A Survey of Web Accessibility on the Texas Public School System

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Abstract

As the World Wide Web becomes one of the main communication channels between school districts and their community of stakeholders, the need to provide equal access and equal opportunity to people with disabilities is no longer just an ethical issue but a legal obligation. This paper tests the 1117 entities within the Texas public school system using the Bobby Software. The results show that most of the websites fail to meet the minimum required standards: Section 508 guidelines and Web Content Accessibility Guidelines (WCAG) priorities.

Introduction

The Internet is becoming more and more important for nearly everybody as it is one of the newest and most forward-looking media in many aspects of our lives: education, employment, government, commerce, health care, recreation, and more. Websites, like buildings, should be designed to meet the needs of all people, including those with disabilities. The Web Accessibility Initiative (WAI) of the World Wide Web Consortium (W3C) defines web accessibility as "meaning that people with disabilities can perceive, understand, navigate, and interact with the Web, and that they can contribute to the Web. Web accessibility also benefits others, including older people with changing abilities due to aging (WAI Home, 2008)."

Though estimates vary, studies (Department of Commerce, 1997; Kraus, L., Stoddard, S., & Gilmartin, D., 1996) found that about one fifth (20%) of the population has some kind of disability, including visual, auditory, physical, speech, cognitive, and neurological disabilities though not all of these people have disabilities that make it difficult for them to access the internet. Lenhart (2002) reports that 12% of all internet users have disabilities. It is essential that the websites are accessible in order to provide **equal access** and **equal opportunity** to people with disabilities. An accessible website can also help people with disabilities more actively participate in society.

Nowadays, Internet plays an increasing integral role in education for the delivery of academic, administrative, and student services. Web pages often contain important information about academic resources, campus events, and administrative policies. The Texas school system supports approximately 4.5 million students; among them, 486,887 (10.6%) are classified as special needs (AEIS, 2007), a significant portion of the users for the Texas school system. Not only do Texas public schools have an ethical obligation to ensure that the students with disabilities they serve have equal access to online services, but they are also mandated by Section 504 of the Rehabilitation Act to ensure that all students have equal access to equitable education and programs (West, et al. 1993). "No otherwise qualified individual with a disability in the United States . . . shall, solely by reason of her or his disability, be excluded from the

participation in, be denied the benefits of … any program or activity receiving Federal financial assistance . . . ” (Section 504, 1973). The Americans with Disabilities Act (ADA, 1990) reinforces and extends Section 504 to public programs and services, regardless of whether or not these programs and services are federally funded.

Review of the Literature

A number of studies have been conducted to research the standards, tools, and legislation supporting accessible web development. Some previous studies have shown that many web pages remain inaccessible to users with disabilities.

Web Accessibility in Higher Education

Many published studies have evaluated the accessibility of selected web pages at institutions of higher education. Schmetzke completed a study of 56 North American colleges that offer American Library Association (ALA) -accredited programs in library and information science (Schmetzke, 2002) and the home pages of 1051 community colleges (Schmetzke, 2001). He found that 77% of university and community college web pages contained at least one accessibility error. Rowland and Smith (1999) evaluated a random sample of 400 prominent U.S. colleges, universities, and online learning institutions and found that fewer than 25% of university home pages met the minimum accessibility criteria. Thompson, Burgstahler, and Comden (2003) manually evaluated critical web pages of 102 public research universities using a 5-point rating scale that focused on each site’s “functional accessibility.” Zaphiris and Ellis (2001) used accessibility testing tools to examine the usability and accessibility of the top 50 universities in the United States. They found that only 15 of the 50 university sites were free of WCAG Priority 1 accessibility errors, and only 7 sites passed both usability and accessibility tests. Kane, Shulman, Shockley, and Ladner (2007) researched the accessibility of the 100 top international universities. They proposed a comprehensive method of testing websites and showed that accessibility was still a problem for many of the top universities worldwide.

Web Accessibility Evaluation Tools

Some evaluation tools can help determine accessibility (Benavidez, Fuertes, Gutierrez, & Martinez, 2006). The best known is Bobby, developed by the Center for Applied Special Technology (CAST, 2008) and now owned by Watchfire. Bobby automatically evaluates the accessibility of web pages on a number of objective measures (Rowland and Smith, 1999; Schmetzke, 2002). Some more automated evaluation tools such as Cynthia Says, utilize WCAG and Section 508 accessibility guidelines (Kane, Shulman, Shockley, & Ladner, 2007). Functional Accessibility Evaluator (FAE) evaluates web sites and provides authors with directed feedback about accessibility in several categories (Gunderson, Rangin, & Hoyt, 2006) and WebInSight which detects what impedes access to the web and offers suggestions to improve access (Bigham, Kaminsky, Ladner, Danielsson & Hempton, 2006). However, many of the authors noted the shortcomings of automated evaluation tools in general. As the World Wide Web Consortium (W3C) points out, “Some of the web-content accessibility checkpoints cannot be checked successfully by software algorithms alone. There will still be a dependence on the user's ability to exercise human judgment to determine conformance to the guidelines” (W3C, 2000).

Some studies have combined the use of automated evaluation tools with a manual process. Rowan, Gregor, Sloan, and Booth (2000) proposed a standard accessibility evaluation method that combines the use of Bobby, a W3C HTML validation tool, and a manual evaluation that includes both general and detailed inspections. Johns (2002) used Bobby, W3C HTML validator, a screen reader, screen magnification software, and a color blindness simulator. Also, Erickson (2002) supplemented Bobby with a simulated application process in which each site was navigated using a screen reader and keyboard.

A few studies used exclusively manual processes in evaluating online library database services for accessibility. Horwath (2003) conducted a survey via email to 11 blind and visually impaired clients of the Canadian National Institute for the Blind Library. In the survey, she instructed the subjects to perform specific tasks with different online library databases and to rate the overall accessibility of each database. Axtell and Dixon (2002) manually checked on service for conformance to the Section 508 web accessibility standards.

Achieving Web Accessibility

Finally, some literature revolves around the achievement of web accessibility. Sloan, Kelly, Heath, Petrie, Hamilton, and Phipps (2006) emphasized that dissemination of accessibility standards and adoption of accessibility guidelines by web authoring tools are not enough. They argued that web pages should be viewed in a much larger social context and that the role of the web page cannot be separated from its accessibility. Sierkowski (2002) pointed out that successful delivery of accessibility is dependent on a developer's awareness of the accessibility aspects involved. Rosmaita (2006) offered an "accessibility first" approach to web design; he proposed an accessibility first pedagogy for web design. Centeno, Kloos, Gaedke, and Nussbaumer (2005) also argued that web accessibility needed to be included in the design process rather than be a post-design process. They also showed that designers cannot rely solely on authoring and design tools. Web accessibility requires human intervention and inspection.

Law, Yi, Choi, and Cko (2006) looked at the need for accessibility personnel to work with web developers from the beginning and the need to share a collaborative work environment. Accessibility should not be solely part of the post-design process. Jackson (2003) laid a framework for interdisciplinary teams to create accessibility guidelines. The interdisciplinary team includes accessibility and web development members. Regan (2004) further emphasized the need for designers and accessibility personnel working together in showing that accessibility and design are converging, and both are connected to web standards. Lastly, Gibson (2007) showed that with Web 2.0 becoming more prevalent, users with disabilities may be unaware of how to interact with the dynamically created rich user interfaces. This highlights the need for accessibility to be considered as part of the design process.

Web Accessibility Standards

Web accessibility is rooted in two sets of guidelines: Section 508 of the Rehabilitation Act and the Web Content Accessibility Guidelines (WCAG). Section 508 is mandated by law and applies to the websites of all federal agencies and organizations that receive federal monies (Section 508, 2006). While not backed by law, the WCAG is part of the World Wide Web Consortium's (W3C) Web Accessibility Initiative (WAI), and it plays a critical role in establishing website accessibility standards. Section 508 and WCAG share some standard

guidelines, and the W3C WAI is working with the United States Access Board--the federal agency responsible for Section 508--to revise and update Section 508 guidelines (WAI Home, 2008). Because of this fact, it behooves all federal organizations to exceed the mandated Section 508 guidelines, and achieve full compliance with WCAG as well.

Section 508

Section 508 is included in the 1998 amendment to the Rehabilitation Act, U.S. Public Law 105-220. It consists of 16 paragraphs that focus on dissolving barriers that inhibit persons with disabilities from accessing information technology (IT) resources. Table 1 provides a summary of section 508 requirements.

Table 1: *The Sixteen Paragraphs of Section 508*

Paragraph	Short Description
(a)	Provide alternate text for images
(b)	Synchronize alternates to multimedia presentations
(c)	Convey information displayed solely in color in another way
(d)	Ensure that pages are readable without its style sheet
(e)	Provide text links for server side image maps
(f)	Use client side image map when possible
(g)	Identify headers and footers in all tables except those used for layout
(h)	Identify tables that have two or more rows or columns that serve as headers
(i)	Give each frame a title
(j)	Make sure that the screen does not flicker quickly
(k)	Provide a text only page for a site that cannot be made accessible
(l)	Provide alternate text for scripts that convey information
(m)	Give a link for accessible plug-ins
(n)	Make sure to associate form controls and their labels
(o)	Allow user to skip repetitive navigation links
(p)	Give notification and extensions of timed responses

Currently Section 508 only applies to the federal government or businesses and to organizations that receive federal monies (Salamone, 2002). By extension, this implies that all state governments and their respective agencies are subject to 508 guidelines. For the purpose of this paper, we are investigating the Texas public school system.

Given that Section 508 addresses the accessibility of information technology, it is important to note that accessibility does not guarantee usability (Petrie & Kheir, 2007). An important distinction needs to be clarified. **Web page usability** refers to users' ability to find the information they need on a website. **Web page accessibility** refers to web services that support disabled user populations. Accessibility does not imply usability, and vice versa. Usability, or design, and accessibility are currently converging, and both rely on web standards to achieve maximum potential (Regan, 2004). However, the fact that web pages meet accessibility guidelines does not guarantee that a user with disabilities will be able to use the web pages without problems (Vigo, Kobsa, Arrue, & Abascal, 2007). The reality is that Section 508 guidelines do not mandate usability, only accessibility.

Because we used the automated software Bobby in this study, only paragraphs (a), (i), and (n) of Section 508 can be explicitly tested. The remaining paragraphs all require human investigation or manual verification. For example, evaluation software can easily be tested to verify that all images have alternate text (paragraph (a)); however, it is more difficult to verify that a site is readable without its associated style sheet (paragraph (d)).

W3C WCAG Priorities

Unlike Section 508, the Web Content Accessibility Guidelines (WCAG) is not required by law. It was developed in 1999 by the World Wide Web Consortium's (W3C) Web Accessibility Initiative (Chisholm, Vanderheiden, & Jacobs, 2001), and supported by U.S. Department of Education's National Institute on Disability and Rehabilitation Research. WCAG provides a set of checkpoints that web developers may follow to ensure that their sites are accessible to a wide variety of users. WCAG defines three levels of web accessibility, Priority 1 (P1), Priority 2 (P2), and Priority 3 (P3). The priorities do not cascade, therefore, a site may meet all the requirements of P3 and still fail to meet the P1 and P2 requirements. Each WCAG priority consists of various guidelines. Fourteen guidelines make up the WCAG framework. Each guideline is broken down into individual checkpoints. For example, guideline 1 is shared between P1 and P3. P1 consists of checkpoint 1.1, 1.2, 1.3, and 1.4, while P3 contains checkpoint 1.5. The WCAG and 508 share some common elements which will be explored in next subsection.

In WCAG, a website must satisfy all P1 checkpoints to be considered minimally accessible. Therefore, P1 is a fundamental requirement for web pages. P2 identifies checkpoints that are recommended; not meeting the P2 requirements indicates that some individuals may have difficulty with the webpage content. P3 checkpoints are the last checkpoints required to complete webpage accessibility. Those pages that fail to meet P3 will find that a few individuals will experience trouble viewing the webpage (WCAG, 1999).

Like 508 guidelines, the WCAG cannot be completely tested using software evaluation tools. In fact, most of the checkpoints require manual verification. The need for manual verification plays an important role in deciding how to address website accessibility and is further discussed later. This paper is based on the 1999 WCAG 1.0 guidelines. The W3C is currently advising on updates to the 508 guidelines while at the same time developing WCAG 2.0 guidelines.

Commonalities

The Section 508 and WCAG guidelines share several common requirements. The table below shows the overlap of 508 and WCAG.

Table2: *Commonalities between Section 508 Guidelines and WCAG 1.0 Guidelines.*

Section 508 Guideline Paragraph	WCAG 1.0 (Priority, Guideline. Checkpoint)
(a)	P1, 1.1
(b)	P1, 1.4
(c)	P1, 2.2
(d)	P1, 6.1

(e)	P1, 1.2
(f)	P1, 9.1
(g)	P1, 5.1
(h)	P1, 5.2
(i)	P1, 12.1
(j)	P1, 7.1
(k)	P1, 11.4
(n)	P2, 12.4

A web page that conforms only to P1 guidelines will not meet the minimum 508 guidelines as stipulated by law, because Section 508's **paragraphs (l), (m), and (n)** are not included in Priority 1. Table 2 also solidifies the need for web pages to move beyond Section 508, and achieve higher accessibility by implementing P1 and P2. As mentioned earlier, the W3C's WAI is closely connected to the development of the revised 508 guidelines. This table also represents the choice to test the school district web pages against the current WCAG 1.0 Priorities.

Research Methodology

In this paper, an assessment of Texas public school system web sites is conducted to measure their web accessibility against Section 508 guidelines and WCAG priorities. Possible solutions to the issues identified are offered, and a more global approach (within the confines of the Texas public school system) to web accessibility is framed later.

Evaluation Methods

The primary tool used in this paper is WatchFire Bobby Software (Rowland and Smith, 1999; Schmetzke, 2002). Bobby allows users to scan entire websites or single web pages. All pages could be compared to 508 guidelines and all three priorities of the WCAG. The secondary instrument used in this study was Microsoft Access. All data collected from the Bobby Software was entered manually into an Access Database. A small application in Visual Basic .Net 2005 was written to ensure the accuracy of data entry and to help analyze the data. Finally, this study used the Ask Texas Education Directory (AskTED, 2008) website in order to ensure a complete, up-to-date, accurate list of all the Texas Local Education Agencies (LEAs). The AskTED website is maintained by Texas Education Agency (TEA), and acts as a public repository of LEA information.

Selection of Web Sites

Websites were chosen as being operated by the entity in question. For example, McLennan County Juvenile Correction Facility I & II are LEAs and do have a web presence. However, their "website" is in fact a one page informational section under the much larger Texas Youth Commission website. As such, McLennan County Facilities are not considered within the boundaries of this research and are indicated as not having a website. For each web site, only the home or front page is tested due to the limited time constraints and the size of the Texas LEA websites. If a website has flash introductions prior to arriving at the true content home page, the

introduction web page was skipped and the home page that provided navigation and information was examined.

For each web page tested against Bobby, the number of P1, P2, P3, and 508 violations were recorded. The guidelines that were violated were recorded rather than the total number of violations per guideline. For example, a web page may have 20 specific instances of images without alternate text; however, only one violation was recorded for the respective web page. All web pages were tested from October 2007 through January 2008. All LEAs that had websites down during this time were revisited three times in order to ensure a complete list.

Because many of the 508 and WCAG priorities are subjective, only the objective errors produced by Bobby were recorded. For example, the 508 guideline - paragraph (a) - indicates that all web images should have an alternate text. As such, this guideline is objective because it can easily be identified and cataloged. However, the 508 guideline paragraph (d), which requires documents to be organized so they are readable without requiring an associated style sheet, is a subjective matter (depending on how one defines readable), and cannot be explicitly tested with the automatic software. This aspect of web accessibility testing indicates clearly that no single software tool can create web accessible web pages; in addition, manual investigation is also required.

Results

This research investigated 1257 Texas school entities listed on the AskTED website. The total number of entities includes all local school districts, region centers, and TEA. For ease of understanding, the analyses have been broken down into four parts: 508 guidelines, P1, P2, and P3 of the WCAG.

Overall Statistics

Only 1117 out of the overall 1257 LEAs are testable, the rationale for not testing 140 districts is detailed in the previous section. The table below shows the breakdown of total schools tested, and the number of LEAs that passed 508 guidelines, P1, P2, and P3. Of the tested websites, only 144 or 12.9% (144/1117) passed paragraphs a, i, and n of the 508 guidelines; 186 or 16.65% (186/1117) passed P1; 8 or 0.72% (8/1117) passed P2; and 5 or 0.45% (5/1117) passed P3. Only 1 passed all 4 areas.

Table3: Results of LEA Accessibility Analysis

Total Districts Tested	1117	88.86%
Total Districts Not Tested	140	11.14%
Total Districts	**1257**	
Passed 508	144	12.89%
Passed P1	186	16.65%
Passed P2	8	0.72%
Passed P3	5	0.45%
Passed All	1	0.09%

Section 508 Guidelines

To reiterate, Section 508 consists of 16 paragraphs, 3 of which can be explicitly tested using the Bobby software – paragraphs (a), (n), and (i). Table 4 shows a breakdown of the three 508 guidelines. The most prevalent error is paragraph (a) which accounts for 80% of all errors; this result is consistent with previous research into website accessibility (Loiacono, 2004; Schmetzke, 2002).

Table 4. *Breakdown of 508 Guidelines.*

Section 508 Paragraph(s)	Number of Violation	Percentage
(a) only	487	50.05%
(i) only	135	13.87%
(n) only	48	4.93%
(a) and (i)	37	3.80%
(a) and (n)	240	24.67%
(i) and (n)	8	0.82%
(a), (i) and (n)	18	1.85%

P1 Priorities

In Priority 1, guidelines 1.1, 6.2, and 12.1 can be tested by Bobby. Priority 1 and Section 508 share many common guidelines. P1 1.1 and P1 12.1 correspond to paragraphs a and i respectively in Section 508. The remaining priority 6.2 pertains to frame sources.

Table 5. *Breakdown of Priority 1 Guidelines.*

P1 Guideline	Number of Violation	Percentage
1.1 only	721	77.44%
6.2 only	6	0.64%
12.1 only	79	8.49%
1.1 and 6.2	6	0.64%
1.1 and 12.1	29	3.11%
6.2 and 12.1	64	6.87%
1.1, 6.2 and 12.1	26	2.79%

P2 Priorities

WCAG P2 represents the largest set of guidelines that can be explicitly tested. P2 contains some specialized errors such 7.2 (blinking text) and 7.3 (marquee text). Some of the errors can be resolved by abstaining from using deprecated XHTML elements and relying on CSS to achieve desired design effects.

In order to simplify the table display, the errors that violate one guideline only and more were combined into a single category. Such as row “3.2 and more”, 532 violations could be the web site that only violate 3.2 guideline or violate 3.2, 3.4, and 7.2 etc which includes 3.2.

Table 6. *Breakdown of Priority 2 Guidelines.*

P2 Guideline	Number of Violation	Percentage
3.2 and more	532	47.97%
3.4 and more	1107	99.82%
3.5 and more	106	9.56%
6.5 and more	4	0.36%
7.2 and more	11	0.99%
7.3 and more	153	13.80%
7.4 and more	4	0.36%
7.5 and more	1	0.09%
9.3 and more	481	43.37%
12.4 and more	314	28.31%
13.1 and more	766	69.07%
13.2 and more	18	1.62%

The highest percentage of violations is coming from guidelines 3.4 (use relative sizing and positioning), 13.1 (avoid using the same link phrase more than once per page), 3.2 (use public text identifiers in the doctype statement) and 9.3 (event handlers do not require the use of a mouse).

P3 Priorities

Priority 3 guidelines may represent the most difficult guidelines for designers to meet. Almost all websites, 99.9% fail to meet P3 guidelines, mostly because of the use of tables to create layout frameworks (Zeldman, 2007). Guidelines 1.5, 4.3, 5.5, 10.4, and 10.5 were tested. Designers must weigh the cost of rebuilding a website with web standards against the small population of users who will benefit from meeting priority 3 guidelines.

Table 7. *Breakdown of Priority 3 Guidelines.*

P3 Guideline	Number of Violation	Percentage
1.5 and more	104	9.35%
4.3 and more	941	84.62%
5.5 and more	968	87.05%
10.4 and more	270	24.28%
10.5 and more	730	65.65%

Conclusions

The World Wide Web has long outgrown its novelty to become a crucial role in the activities of current public school systems. Federal laws require state schools to provide accessible web sites for persons with disabilities. In our research, we tested the entities within Texas public school system against section 508 guidelines and WCAG. Unfortunately, results showed that most Texas public schools failed to meet these obligations, perhaps due to developers' ignorance and misconceptions that enabling access is expensive and time-consuming. In this paper, the role of accessibility in web design is investigated and a holistic approach to achieving web accessibility is proposed.

In this paper, only automated software Bobby is used to evaluate the accessibility of web pages on a number of objective measures; only a portion of the paragraphs of Section 508 and WCAG guidelines are tested. Some manual processes could be added in future study to allow a more general evaluation on service for conformance to the Section 508 web accessibility standard.

Another interesting finding from this study is the realization that three pillars support web development. Usability, accessibility, and web standards all play an interconnected role in developing websites. Many of the accessibility guidelines are aimed at universal usability. For example, the accessibility guidelines for forms serve a dual purpose for accessibility and usability. Furthermore, many of the accessibility problems can be solved using semantic markup, and web standards. According to Sierkowski (2002), accessibility encourages the separation of content from formatting, which is the keystone of web standards. Moreover, paragraph (d) of Section 508 requires that all web pages remain readable without their associated style sheet. Readability without the associated style sheets can easily be achieved when content is separated from formatting. More research needs to be done in regard to the interrelated connection among these three fundamentals of web design.

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