Accessibility of School Districts' Web Sites: A Descriptive Study

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Many school districts (SDs) use the World Wide Web (WWW or Web) to disseminate a wide variety of information about things such as district events, policies, and a wide variety of student information. On-line barriers limit the accessibility of the WWW for persons and students with disabilities and thus can limit their access to vital information. The purpose of this study was to evaluate the accessibility of SD home pages in the United States and Canada. A total of 120 SD Web sites were located using a popular online school directory and evaluated for accessibility. A software program was used to quantify the number of accessibility errors at each site. The results indicated that most (74.3%) SD home pages had accessibility problems, and the majority of these problems were severe problems that should be given a high priority for correcting. The good news is that the majority of the errors can easily be corrected. The work reflects a need for SDs to examine the accessibility of their home pages. Recommendations for improving accessibility are provided.

Since the mid 1990s the World Wide Web (WWW or Web) has become an important way to disseminate information about a wide variety of organizations. These organizations include many educational institutions such as universities, departments of public instruction, and individual schools. All of these institutions' policies concerning equal access are guided by federal laws such as the Americans with Disabilities Act (ADA). The ADA, enacted in 1990, provides the same civil rights protection to individuals with disabilities as other federal laws that prevent discrimination on the basis of race,

gender, national origin, and religion (Button & Wobschall, 1994). Title III of the ADA directs that public facilities make reasonable modifications to control discrimination and support accessibility in policies, practices, and procedures (Council for Exceptional Children, 1994). As a result of this landmark legislation, accessibility alterations such as providing ramps to elevated areas and providing accessible signage through height adjustments and raised lettering have become commonplace across the country.

A projected $5.67 billion was spent on technology in America's public schools during the 1999-2000 school year. While 63% of those dollars were spent on hardware, it appears that public schools have shifted their budgets toward software and staff development. More than 46% of schools reported that the majority of their teachers are intermediate level users of technology (able to use a wide variety of computer applications). More than 60% of schools reported that the majority of teachers use the WWW for instructional purposes, and 82% of schools provide WWW access in classrooms.

Fifty-two percent of U.S. homes with children ages 2 – 17 have WWW connections at home, up form just 15% just two years ago. In addition, 20% of students ages 8 – 16 have computers in their bedrooms, with more than half hooked up to the WWW. As the percentage of WWW usage continues to increase both at school and at home so does the need for clearer behavioral guidelines for students. The following is a list of practical steps for school administrators that addresses student usage of the WWW on school premises and at home.

1. When school administrators review a situation, he/she should first determine whether the fact pattern actually falls within the code of student behavior set at each particular school. Often, the school rules may fall short of covering new situations. Stretching rules to fit new situations is a dangerous and risky practice.
2. Before school administrators move forward with discipline for offsite Internet conduct, he/she should put down in writing, the connection between offsite conduct and the impact that it has or will have at school. School administrators should always investigate to see if the student violated any discipline code, if so, this might provide a stronger basis for disciplinary action.
3. Compare WWW behavior with its non-WWW behavioral counterpart. For example, if the issue is vulgarity, can a student be held accountable under the behavioral policy set by the school?
4. School administrators should make it clear to all students that your staff monitors the WWW on a regular basis.

5. School administrators should enlist the aid and support of parents. Parents need to be aware of the schools WWW policy. Having parents sign a "student WWW code of conduct" at the beginning of each school year will help parents to better understand what the school deems as appropriate and inappropriate.

6. School administrators should have a clear set of procedures that staff should follow if they believe a student has violated the WWW code of conduct. Staff should acquire as much evidence as possible.

7. School administrators may consider lodging a complaint to the WWW/Internet service provider. Often the WWW/Internet service provider will remove offensive material especially when the material is sexually explicit, personally degrading to target specific individuals, or racially or sexually harassing.

Physical barriers are obvious accessibility concerns confronting students with disabilities. Web site developers need to be just as aware that on-line barriers can create significant accessibility problems for some users. The ADA requires that all organizations make reasonable accommodations for individuals with disabilities. Section 508 of the Rehabilitation Act requires that all organizations receiving US Federal funds must comply with standards that make electronic equipment and web sites usable by people with sight, hearing, and other disabilities. Using the WWW as a resource for distributing information is no exception. It is important that school district web site developers use and follow standards that allow accessibility to all WWW users.

A variety of disabilities can reduce accessibility to the WWW. Visual, hearing, movement, cognitive, speech, and other impairments can limit availability of information. Assisted technologies or accessibility aids such as Braille output systems, modification of keyboards, screen enlargement utilities, voice output utilities, and other technologies allow students with disabilities to access information on the WWW. However, because of the complexity of many Internet resources, some information cannot be accessed with these aids. Developers of accessibility aids continue to identify and develop features that can overcome some of these barriers, but there are many things that web site developers can do, with very little effort, that would make their pages more accessible.

The Trace Research and Development Center at the University of Wisconsin at Madison produced the *Unified Web Site Accessibility Guidelines* (1999). These guidelines were transferred to the Web Accessibility Initiative (WAI) of the World Wide Web Consortium (W3C) and used to produce the

Web Content Accessibility Guidelines 1.0 (Chisholm & Vanderheiden, 1999a). The primary goal of the guidelines is to promote content accessibility. The guidelines do not discourage content developers from using images, video, and other multimedia tools, but rather explain how to make multimedia content more accessible to a wider audience.

According to the guidelines, measures for improving accessibility fall into the following categories: (a) structure—HTML documents should use markup to convey meaning and less for format and layout pages; (b) navigation—authors should support keyboard-only navigation and methods to facilitate orientation; and (c) alternative content—authors should always provide alternative ways to access information presented with images, sounds, applets, and scripts. These recommendations have been categorized as Priority 1, 2, and 3 errors. Priority 1 errors involve issues that make it impossible for one or more groups to access information about the web site. These issues must be addressed to consider the web site minimally accessible. Priority 2 errors make it difficult for users to access web site content. Priority 3 errors may be addressed by web developers and make it somewhat difficult for readers to access information in the webpage. Additionally, the WAI provides specific recommendations and strategies on how to produce web sites that are in agreement with the guidelines. Examples and models of the appropriate use of HTML tags (i.e., page title, text, lists and outlining, tables, links, objects, images, audio, applet, frames, forms, and scripts) and elements are provided.

The *Web Content Accessibility Guidelines 1.0* (Chisholm & Vanderheiden, 1999a) document is organized around two general themes and 14 guidelines or general principles of accessible design (Table 1). The themes are (a) ensuring graceful transformation and (b) making content understandable and navigable. The document provides the rationale behind the guidelines and describes some of the users who benefit when they are applied to web sites. In addition, a list of checkpoints is provided that explains how the guidelines apply to typical content development scenarios. Each checkpoint is specific enough to be verified while general enough to allow web developers freedom to use appropriate strategies.

Table 1

Web Content Accessibility Themes and Guidelines

Theme	Item	Guideline
Ensuring Graceful Transformation	1	Provide equivalent alternatives to auditory and visual content.
	2	Don't rely on color alone
	3	Proper use of markup and style sheets.
	4	Clarify natural language usage
	5	Create tables that transform gracefully
	6	Ensure that pages featuring new technologies transform gracefully
	7	Ensure user control of time-sensitive content changes
	8	Ensure direct accessibility of embedded user interfaces.
	9	Design for device-independence.
	10	Use interim solutions.
Making Content Understandable and Navigable	11	Use W3C technologies and guidelines
	12	Provide context and orientation information
	13	Provide clear navigation mechanisms.
	14	Ensure that documents are clear and simple

The guidelines that primarily address the theme of ensuring graceful transformation, Guidelines 1 through 10, assist web developers in producing sites that remain accessible despite constraints confronted by people with disabilities. For example, Guideline 1 states that web developers should provide equivalent alternatives to auditory and visual content. Text can be rendered in ways that are available to almost all browsing devices and accessible to all users, but auditory and visual content are not. Guidelines 11 through 14 primarily address the theme of making content understandable and navigable. This includes providing navigation tools and orientation information in pages with maximize accessibility and usability. Not all users can make use of visual clues such as image maps or graphical information, but with orientation information, users can understand many of these graphical images. Of course the information presented here is an overview of these guidelines and the *Web Content Accessibility Guidelines 1.0* (Chisholm & Vanderheiden, 1999a) document should be consulted for more detail in developing content-accessible web sites.

Building web sites that comply with standards for accessibility should be a high priority for web site developers. To date, little research has documented the extent to which accessibility goals have been reached.

METHOD

This study examined the accessibility of school district home pages. The purpose of the research described in this article was to: (a) evaluate the accessibility of school district home pages, and (b) direct readers to resources that are available to assist in the development of accessible home pages.

Sampling

A list of URLs for school district home pages was generated using the Web 66 (2001) website. This online resource provides a detailed list of school district websites in the US and Canada as well as around the world. A total of 567 school district web sites in the US and Canada were randomly selected from this directory.

Evaluation Process

Each School District's home page was evaluated using *Bobby 3.2* (Center for Applied Special Technology, 2001), a software package that analyzes web sites in accordance with the W3C Web Accessibility Initiative guidelines. Results from *Bobby 3.2* provide a measure of the extent to which a web site is accessible for people with disabilities. The type of accessibility error (e.g., images without alternative text, links without alternative text, and pages not usable without frame), the severity of the error (e.g., Priority 1, Priority 2, Priority 3), and the ease with which the error can be fixed (e.g., easy, moderate, hard) are provided in a summary report. In this study only the initial school district home page was evaluated and no links within the domain were evaluated. Scores for each home page were tabulated and analyzed.

There are many accessibility issues that *Bobby 3.2* cannot detect. For example, *Bobby* cannot determine programmatically if the web site is following accessibility principles, and can only draw the users attention to the potential risks of any technology that is used. The potential errors will be reported in the results, but the researchers did not physically examine the web site to evaluate these potential errors.

RESULTS

Of the 567 web pages evaluated, 74.3% of the web site home pages had at least one accessibility error. The means and standard deviations for the accessibility and potential accessibility errors sorted by priority are presented in Table 2. There was an average of .91 Priority 1 accessibility errors on the school district home pages. This indicates significant accessibility issues that can hinder the reader's access to information on the webpage. Priority 2 and Priority 3 errors averaged 2.33 and 1.64. While these errors are not as severe as Priority 1 errors, they can still affect the degree to which a reader can access a web site. As seen in Table 3 the most common Priority 1 accessibility problems identified in home pages of school districts were (a) using alternate ways to convey information represented by color (74%), (b) providing extended descriptions of alternate text (71%), and (c) using structural markup to identify their hierarchy and relationship of two or more header rows or columns in a table (66%). Using alternate ways to convey information represented by color means that information represented or emphasized by specific colors, red for example, should be conveyed in ways that can be recognized by software readers that convert text to speech. If images are used and they convey information then extended descriptions should be used to convey this information. Finally, the relationship of multiple rows and or columns used for table headers should be described so that software readers can correctly relay the relationship of the information among these elements. As will be seen later, many of these problems were rated as easy to fix. Priority 2 errors reported included sufficient contrast between foreground and background colors (81%), lack of descriptive titles to links (78%), and use of movement in images (64%). The most frequent Priority 3 errors reported included no identification the language of the text (96%), lack of keyboard shortcuts to frequently used links (80%), and no logical tab order among page elements (80%).

Table 2
Accessibility Errors Categorized by Priority

			Accessibility Errors		
Severity	*N*	Minimum	Maximum	*M*	*SD*
Priority 1	567	0	4	.91	.67
Priority 2	567	0	6	2.33	1.57
Priority 3	567	0	3	1.64	.57

Table 3

Type Accessibility Error, Percentage of Homepages with Error,
and Ease of Fixing Error

Type of Accessibility Error	Percent	Ease To Fix
Priority One Errors		
If you use color to convey information, make sure the information is also represented another way.	74	Moderate
If an image conveys important information beyond what is its alternative text, provide an extended description.	71	Moderate
If a table has two or more rows or columns that serve as headers, use structural markup to identify their hierarchy and relationship.	66	Moderate
Provide alternative text for all images.	62	Easy
For tables not used for layout (for example, a spreadsheet), identify headers for the table rows and columns.	53	Easy
Provide alternative content for each SCRIPT that conveys important information or functionality.	33	Moderate
Be sure pages are readable and usable if style sheets are ignored.	29	Moderate
Priority Two Errors		
Check that the foreground and background colors contrast sufficiently with each other.	81	Easy
Add a descriptive title to links when needed.	78	Easy
Avoid use of deprecated language features if possible.	74	Moderate
Avoid using tables to format text documents in columns unless the table can be linearized.	66	Hard
Avoid using movement in images where possible.	64	Easy
Use relative sizing and positioning (% values) rather than absolute (pixels).	63	Moderate
Mark up quotations with the Q and BLOCKQUOTE elements.	47	Moderate
If scripts create pop-up windows or change the active window, ensure that the user is aware this is happening.	39	Moderate

Table 3 (continued)
Type Accessibility Error, Percentage of Homepages with Error,
and Ease of Fixing Error

Type of Accessibility Error	Percent	Ease To Fix
Use header elements in the proper sequence and not for bold text.	33	Moderate
Style sheets should be used to control layout and presentation wherever possible.	29	Moderate
Do not use pop-up windows or change the active window unless the user is aware this is happening.	21	Moderate
Make sure event handlers do not require use of a mouse.	20	Moderate
Priority Three Errors		
Specify a logical tab order among form controls, links and objects.	80	Moderate
Consider adding keyboard shortcuts to frequently used links.	80	Moderate
Provide a summary and caption for tables.	67	Moderate
Provide abbreviations for long row or column labels.	67	Easy
Provided a linear text alternative for tables that lay out content in parallel, word-wrapped columns.	67	Hard
Group related links.	38	Moderate
Identify the language of the text.	96	Moderate

Table 3 also indicates that the majority of accessibility errors were rated as easy to fix. Examples of these types of errors include alternate text for images, and specifying the relationship among multiple headers in tables. Some suggested ways to fix these errors include the use of the ALT tag and descriptive text with every image to present textual information about images. A similar technique can be employed to provide descriptive information about links.

DISCUSSION

The ADA directs that individuals with disabilities including students and parents being served by school districts are entitled to the same civil rights

protections as their neighbors and peers without disabilities. The law has come to be associated with efforts to make public and private facilities and institutions more accessible for individuals with disabilities. The Internet and WWW have revolutionized access to the resources and services of American businesses, public and private institutions, and other organizations. The accessibility of this information to students with disabilities has not been extensively studied.

School Districts use the WWW to disseminate and gather information. Online barriers limit the accessibility of the WWW for individuals with disabilities. The purpose of this study was to evaluate the accessibility of School Districts' home pages. 567 web sites were randomly selected for evaluation. *Bobby 3.2*, a software program, was used to quantify the number of accessibility errors at each site. Most School Districts' home pages had accessibility problems (74.9%). Most of the errors were rated as severe and should be given a high priority. The good news is that the majority of the errors can easily be corrected. The need for School Districts to examine the accessibility of their home pages is evident in the outcomes.

School district web developers need to examine their web sites for accessibility problems. It is strongly recommended that validation methods be used in the early stages of web development that will help make problems easier to correct and assist developers in avoiding accessibility problems. There are two suggested methods of validating a web site for accessibility (Chisholm & Vanderheiden, 1999a). First, automatic tools are available for scanning the site and providing data. *Bobby 3.2* and other validation services should be used to provide information concerning accessibility problems. Automatic tools are convenient but do not identify all accessibility issues; therefore, it is recommended that each site be examined by a knowledgeable individual and individuals with disabilities to ensure clarity of language and ease of navigation. The processes of rapid prototyping and formative evaluation have been used for many years to help develop educational software and have proven to be useful in the process of web site development (Corry, Frick, & Hansen, 1997). Expert and novice users with disabilities should be invited to view home pages and provide feedback about the severity of accessibility or usability problems.

One global suggestion for the web site designer is that all web pages should be encoded for meaning rather than appearance. For example, providing alternative ways of obtaining information is a key to overcoming many accessibility errors. By using ALT="TEXT" tags on all images, approximately one-third of the errors discovered in this study would be fixed.

There are many web sites that provide information and recommendations for accessible web pages. Below are a few recommendations for evaluating web sites for accessibility:

1. Web site designers should follow the accessibility guidelines. There are several sites on the WWW that give recommendations.

2. Each web page should be tested for accessibility. Several different procedures should be used: (a) view each page on monochrome screen or use high contrast option of control panel; (b) turn off graphics and view page for readability or use Lynx to view the page; (c) select only text, print to clipboard, and view for readability; (d) navigate using only the keyboard; and (e) use *Bobby* or other web evaluation software to test the web pages.

3. Web site designers should provide a "text only" version of the school district's web site. This can be done using cascading style sheets so that updates can be accomplished more easily. Providing a text only version of a web site also provides users with slow Internet connections with a relatively fast method of accessing an institution's web site.

4. Web site designers should provide the reader with alternative methods for obtaining information about the district's program. Providing a phone number, e-mail, or mailing address can do this. This information should be displayed in a prominent place on the district's web site.

Page authors should not produce "handicapped products" to make web sites accessible. Every effort should be made to keep all web sites in the mainstream and provide elements that allow universal access. Table 4 provides a list of resources that can assist in the development of accessible web sites. Accessibility guidelines are not designed to stifle the creative freedom of web site designers; however, extra thought and effort is required in designing accessible web sites.

Table 4
World Wide Web Resources

Guidelines	Description
World Wide Web Consortium (W3C) Web Accessibility Initiative http://www.w3.org/WAI/GL/central.htm	This online document by a subgroup of the World Wide Web consortium provides guidelines for making web sites assessable to persons with handicaps. The W3C is responsible for setting interna tional standards for web technolo- gies.
Microsoft Guidelines for Accessible Web sites www.microsoft.com/enable/dev/Web_ guidelines.htm	This online document provided by Microsoft provides guidelines for making web sites more handi capped assessable. Microsoft is a leading manufacturer of PC based software and makes several web development tools.
Sun Microsystems'"Accessible Design for Users with Disabilities" http://www.sun.com/columns/alertbox/ 9610.html	This online document by Sun Microsystems provides a set of guidelines for developing handicap accessible web sites. Sun is a leading manufacturer of web servers and other internet technolo- gies.
NCD Congressional Mandate www.ncd.gov/mandate.html	These online documents provide federally developed guidelines for the development of handicapped accessible web sites. The National Council on Disability is a federal agency whose charge is to develop guidelines on a range of accessibili- ty issues.
Online Tools	
W3C HTML Validation Service http://validator.w3.org/	Users can submit a web address to this service that will then automati- cally check the associated web page(s) for compliance with current W3C accessibility standards.
Center for Applied Special Technology— Bobby 3.0 http://www.cast.org/bobby/	Bobby is a downloadable software utility that will check a web site and return information to the user as to the site's accessibility.

Currently, several tools and standards are being developed to help web developers in these efforts. In Microsoft Corporation (2001) has recently announced its plans to help developers using *FrontPage*, a popular web development tool, to make their websites conform to the latest US federal guidelines. The WWW consortium has also announced guidelines for software tools to help persons with disabilities access a variety of multimedia content (World Wide Web Consortium, 2001a). Finally, at the time of this writing, the World Wide Web consortium is working on the second version of Web Accessibility Standards (World Wide Web Consortium, 2001b). These new standards will not only help authors create accessible web sites but will also improve accessibility to the Web for persons with disabilities.

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