB/WGBH National Center for Accessible Media (NCAM) has developed a tool to accomplish this—the Media Access Generator (MAGpie).[6] Using MAGpie, media producers can add captions to three multimedia formats: Apple's QuickTime, the World Wide Web Consortium's Synchronized Multimedia Integration Language (SMIL), and Microsoft's Synchronized Accessible Media Interchange (SAMI).

Obviously, constructing a Web site to be accessible is the most efficient and least costly way to provide access for people with disabilities. However, there is a significant need for tools that will help designers retrofit existing sites. The A-Prompt Toolkit utility has been developed through a joint collaboration between the Adaptive Technology Resource Centre (ATRC) at the University of Toronto and the Trace Center at the University of Wisconsin.[7] A-Prompt checks and repairs HTML to conform with either WAI Web Content Accessibility Guidelines 1.0 or Section 508 standards. If A-Prompt detects an accessibility problem, it guides the user through a set of dialogs to fix the problem. When all problems have been resolved, the software automatically inserts the repaired HTML code into the document and saves a new version of the file. Presently, A-Prompt works only on one page at a time and only on a user's computer. The developers of A-Prompt plan to update the tool to work with a collection of pages and are considering adapting A-Prompt to repair files on an online site.

Web designers need to validate their

pages both for conformity with proper HTML code and for accessibility to users with disabilities. Authoring tools provide some page validation, and some sites on the Web do this, also. Dreamweaver and A-Prompt provide a kind of accessibility validation. Bobby also has a version available online. The user inputs the URL of the page to check, and in seconds Bobby displays an analysis page that lists errors it located as well as those items that require a human to make a judgment call on the page's conformance with the rules. The present version of Bobby will check either for the WAI guidelines or for Section 508 standards. The WAI guidelines break accessibility issues into three separate priority levels. Bobby will rate a page against the priority level the user requests. Bobby now has a commercial downloadable version with the ability to check a large Web site consisting of a number of pages. Bobby will point users to the items that need repair, but it does not facilitate the repair.

Legal Issues

Although many people assume that all legislation related to persons with disabilities is lumped into the Americans with Disabilities Act (ADA), this is far from accurate. Three key pieces of legislation address accessibility and are of particular interest to colleges and universities.

Historically, the 1973 Vocational Rehabilitation Act has been the cornerstone of law for education and disabilities, particularly Section 504, which mandates that students with disabilities receive equal opportunities for a full education. The second piece of relevant legislation is Title II of the ADA, which deals with providing equal communications for people with disabilities as for those provided others. Obviously, communication is an integral aspect of teaching and learning. Neither of these laws mentions the Web because the laws were passed before the Web came into being. However, past legislation is constantly being reinterpreted to fit a modern context, and these laws are being applied to the Web today.

Case Docket No. 09-97-2002[8] high-lights several key points associated with Section 504 and Title II, specifically regarding their application to the accessibility of technology at California State University. Of particular concern, the docket indicates the following:

- Recipients of federal financial assistance are prohibited from discriminating on the basis of disability in programs and activities.
- Title II of the ADA requires that communications with persons with disabilities "are as effective as communications with others" [28 C.F.R. ss 35.160a]. In this context, communication means "the transfer of information, including (but not limited to) the verbal presentation of a lecture, the printed text of a book, and the resources of the Internet." The Office of Civil Rights (OCR) has held that "the three basic components of effectiveness 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."
- The OCR is responsible for enforcing Section 504 of the Rehabilitation Act of 1973.
- Colleges and universities that receive federal financial assistance are subject to the jurisdiction of the OCR under both Section 504 and Title II.
- The OCR has responsibility over complaints alleging discrimination on the basis of disability filed against public educational institutions, including public colleges and universities.

Frequently, people have taken pains to note that the mandate to make adaptations is limited to providing "reasonable accommodations." Increasingly, the law is being interpreted to set the bar very high in defining "reasonable." In specifically discussing the university library, Case Docket No. 09-97-2002 states,

> The larger and more financially endowed the library, the higher the expectation that a greater volume of information will be made available within a shorter amount of time, particularly when reasonably priced adaptive technology is available to replace tasks that previously required personnel. An important indicator regarding the extent to which a public library is obligated to utilize adaptive technology is the degree to which it is relying on technology to serve its non-disabled patrons. The more technology that has been purchased by a public library to serve non-disabled patrons, the more reasonable the expectation that it will employ technology such as scanners to serve its patrons with disabilities. In other words, a library's decision to purchase technology of any kind not only creates an expectation that the newly purchased technology will be accessible, but it suggests that the library now has the resources and expertise to fully consider the role of technology with regard to other aspects of its program.

In this docket and in many other OCR and court writings, it is clear that colleges and universities must provide students with disabilities with access to electronic information, information technology, computers, the Internet, and the Web. In many instances, however, one or more of these are not accessible to students with disabilities. Lacking is a specific measuring system that indicates whether the institution is complying. If a student were to sue the institution, how could the institution know if it had, or had not, fulfilled its responsibilities?

The third piece of legislation that affects accessibility is the 1998 revision of Section 508 of the Vocational Rehabilitation Act, which addresses accessibility of electronic and information technology in considerable detail.[9] The law "requires access to electronic and information technology provided by the federal government" and specifies that federal agencies must ensure that this technology is accessible to employees and members of the public

with disabilities to the extent it does not pose an "undue burden."

Section 508 primarily applies to the federal government, specifically to federal Web pages, but it does not pertain explicitly to private Web pages of non-public institutions. A Department of Justice Web page concerning Section 508 says that the regulation "applies to federal departments and agencies. It does not apply to recipients of federal funds..." This seems relevant to colleges and universities, which are major recipients of federal monies. "However," the Web page continues, "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."[10]

This has resulted in many vigorous discussions as to whether state universities and colleges are covered by Section 508; there is no widely accepted conclusion to the question. Some colleges have adopted the Section 508 standards either to be safe or because they seem like a credible guide to follow. Others seem to assume that Section 508 will not apply and are developing their Web accessibility policies, if any, independently. Regardless, institutions may be wise to spend money on making education more accessible rather than defending themselves from litigation.

What It Means to Higher Education

Although the number of persons with disabilities on an individual campus may seem relatively small, the institution has a moral and legal obligation to attend to their needs. While few institutions are unwilling, many are unaware. This problem may be exacerbated by the fact that those whose work impacts students with disabilities are spread across campus, and their efforts may not be coordinated.

The following individuals and groups need to be aware of the accessibility issues and tools described in this Research Bulletin:

■ The institution's chief academic officer needs to be aware of accessibility issues.
■ The CIO should include accessibility

issues in any institution-wide policies for Web design.
■ The university's Webmaster and staff should be skilled in the WAI guidelines and the Section 508 standards.
■ Distance and/or online learning departments need to designate at least one person to understand accessibility needs and to provide training to faculty who are posting courses to the Web.
■ Librarians need to know accessible design to guarantee that the online library materials are available to users with disabilities.
■ Faculty teaching Web design must understand accessibility and include it in their course material.
■ The ADA coordinator needs an awareness of these issues.
■ Staff from the disabled-student service office should have a working knowledge of these guidelines and standards.

Besides building accessibility for people with disabilities into a campus policy document, colleges and universities need some mechanism to review Web pages regularly for their conformity to the policy.

As your institution addresses issues of accessibility for persons with disabilities, some key questions to ask include

■ Is there institutional support to make all parts of the Web site accessible? Are academic sites accessible? Are Web-based recruitment, enrollment, and student services pages accessible?
■ Who has responsibility for ensuring that Web sites are accessible? Is there a defined office that has oversight for disability issues? Does it coordinate the activities of other offices that might deal with these issues?
■ Can those who work with the Web easily access training to help them understand and anticipate issues that might affect persons with disabilities?

Education is one of society's great equalizers. The Internet is another. Yet both are sometimes out of reach of persons with disabilities. Each insti-

tution should take responsibility to ensure that the benefits of education and Web-based educational resources are available to all.

Where to Learn More

■ For information about the Web Accessibility Initiative, see <http://w3.org/wai/>.
■ For information about the Access Board, see <http://www.access-board.gov/>.
■ Online and on-site training opportunities are listed at <http://www.webaim.org/> and at <http://easi.cc/workshop.htm>.
■ Paciello, Michael G., *Web Accessibility for People with Disabilities* (Gilroy, California: CMP Books, 2000). *e*

Endnotes

1. From Edupage, February 4, 2002 <http://listserv.educause.edu/cgi-bin/wa.exe?A2=ind0202&L=edupage&D=1&H=1&O=D&F=&S=&P=170>.
2. Access to on-site computing and information technology is important but would require more space than this bulletin allows.
3. The WAI guidelines and a large body of supporting information are available at <http://w3.org/wai/>.
4. A free, online version of Bobby is available at <http://www.cast.org/bobby/>. Downloadable copies of the software are also available at this URL.
5. Full results from the studies are available at <http://library.uwsp.edu/aschmetz/accessible/websurveys.htm>.
6. MAGpie can be downloaded free from <http://ncam.wgbh.org/>.
7. The A-Prompt Toolkit is downloadable free of charge at <http://www.aprompt.ca/>.
8. This docket is available at <http://www.rit.edu/~easi/law/csula.htm>.
9. Information about Section 508 is taken from the Access Board's Web page at <http://www.access-board.gov/>.
10. Information taken from comments relevant to educational institutions included in a discussion at <http://www.usdoj.gov/crt/508/archive/deptofed.html>.

Norman Coombs, Ph.D. (nrcgsh@rit.edu; http://www.rit.edu/~nrcgsh) is Professor Emeritus at the Rochester Institute of Technology and CEO of EASI (Equal Access to Software and Information; http://www. easi.cc).