Accessibility of Higher Education Web Pages for Students with Disabilities

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Abstract:

The ADA mandates that all public institutions, such as state universities, be accessible to people with disabilities. Due to the growing importance of the internet, online learning, and an ever widening digital divide, we wanted to see if state university websites were digitally accessible as their campuses are becoming increasingly physically accessible. Fifty university home pages (one from each state) and their corresponding disability services web pages were tested for accessibility using the automatic tool WebXact, manual inspections with a screen reader and visual inspections. Findings illustrated that both sets of pages continue to include inaccessible features many of which can be easily resolved and without compromising the main structure or context of the web page. Furthermore, the results showed the importance of conducting manual checks in addition to automatic checks that are insufficient alone to uncover all of the inaccessible aspects of a given web page. Recommendations are given for future research on web accessibility as well as potential negative consequences of inaccessible web pages to universities and people with disabilities.

Table of Contents:

INTRODUCTION

The rapidly increasing use of the web by post-secondary educational institutions in distance-learning programs, on-campus classes, and as a mode of communication to students, faculty, staff and the public, can present significant barriers to users with disabilities if those websites are not accessible (Johnson, Brown, Amtmann, & Thompson, 2003). In fact, the internet plays a very important role in today's educational system, since institutions of Higher Education in the U.S. increasingly use the internet as a means of distributing copious amounts of information. Despite the fact that technology such as the internet has the potential to improve the quality of life of people with disabilities and help increase their participation and integration into community activities, higher education's web pages continue to experience difficulties in complying, as measured by automatic evaluation tools such as 'Bobby' (Thompson, Burgstahler, and Comden, 2003). Although federal civil rights laws mandate that individuals with disabilities have access to the information contained on the university websites, to date, however, there is no federal legal mandate that private or public institutions of higher education make their websites accessible (Johnson, Brown, Amtmann, & Thompson, 2003). On the other hand, the authors reported the good news that higher education administrations are increasingly developing and implementing institutional policy that requires websites to be accessible for individuals with disabilities.

As pointed out by Thompson et al. (2003), section 504 of the Rehabilitation Act of 1973 mandates that access to individuals with disabilities be assured within institutions that receive federal funds. The Americans with Disabilities Act (ADA) of 1990 reinforces and extends Section 504 to public programs and services, regardless of whether or not these programs and services are federally funded. According to these laws, 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. Although Section 504 and the ADA do not specifically address access to technology-based educational offerings and resources, the United States Department of Justice clarified that the ADA accessibility requirements apply to programs offered on the Internet. More recently, amendments to Section 508 of the Rehabilitation Act require 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 (Thompson et al., 2003).

Issues of access are not limited to individuals with sensory disabilities. So, individuals with other disabilities, including learning difficulties, cognitive limitations, limited movement, speech difficulties, photosensitivity, etc. can also benefit or be at a disadvantage by web page's design. Take the case of a journalist student with a repetitive stress injury of the hands. This individual has access to assistive technology in the form of software that recognizes speech (e.g., Dragon Naturally Speaking). However, an internet page or a software application that is not fully supported by spoken commands and requires the use of a keyboard or mouse represents a design barrier to this student. Other barriers for design can be identified in distant learning or online courses. In a classroom, a deaf student will be entitled to use an interpreter or captions as a means to accessing the program of instruction, as required by legislation. However, the barrier on distant education occurs when the uploaded materials include audio (e.g., a video clip or pod cast) that is neither captioned nor interpreted using sign language. These examples are not an exhaustive list of the many ways in which internet design acts as a barrier for students with disabilities, regardless of the availability of assistive technology. However, the main point of emphasis is that these type of barriers are avoidable and the World Wide Web Consortium (W3C) has developed guidelines to help web designers eliminate these barriers. The W3C is an international community that develops open standards to ensure the long-term growth of the Web (W3C, nd).

The accessibility of the web pages of postsecondary institutions has been scrutinized by several researchers (see Flowers, Bray, & Algozzine, 1999; Jackson-Sandborn, Odess-Harnish, & Warren, 2001, 2002; NCDDR, 1998; Rowland & Smith, 1999; Schmetzke, 2001, 2002a, and 2002b; and Walden, Rowland, & Bohman, 2000). For instance, Flowers, Bray, & Algozzine (1999) evaluated departmental websites from 89 departments of special education.

Jackson-Sandborn, Odess-Harnish, and Warren (2001) evaluated the home pages of the 100 most visited sites in several categories, including colleges. The National Center for the Dissemination of Disability Research (1998) evaluated the websites from 213 programs that received funding from the agency, most of which were postsecondary educational institutions. Rowland and Smith (1999) evaluated a random sample of 400 U.S. prominent colleges, universities, and online learning institutions. A follow-up study by Walden, Rowland, & Bohman (2000) evaluated a similar sample of 518 U.S. institutions. Finally, Schmetzke (2002a) completed an evaluation of the University of Wisconsin's 13 four-year campuses, the 56 North American colleges that offer accredited programs in library and information science (Schmetzke, 2002b), and the home pages of 1051 community colleges (Schmetzke, 2001).

"There is a compelling need to, not only, design interventions to improve outcome for persons with TBI, but also, to address the lives and well-being of their caregivers."

All of the studies use the evaluation tool Bobby, which was launched in 1995 by the Center for Applied Special Technology (CAST). Over the next decade, Bobby helped novice and professional Web designers analyze and make improvements to millions of Web pages. CAST no longer supports the Bobby accessibility testing software. Bobby was sold to Watchfire in 2004 which, in turn, was acquired by IBM in 2007. Nevertheless, these studies focused on priority 1 issues.

Bobby's report consists of 3 sections, each having a different priority level:

- ***Priority 1*** -- Accessibility indicates that problems seriously affect the usability of the page by users and should be addressed first. Fixing these problems will get a website a Bobby Approved rating "A."
- ***Priority 2*** -- Accessibility problems, while not as vital as priority 1 problems do affect the accessibility of a website. Addressing both priority 1 and priority 2 problems is considered the preferred minimum conformance level for an accessible web site rating "AA."
- ***Priority 3*** -- Accessibility problems includes other errors which, if corrected, can get a website the "AAA" Bobby approved level.

Although Bobby automatically evaluates the accessibility of web pages on a number of objective measures, many of the authors noted above report the shortcomings of this tool and of automated evaluation tools in general. As the World Wide Web Consortium (W3C)(2008) points out, some of the web-content accessibility checkpoints cannot be checked successfully by software algorithms alone. Only one of the studies performed some sort of manual checks by using JAWS, which is a screen reader software that produces audio output by reading the content of a page. Therefore, the reviewed studies have two considerable limitations. First, it is important to remember that evaluation tools -- including Bobby -- provide a limited picture of accessibility. Since most of the studies discussed here only used Bobby, we cannot confirm whether these findings are completely accurate measures of accessibility. To have a full and reliable story, it is essential to complete the manual checks that were only utilized by one of the cited studies. The second limitation of the studies reviewed in this summary, is that they focused on the success criteria meeting the priority 1 level, i.e., minimal accessibility. Perhaps, due to the complexity of studying all the related web pages of an institution, and to at least grasp a general view of the status of accessibility, it is practical for studies to run this limited test. However, one should not forget that when browsing the net, individuals typically visit a collection of pages. So, true accessibility will be achieved when institutions of higher learning implement and test all of their pages according to the highest standards of the W3C.

Despite of the limitations of the studies listed, the findings are not very re-assuring. The majority of postsecondary education WebPages failed to gain 'Bobby' approval. The highest percentage of WebPages meeting Bobby "A" approval was found on the home pages of postsecondary libraries and only 51% achieved this mark. In contrast, only 6% of university home pages received Bobby A approval at the time – minimum accessibility. The findings from the home pages of Liberal Arts colleges were very troublesome because these serve as the web portal for any student with a disability seeking entrance to the institution. The studies portray an appalling picture of access for students with disabilities, especially since these studies were testing for minimum accessibility standards – priority 1. Following is a brief summary of the types of errors found in these studies.

The problems found in these studies only address accessibility minimums and therefore, are not a comprehensive list of accessibility issues. Among the problems the researchers found on these pages were Images without alternate text (e.g., Jackson-Sandborn, Odess-Harnish, & Warren, 2001). This issue is defined by guideline 1.1 which states that, "text alternatives for all content must be provided". The testable success criterion gives the different options in which images can be made accessible. Not complying with this criterion, will hinder the ability of screen reader users who depend upon the proper tagging of images in order to understand its content. Another problem found was Mouse Over, also known as hovering menus (e.g., Schmetzke, 2001, 2002a, and 2002b). This error is related to guideline 2.1 which states that all funtionality should be operable via a keyboard interface and can be tested with criterion 2.1.1. Menus that required the use of the mouse limits the access to individuals using voice activated software, as well as people who depend upon audio cues for accessing information. If menus cannot be activated via keyboard commands, users who are visually impaired and other users with disabilities will have difficulties navigating institutional web pages. The errors found are not limited to the few examples just given, other issues with accessibility were: no options for resizing fonts, drop down menus requiring the use of a mouse, flash movies, moving images frames without titles, pages that are not readable without frames, and images hot spots without alternative text.

As previously mentioned, this study seeks to advance the knowledge on issues regarding the accessibility of web pages by performing a more comprehensive evaluation of college's web pages. The investigative team holds the position that accessibility should be measured beyond minimal standards and if a person with a disability is receiving meaningless or incorrect information, then the page is not accessible. To achieve this objective, this study examined issues of usability by determining and highlighting, the steps required by students to get from a portal to the pages of disability services.

Therefore, this study answered the following questions:

1. Are college's home and disability service home pages accessible?
2. Do disability services pages required complex navigation movements?

This study added to the existing body of literature in three specific ways: First, this study goes beyond the typical minimal performed by other studies by using both automatic and manual checks of priority level one, two and three of accessibility as established by the World Wide Web Consortium (W3C); second, it studies the main portal or home pages of the institutions as well as the pages for disability service, a key resource for students with disabilities; and third, it looks at other navigation issues with regards to the ease of getting from the main institution home page to the disability service office page of each university examined.

METHOD

Participants

For this study, 50 universities, one from each state of the union, were selected to test the accessibility of their home and disability pages. The Criteria for selection included that the university was a Public Research 1 institution. To eliminate as much bias as possible from

the sample selection, the researcher picked institutions listed on the National Science Foundation's web page http://www.nsf.gov/statistics/profiles/, a list divided by state. The researchers focused on Public institutions, to ensure that religious private schools that may not be covered under the provisions of Section 504 of the Rehabilitation Act of 1973 and/or the American with Disabilities Act of 1990 were excluded. This purposive sample used research universities because the federal government, including the National Science Foundation promotes the participation of persons with disabilities in research activities. The identities of the 50 universities were kept confidential to third parties and are only known to the researchers. The general populations of these institutions ranged from 3,234 to 36,878 students and have disability offices providing services from 22 to 1,553 students. Out of the 50 universities, 14 were located in a rural setting and 36 in an urban setting. A total of 97 web pages were tested automatically and manually (50 home pages and 47 disability pages). Three of the disability pages were not available at the time of testing, either because they had become inactive or were under construction.

Automatic Checks

All web pages were viewed using Internet explorer version 6, from Microsoft. Automatic checks were conducted using Watchfire WebXACT, a free online tool available at www.webxact.com. WebXACT allows users to check WebPages for quality, accessibility and privacy level of their online content (http://www.watchfire.com/news/releases/5-12-03.aspx). This accessibility tool was chosen over others (e.g. Cynthia says, WAVE, or the W3C validator) because WebXACT replaced 'Bobby', the tool used by the researchers assessing accessibility in higher education web pages.

To use WebXact, the researchers used the following procedures: Entered WebXact's URL www.webxact.com on the internet browser. As per the instructions, the researchers typed or pasted the complete URL of the web page being tested into the search box. At that point, the researchers chose one of the four levels of accessibility criteria available for testing.

The choices included:

1. Section 508;
2. the World Wide Web Consortium's (W3C) Web Content Accessibility Guidelines WCAG A;
3. Bobby AA; or
4. Bobby AAA compliance.

In addition, the researchers chose to check the following options:

- "Collect code fragments for accessibility issues,
- scan for broken links,
- automatically update status while scan is in progress (not recommended for screen readers), and
- remember these settings for use on my next visit."

All pages in this study were tested using W3C WCAG - AAA Compliance. This was chosen in place of Section 508, or W3C WCAG - A or AA Compliance because it adheres to the strictest standards of the W3C WCAG guidelines. All of the other four preferences were also chosen in order to ensure the most comprehensive and thorough analysis of each web page. The next step was to click the go button to perform the analysis. WebXACT scans the entire web page selected, checking its html code against the particular guideline chosen by the user. This action means that the evaluation tool searches for possible accessibility errors or warnings; and for potential errors that cannot be automatically verified and need to be checked manually. When the evaluation tool completes the assessment, it generated a report detailing the quality, accessibility, and privacy errors or warnings discovered and offers suggestions on how to fix them. This study was only concerned with the accessibility issues of each webpage, so this part of the report was saved for each of the 97 web pages tested and relevant data was later entered into a SPSS database.

Manual Checks

In order to check the validity of WebXACT's results, manual checks were also conducted. These manual checks were paired with their automatic counterparts. The 97 web pages were checked one at a time and simultaneously by members of the research team. The first researcher used a screen reader and the second conducted manual and visual inspections to evaluate the page accessibility. All errors found were recorded in a SPSS database. These manual checks were necessary because the depth of the automatic checks was limited. For instance, when WebXACT tests a page for a 1.1 guideline error (Provide a text equivalent for every non-text element) it simply looks to make sure that every photograph, graphic, image, etc. is associated with what is called "alt tag," which is a specific code written in the html that identifies these items as non-text elements and gives them a label. However, it does not check whether any text is written in this label or if the text makes any sense. Thus, WebXACT may consider a photograph as accessible because it has the alt tag "picture of a cat" associated with it but what is actually displayed on the visible webpage is a picture of the dog; which means that although there is nothing wrong in the way the html code is written, the image is still not accessible because someone with a screen reader will be given false information about the photograph. The manual checks take into consideration contextual factors that are impossible for an automated tool to assess. This is why the research team checked each non-text element simultaneously to make sure that the screen reader was identifying and reading the pictures properly and that the text associated with each element made sense.

Data Analysis

All of the automatic and manual errors found for each webpage were compiled and entered into a SPSS database. This study only performed descriptive statistics of the data collected. The data was not intended to compare the accessibility within or between institutional pages, but to help portrait a better picture of the state of accessibility in institutions' web pages. For each of the 10 paired errors one of the following classifications were assigned: automatic and manual checks agree that an error exists; automatic and manual checks agree that no error exists; automatic check discovered an error but no error was found by the manual check (false positive); and automatic check did not discover an error but manual check did discover an error. This was done for each of the 97 web pages. For each of the 10 types of errors, percentages were calculated for valid automatic errors, overall errors, and false positives. The percentages of each error type made up of its priority and of all errors were compiled into two tables, one for the universities home pages and one for the disability services pages.

Results

Automatic errors were found in all three priorities and a total of 16 types of errors were discovered for both home and disability pages, 10 of which had corresponding manual checks. The following results focus only on those 10 errors that had both an automatic and manual check. A complete list of all home page errors is included in Table 1 below.

Table 1: List of Errors by Type

Type of Error	Meaning of Error
1.1	Provide a text equivalent for every non-text element This includes: images, graphical representations of text (including symbols), image map regions, animations, graphical buttons, sounds, stand-alone audio files, and video, etc.
1.5	Until user agents render text equivalents for client-side image map links, provide redundant text links for each active region of a client-side image map.
3.2	Create documents that validate to published formal grammars.
3.4	Use relative rather than absolute units in markup language attribute values and style sheet property values.
4.3	Identify the primary natural language of a document.
5.5	Provide summaries for tables.
10.4	Until user agents handle empty controls correctly, include default, place-holding characters in edit boxes and text areas.
10.5	Until user agents (including assistive technologies) render adjacent links distinctly, include non-link, printable characters (surrounded by spaces) between adjacent links.
12.1	Title each frame to facilitate frame identification and navigation.
13.1	Clearly identify the target of each link.

The most common error found on the home pages (see Table 2 on the following page) was 1.1, with 66% of all home pages having this type of error and making up 20.89% of all errors discovered in the home pages. The least common errors were 12.1 and 10.5 with no home pages having such errors. The error type with the most false positive was 10.5 with 82% of home pages tested. The error type with the least false positives was 3.2 with 0% of home pages tested. For the 50 home pages tested there were a total of 158 valid errors found.

The most common error found on the disability pages (see Table 3 on the following page) was 4.3 with 53.19% of all disability pages having such errors and making up 19.08% of all errors discovered in the disability pages. The least common error was 10.5 with no disability pages having such error. The error type with the most false positives was 10.5 with 76.60% of disability pages tested. The error type with the least false positives was 3.2 with 0% of disability pages tested. For the 47 disability pages tested there was a total of 131 valid errors found.

Table 2: University Home Page Error Percentages (N = 50)

Type of Error	Valid Automatic Errors	Overall Valid Errors	Automtic False Positives	Percentage of Priority Errors	Percentage of Home Page Error
1.1	30%	66%	8%	100%	20.89%
12.1	0%	0%	8%	0%	0%
Priority 1 error total					20.89%
3.2	6%	8%	0%	6.06%	2.53%
3.4	38%	62%	8%	46.97%	19.62%
13.1	50%	62%	14%	46.97%	19.62%
Priority 2 error total					41.77%
1.5	12%	38%	10%	32.2%	12.03%
4.3	30%	32%	16%	27.12%	10.13%
5.5	26%	28%	34%	23.73%	8.86%
10.4	18%	20%	50%	16.95%	6.33%
10.5	0%	0%	82%	0%	0%
Priority 3 error total					37.34%

Table 3: Disability Services Page Error Percentages (N = 47)

Type of Error	Valid Automatic Errors	Overall Valid Errors	Automtic False Positives	Percentage of Priority Errors	Percentage of Disability Page Error
1.1	17.02%	38.30%	23.40%	94.74%	13.74%
12.1	2.13%	2.13%	23.40%	5.26%	.76%
Priority 1 error total					14.50%
3.2	31.91%	34.04%	0%	27.59%	12.21%
3.4	27.66%	46.81%	36.17%	37.93%	16.79%
13.1	29.79%	42.55%	21.28%	34.48%	15.27%
Priority 2 error total					44.27%
1.5	4.26%	19.15%	17.02%	16.67%	6.87%
4.3	48.94%	53.19%	12.77%	46.30%	19.08%
5.5	25.53%	29.75%	40.43%	25.93%	10.69%
10.4	10.64%	12.77%	12.77%	11.11%	4.58%
10.5	0%	0%	76.60%	0%	0%
Priority 3 error total					41.22%

In addition to the manual and automatic checks, the research team looked for other criteria impacting the functionality or ease of navigation of the web pages. Home pages were examined to determine how easy it was to reach the disability services web page. It was found that 45 out of 50 universities did not have a direct link to the office of disability services. Then the researchers used the A-Z index or site map, usually found on the main page of the institution, to see how many of the universities had the office of disability services listed in this searchable resource. Disability services was found on 31 of the universities site map or A-Z index, it was not located on 5 of them and 14 university websites did not have a site map or A-Z index. Lastly, the research team attempted to find the office of disability services, utilizing the institutions' search engine. Here the research team found that 41 searches returned positive results, 8 returned no results, and 1 did not have a search engine.

Discussion

The results from this study suggest that web designers in colleges and offices of disability services, often continue to make simple and preventable errors. The results confirm that continued efforts are needed to educate administrators, faculty, and web designers about the need for web accessibility for students with disabilities and the techniques for improving the accessibility of the web pages. In the university web pages, the prevalence of type 1.1 (Provide a text equivalent for every non-text element), and 13.1(Clearly identify the target of each link) errors indicate the need for website developers to be aware of basic accessibility needs of people with disabilities. Though these errors were prevalent they are very easy to fix by simply adding an image tag to any non-text element which describes what the item is so screen readers can verbally describe the item to the user. So if there is a picture of a dog on the site the screen reader would read the image tag "picture of a dog" to the user. Rather than making the text of a link indistinguishable from the rest of the text on the page make clear it is a link by making the words click here the hyperlink for example. In the disability services web pages, the errors were not as high but still prevalent regarding type 4.3, 3.4 and 13.1 errors. On the other hand, our findings validate the need for manual inspections in order to address false positives that result from using programs like Bobby. The evaluation of university pages indicated significant false positives in the 10.5, 10.4 and 5.5 type errors. The disability services pages indicated significant false positives in the 10.5, 5.5 and 3.4 type errors. Noteworthy, the disability pages showed three times as much false positive errors in the Type 1 error category than the university pages.

Persons with disabilities have an array of tools that help them in accessing the Internet. However , "assistive technology alone cannot overcome the barriers that are created at a more basic level-- the format in which content is presented" (Schmetzke, 2001). Although it is easier to understand that design of web pages can create barriers for students with visual impairments, inappropriate accessibility on a web page goes further and can also be a barrier for those students having difficulty using a mouse and those with some cognitive impairments, and deaf individuals coming across videos or podcasts that are not transcribed. Previous research looking at web pages' accessibility, suggest that many of the higher education web pages tested, failed to gain Bobby approval, a trend that continues to be reflected in the findings of this study.

The study has several limitations. First, the selection of university sites was not random. Although we selected sites from a pool of sites from each state, we had to exclude many colleges and universities and only focused on large public ones. The one advantage this has is that we target sites that tend to attract a large number of students with disabilities and usually have more resources to provide disability services. Second, Bobby is no longer in use, so the comparison with previous studies that used Bobby is someone limited. Third, visual inspectors that verify the sites accessibility need to be carefully trained. We used two inspectors but did not collect reliability data. This oversight should be corrected in future research.

Directions for Future Research

Johnson et al., (2003) argued that post-secondary institutions must develop policies on web accessibility to meet their obligations under Section 504 and the ADA and in response to state or local government policy or laws, administrative leadership, or from any unit within a university that reflect the interests or needs

of individuals with disabilities. Rowland (2000) proposed that there are several elements to the future success of postsecondary access. The most salient would be (a) institutional commitment; (b) taking corrective action; and (c) remaining up to date with new technology developments. She argues that colleges and universities must begin to grapple with current inequities and the federal mandates. Institutional commitment and coordination will go a long way toward reforming the present crisis. 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 systems must be created to optimize the participation of all students.

The National Center on Disability and Access to Education (2007) proposed the following steps toward addressing accessibility needs: (a) a clear rationale and more research to support accessibility in university and college's accrediting guidelines; (b) the formulation of institutional "indicators of accessibility" designed to provide a comprehensive outline and description of required, recommended, and best practices in electronic-accessibility in education; (c) an institutional self-assessment instrument to offer universities and colleges a process for reviewing institutional practices; (d) a compendium of accessibility support materials and resources for institutional or accreditation site-teams; and (e) a document for site-teams to recommend how they might capture and properly report on institutional accessibility findings. Making the information about the accessibility of a university public, would increase accountability and motivate sites to make the necessary changes and improvements.

CONCLUSION

The results of this study are consistent with those of previous studies. In other words, there is still a lot of room for improvement. Thompson et al., (2003) concluded that as advocates continue their efforts to make the web in higher education more accessible, it is important to continue research that assesses progress toward this goal. More accurate and efficient methods for evaluating the accessibility of websites are critical to assuring that we have an accurate measure of web accessibility in higher education. On their part, Johnson et al. (2003) said that by developing comprehensive policies about web accessibility, institutions can ensure that all members of the institution community have access to information on their web sites. Policy may develop in response to advocacy by individuals on campus, administrative leadership, state laws, or in settlements over legal action. When policies are well designed and implemented, they provide flexible guidance and appropriate allocation of resources to allow implementation and maintenance. Let's hope that we do not have to resort to legal action in order to achieve what is right.

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