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Website Accessibility for Users with Visual Impairment

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Keywords: web accessibility, WCAG, screen readers, mobile devices, online learning

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Website Accessibility for Users with Visual Impairment

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Abstract

In this web accessibility study of homepages of education departments in post secondary educational institutions, the 1998 US Section 508 Law regarding webpage accessibility for people with disabilities was addressed. Along with the requirements of this legislation, there are growing demands for web accessibility resulting from age-related visual disabilities and the ubiquitous handheld, mobile Internet devices. In this study six hypotheses were addressed to analyze web accessibility in terms of website complexity, enactment of web accessibility policies and practices, and webmaster web accessibility training, end-user communications, and strategic decision-making. A survey was mailed to education department webmasters to identify levels of web accessibility skills and training. Tools utilized to analyze homepage accessibility were AChecker™, A-Prompt™, JAWS™, and Kelvin™. Also, the existence of institutional web accessibility policies and language in job requirements for webmaster job postings were examined to determine the importance placed on Section 508 compliance by employers. Results showed a 95% failure rate in Section 508 compliance where two significant relationships existed for higher web inaccessibility: lower levels of webmaster web accessibility training and increasing complexity in webpage design.

Keywords: Web accessibility, WCAG, screen readers, mobile devices, online learning

1. INTRODUCTION

An increasing supply of web applications and mobile devices are available to access the web to assist individuals in their daily lives; however, web design and programming can limit these devices and applications in terms of accessibility and navigation of the World Wide Web. Additionally, as websites utilize more complex technologies such as video streaming, plugins, AJAX, etc. and the user participates interactively in blogs and wikis (Kelly, Nevile, Draffan, & Fanou, 2008; Moreno, Martinez, & Ruiz, 2008) the creation of

more accessible websites has become more difficult.

This paper addresses the ongoing issue of web page inaccessibility for post-secondary educational institutions. A multiple-methodological approach was employed to further understand web accessibility issues relating specifically to visually-impaired web users using screen reader devices.

The population studied was U.S. educational institutions accredited by the National Council for Accreditation of Teacher Education

(NCATE) and analyses were based on Section 508 of the U.S. Rehabilitation Act (U.S. Department of Justice, 1990) and Web Content Accessibility Guidelines (WCAG) by the Worldwide Web Consortium (W3C, 2007a, 2007b, 2007c). Most U.S. educational institutions must adhere to Section 508 specifications (U.S. Department of Justice, 2007a, 2007b) and WCAG was initially designed based on Section 508 (see Table 1 in the Appendix). This federal law, U.S. Section 508, was enacted in 1998 and studies since then have consistently shown that most websites mandated to meet this law have failed web accessibility (Cardinali & Gordon, 2002; Takata, Nakamura, & Seki, 2004; Yu, 2002); and, failure rates have increased through time (Hackett & Parmanto, 2005; Hackett, Parmanto, & Zeng, 2003), inclusive of this study.

This paper studied web accessibility specific to users with visual disabilities because of a growing concern of web technologies failing to meet the needs of many web users. The demands for web accessibility are increasing not decreasing (Kelly et al., 2008). One factor attributing to the rise of screen reader use is the aging baby boomer population acquiring age-related visual disabilities (U.S. Department of Commerce, 2003). The baby boomer segment has evolved to use the Web in almost every aspect of their lives (Rainie, 2005). There also has been an increased demand for screen reading technologies due to a variety of new devices being offered to the public, such as screen reader options for Amazon’s Kindle™ which is usable on the iPhone™ - assisting people whether or not they have a visual disability. Those who use mobile devices, such as smart phones, benefit from Section 508 web accessibility (Tilson & Lyytinen, 2006). In fact, new mobile web programming guidelines by the W3C have been created, called *mobileOK*, that include Section 508 and WCAG specifications (W3C, 2008). How will the educational sector address this apparent growing demand for web accessibility?

2. METHODOLOGY

The literature regarding Section 508 conformity and WCAG web accessibility has shown to be a multi-faceted problem (Manzari & Trinidad-Christensen, 2006; Phipps & Kelly, 2006; Seale, 2006). This study tested six

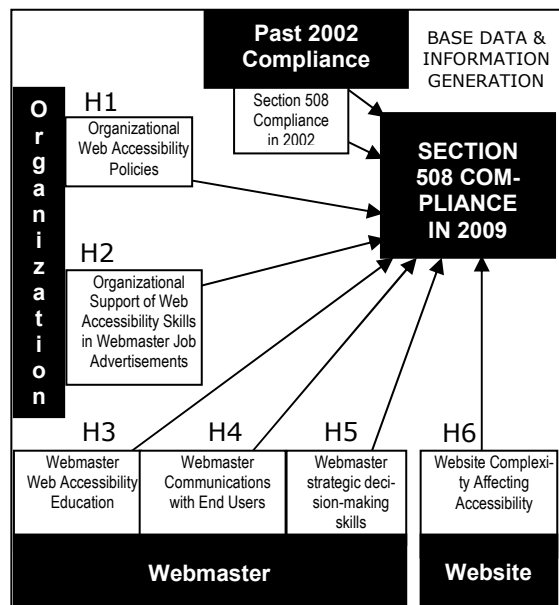
hypotheses to analyze levels of Section 508 compliance and levels of web accessibility of NCATE education departments’ homepages that related to the three most pressing issues produced by the literature and are represented in the conceptual framework (Figure 1):

- 1) organizational issues: enactment of accessibility policies/guidelines and hiring practices,
- 2) webmaster issues: web accessibility education/training, end-user communications, and strategic decision-making abilities, and,
- 3) website design issues: complexity with the use of higher technologies.

Based on the literature, WCAG guidelines currently provide the best means to educate a web developer as to what is needed for a web user with assistive devices to access their website. This study utilized tools that are based on these guidelines to measure levels of web accessibility and to test Section 508 conformance.

The responsible subjects consistently seen in the literature involved in web accessibility are the organization, webmaster, and website design itself, which helped form the conceptual model of this study (Figure 1).

Figure 1. Conceptual Framework for Web Accessibility



The study first compared Section 508 web accessibility conformance with previous studies which had been conducted to produce the base data and information. Hypotheses one and two addressed the organization, i.e., the higher administrative practices that may impact web accessibility. Hypotheses three, four, and five, addressed the webmaster. The last hypothesis addressed the website design focusing on complexity testing, i.e., the growing incorporation of high technologies, such as images, image mapping, and videos, that can affect accessibility.

Multiple methods were used for data generation and hypotheses testing. A webmaster survey (Table 2 in the Appendix) based on previous survey tools (Lazar, Dudley-Sponaugle, & Greenidge, 2004; Wade and Parent, 2002) was mailed to NCATE education department webmasters to identify their level of education, training, and experience. The survey questions provided qualitative information and the quantitative data to test hypotheses three, four, and five.

Tools utilized to analyze the homepages for accessibility were the University of Toronto's AChecker™ and A-Prompt™, Freedom Scientific's screen reader, JAWS™, as well as University of Pittsburgh's Web Accessibility Barrier (WAB) and complexity scoring webcrawler, Kelvin™ (Parmanto & Zeng, 2005). Kelvin™ results tested hypothesis six as well as created the WAB variable to use in testing all of the hypotheses. Additionally, JAWS™ heuristic testing was conducted based on Stewart, Narendra, and Schmetzke's (2005) study as seen in Table 3 in the Appendix. Additional website manual checks were made to determine the existence of institutional policies/guidelines related to web accessibility and web development to test hypothesis one. Lastly, post-secondary education webmaster job advertisements for web accessibility training/education were evaluated via a job-content analysis based on Wade and Parent (2002) to help further determine the importance placed on web accessibility by these institutions. This data was used to test hypothesis two. Quantitative and qualitative data were gathered, analyzed, and evaluated.

Base data and information were first gathered on both the census (N=650) and a sample generated from the webmaster sur-

vey response (97 responses, rate 14.9%), which pertained to Section 508 conformance and levels of webpage accessibility. To determine Section 508 conformance, AChecker™ and A-Prompt™ were both used to determine passing or failing scores. For those webpages that passed, additional manual testing was conducted using these programs' recommendations to ensure Section 508 conformance was achieved. The base data of passing or failing Section 508 conformance was analyzed and compared to the past studies conducted by Chilson (2002) and McCullough Stein (2002). These previous studies used the online Bobby program (now defunct) which was a standard web accessibility verification tool. Bobby used Section 508 requirements as do AChecker™ and A-Prompt™ when Section 508 checks are selected. It was assumed that the results would be comparative to Bobby, or perhaps superior per Diaper and Worman's (2003) study rating A-Prompt™ better than Bobby in Section 508 checks.

Once the base data for Section 508 conformance was completed and other manual data gathering was achieved, hypothesis testing was conducted. The WAB scores from the Kelvin™ program produced a means to analyze the levels of web accessibility (rather than a pass or fail score). Each homepage's WAB score was tested with the variable being studied using *t*-Tests for hypotheses one and two and Pearson's correlation for hypotheses three, four, five, and six. These measures of the six hypotheses are as follows:

H1: NCATE institutions that have web accessibility policies/guidelines will have homepages with higher levels of web accessibility than those without these policies/guidelines.

Measures: WAB score and policies/guidelines in existence (*t*-Tests)

H2: NCATE institutions stating the need for web accessibility knowledge in webmaster job advertisements will have homepages with a higher level of web accessibility than those that do not state this need in job advertisements.

Measures: WAB score and existence of web accessibility language in job postings (*t*-Tests)

H3: NCATE webmasters who have web accessibility training will produce homepages with a higher level of web accessibility than those who do not have this training.

Measures: WAB score and survey question construct (questions 17-28, Table 2 in Appendix; Pearson's correlation)

H4: Webmasters of NCATE accredited institutions who have a higher degree of communications with the web users will produce homepages with higher levels of web accessibility than those who do not.

Measures: WAB score and survey question construct (questions 29-32, Table 2 in Appendix; Pearson's correlation)

H5: Webmasters of NCATE accredited institutions who have a higher degree of strategic decision-making will produce homepages with a higher level of web accessibility.

Measures: WAB score and survey question construct (questions 3-10, Table 2 in Appendix; Pearson's correlation)

H6: The less complex the NCATE institution's homepage, the greater its web accessibility.

Measures: WAB score and complexity score (Pearson's correlation)

Hypotheses one and two used yes (1) or no (0) measures to correlate with the WAB scores. Hypothesis six used the level of the numerical complexity score (also generated by the Kelvin™ program) to correlate with the numerical WAB score.

For hypotheses three, four, and five, constructs were created from answers from specific survey Likert questions pertinent to the hypotheses (see Table 2 in the Appendix). Before testing these hypotheses, reliability was first established by using SPSS to identify Cronbach alpha coefficients. The results of these reliability analyses for hypotheses three, four, and five are below:

a. The inter-item correlation of the answers to questions 17-28 to test hypothesis three had a Cronbach alpha coefficient of

0.944 and all values in the inter-item correlation matrix were positive.

b. The inter-item correlation of the answers to questions 29 through 32 to test hypothesis four had a Cronbach alpha coefficient of 0.881 and all values in the inter-item correlation matrix were positive.

c. The inter-item correlation of the answers to questions 3 through 10 to test hypothesis five had a Cronbach alpha coefficient of 0.798 and all values in the inter-item correlation matrix were positive.

Based on Nunnally (1978), all of these alpha coefficients were high (i.e., greater than 0.70). A high alpha and positive values in the inter-item correlation matrix show strong inter-correlation and reliability (Furr & Bacharach, 2007). Based on the reliability of these multiple-item constructs, further analyses and hypothesis testing occurred. Pearson's correlations were used to test hypotheses three, four, five, and six to determine any significant relationship. Hypotheses one and two utilized *t*-Tests.

3. RESULTS

Web Accessibility Conformance

The results of the base data gathered and analyzed using AChecker™, A-Prompt™, manual tests and JAWS™ (screen reader test results are seen in Table 3 in the Appendix), produced a 95% failure rate in Section 508 compliance of both the census and sample of 97. Comparative study of results with 2002 results of 57 NCATE education homepages showed an increased failure rate: in 2002, seven of the 57 (12.3%) passed Section 508 Bobby tests; in 2009, five of the 57 (8.8%) passed Section 508 AChecker™ and A-Prompt™ tests. Only one of the institutions passed both years.

Qualitative Survey Responses

It was interesting to note that the "webmasters" ranged in academic function from faculty to information technology staff to administrative support. In all of the qualitative survey responses for the survey questions 39, 49, 50, and 52 (i.e., qualitative information which follows Table 2 in the Appendix), the lack of time, knowledge, resources, and institutional support were present. Also, the acquisition of design templates and/or con-

tent management systems (CMS) were addressed, however the context was either that the institution should incorporate these technologies to centralize website updating to meet accessibility or that their current design template or CMS was not web accessible and needed to improve.

The responsible parties to improve web accessibility were two groups comprising over 75% of the responses: information technology directors/managers ranked number one (40.7%) and webmasters/developers ranked number two (35.1%). Additional survey responses (qualitative and quantitative) appear in Table 2 of the Appendix.

Hypothesis Testing

For hypotheses one and two, *t*-Tests were employed to determine a significant relationship with the homepage WAB score and the specific variable being tested. Hypothesis-testing on hypotheses three, four, and five was based upon Pearson’s correlation analyses using the question constructs and WAB scores. Pearson’s correlations showed only two significant relationships for hypotheses three and six.

Hypothesis One. No significance was found between the levels of Web accessibility using WAB scores and whether or not the institution had accessibility policies or guidelines present on the institutional website. *t*-Tests were conducted and results are displayed in Tables 3a and 3b. Levene’s test showed a significance of 0.679, which was greater than 0.05, where the null hypothesis could not be rejected to support this hypothesis. However it was interesting to note that institutions having web accessibility policies/guidelines comprised 62.9% of the sample.

Hypothesis Two. No significance was found between the level of Web accessibility using WAB scores and whether or not the institution had accessibility language in their webmaster job advertisements. *t*-Tests were conducted and results are displayed in Tables 4a and 4b. Levene’s test showed a significance of 0.496, which was greater than 0.05, where the null hypothesis could not be rejected to support this hypothesis. However it is interesting to note that NCATE institutions having web accessibility language in job advertisements comprised

6.7% of the sample and those that did not comprised 93.3%.

Table 3a. Hypothesis One Group Statistics of Web Accessibility Policy/Guidelines and WAB Scores.

H1	N	Mean	Std. Deviation	Std. Error Mean
WAB 0	36	6.55	3.124	.528
1	61	6.68	3.208	.418

Table 3b. *t*-Tests of Web Accessibility Policy/Guidelines and WAB Scores

	Levene's Test for Equality of Variances		t-Test for Equality of Means				
	F	Sig.	t	df	Sig. 2-tailed	Mean Difference	Std Error Difference
WAB Equal variance	.172	.679	-.186	92	.853	-.126	.678
WAB Not equal variances			-.187	73.1	.852	-.126	.673

Table 4a. Hypothesis Two Group Statistics of Web Accessibility Language in Webmaster Job Advertisement Requirements/Preferences and WAB Scores

Web Ad	N	Mean	Std. Deviation	Std. Error Mean
WAB 0 (no)	40	7.83	7.585	1.199
WAB 1 (yes)	3	6.53	1.716	.991

Table 4b. *t*-Tests of Web Accessibility Language in Webmaster Job Advertisement Requirements/Preferences and WAB Scores

	Levene's Test for Equality of Variances		t-Test for Equality of Means				
	F	Sig.	t	df	Sig. 2-tailed	Mean Difference	Std Error Difference
WAB Equal variance	.471	.496	.295	41	.770	1.306	4.434
WAB Not Equal variance			.839	10.94	.419	1.306	1.556

Hypothesis Three. Significance was found between the level of Web accessibility using WAB scores and whether the webmaster had accessibility training. WAB scores were lower, i.e., higher levels of Web accessibility, for those webmasters with higher levels of accessibility training. Correlations were done using Pearson's Correlation as seen in Tables 5a and 5b. Three out of the 97 respondents did not respond to any of the questions that were part of this construct to test hypothesis three (H3: N=94). Correlation was positive and significance was 0.030, which was less than 0.05, where the null hypothesis could be rejected to support this hypothesis.

Table 5a. Descriptive Statistics of Webmaster Web Accessibility Training/Education and WAB Scores

	Mean	Std. Deviation	N
WAB	6.615361	3.1466232	97
H3	2.576381	.8784087	94

Table 5b. Correlations of Webmaster Web Accessibility Training/Education and WAB Scores

		WAB	H3
WAB	Pearson's Correlation	1	.225*
	Sig. (2-tailed)		.030
	N	97	94
H3	Pearson's Correlation	.225*	1
	Sig. (2-tailed)	.030	
	N	94	94

* Correlation is significant at the 0.05 level (2-tailed).

Hypothesis Four. No significance was found between the level of Web accessibility using WAB scores and the level of webmaster communications with end users. Correlations were done using Pearson's Correlation as seen in Tables 6a and 6b. Three out of the 97 respondents did not respond to any of the questions that were part of this construct to test hypothesis four (H4: N=94). Correlation was positive, but significance was 0.666, which was greater than 0.05, where the null hypothesis could not be rejected to support this hypothesis

Table 6a. Descriptive Statistics of Webmaster End User Communications and WAB Scores

	Mean	Std. Deviation	N
WAB	6.615361	3.1466232	97
H4	3.555851	.8951439	94

Table 6b. Correlations of Webmaster End User Communications and WAB Scores

		WAB	H4
WAB	Pearson's Correlation	1	.045
	Sig. (2-tailed)		.666
	N	97	94
H4	Pearson's Correlation	.045	1
	Sig. (2-tailed)	.666	
	N	94	94

Table 7a. Descriptive Statistics of Webmaster Level of Strategic Web Decision Making and WAB Scores

	Mean	Std. Deviation	N
WAB	6.615361	3.1466232	97
H5	3.685199	.6088982	97

Table 7b. Correlations of Webmaster Level of Strategic Web Decision Making and WAB Scores

		WAB	H5
WAB	Pearson's Correlation	1	-.008
	Sig. (2-tailed)		.938
	N	97	97
H5	Pearson's Correlation	-.008	1
	Sig. (2-tailed)	.938	
	N	97	97

Hypothesis Five. No significance was found between the level of Web accessibility using WAB scores and the webmasters having strategic decision-making level responsibilities. Correlations were done using Pearson's

Correlation as seen in Tables 7a and 7b. Correlation was negative and significance was 0.938, which was greater than 0.05, where the null hypothesis could not be rejected to support this hypothesis

Hypothesis Six. Significance was found between the level of Web accessibility using WAB scores and the level of complexity of the Web site. As Complexity Scores increased, WAB scores increased to produce a lower level of Web accessibility. Correlations were completed on the whole population using Pearson’s Correlation as seen in Tables 8a and 8b. Correlation was positive and significance was 0.000, which was less than 0.05, where the null hypothesis could be rejected to support this hypothesis

Table 8a. Descriptive Statistics of Education Department Homepages’ Complexity Scores and WAB Scores

	Mean	Std. Deviation	N
WAB	6.6246	3.15878	650
H6	157.99	153.251	650

Table 8b. Correlations of Education Department Homepages’ Complexity Scores and WAB Scores

		WAB	H6
WAB	Pearson’s Correlation	1	.182**
	Sig. (2-tailed)		.000
	N	650	650
H6	Pearson’s Correlation	.182**	1
	Sig. (2-tailed)	.000	
	N	650	650

** Correlation is significant at the 0.01 level (2-tailed).

In summation, through hypotheses-tests, two significant relationships existed: 1) increasingly complex websites and lower web accessibility, and, 2) lower levels of webmaster accessibility training and lower levels of accessible websites produced. No significant relationship existed between the level of web accessibility and the existence of organizational accessibility policies / guidelines, accessibility language in webmaster

job ads, and/or the levels of webmaster end user communications and strategic-decision making.

4. ASSUMPTIONS AND LIMITATIONS

An assumption of this study was that these results are generalizable to other higher educational institutions to assist in improving web accessibility. It was also assumed that AChecker™ and A-Prompt™ would provide reasonable results for a comparison of the 2002 Bobby analyses of specific NCATE homepages, and that the secondary measurement tools used would be valid, reliable, and practical. Although the qualitative information gathered was to provide further insight into the web accessibility problem, analysis of this type of data was restrictive. Another limitation was that web accessibility was analyzed only regarding the institution’s education departments’ homepage and at a moment in time. Webpages were only a partial aspect to each website and each page could change on a regular basis. This study only focused on web users with visual disabilities and disregarded other disabilities, and used only one leading assistive technology which is navigated by the non-disabled investigator. Lastly, because of time and resource limitations, this study was limited in that it did not approach a learner centered model such as Kelly, Phipps, Sloan, Petrie and Hamilton’s (2005) or the associated issues of other stakeholders, political issues, and personal views on disability and accessibility as addressed by Seale’s model (2006).

5. CONCLUSIONS

Preventing individuals from having access to public information and data is comparative to not being able to physically access a library building. Whether or not you have a disability, your opportunities are limited if your device cannot access information as others are able. Post secondary educational institutions are familiar with devices and applications that assist those with disabilities, such as screen readers, and the related problems with web access and navigability.

This study showed that many factors are involved in the web accessibility issues concerning higher education websites, particularly those institutions accredited by NCATE. The main insight of this study showcased a

situation found with websites across all sectors, in that very little web accessibility is achieved. This study's population had lower rates of accessibility in 2009 compared to 2002 and a very high Section 508 nonconformance level of 95%, even with this law being enacted over ten years ago.

This study also corroborated that a lack of webmaster accessibility training and the increasing use of high technologies in website design can negatively impact web accessibility. Even though the other hypotheses were rejected, it is interesting to note that most institutions had web accessibility policies/guidelines in place. However, when they hired their webmasters/developers, web accessibility skills or experience were listed in less than 7% of the job advertisements found.

Webmasters also expressed their opinions in this dilemma. According to most of the responses, lack of time, knowledge, resources, and institutional support add to the web accessibility problem. Another recurring theme was that even though one solution was to centralize the web-development process using design templates and/or content management systems (CMS), the proper design was still necessary to help ensure webpages were actually accessible utilizing these technologies.

Other areas of accessibility research that could be furthered and were beyond this study were the works by Seale (2006) and Kelly et al. (2005). Seale's work may reflect attitudes and biases about disability that prevent the key stakeholders to take the issue seriously and enforce Section 508 to provide the right resources and training for their webmasters. Kelly et al. (2005 & 2008) argued their alternative avenue to lead research, which was away from WCAG or other guidelines by shifting the focus on each individual learner. Their focus has been to adapt (alternative) resources to each learner and have that learner participate in the creation of that resource to benefit them. Their recommendations could help people with disabilities or possibly any learner who may have specialized needs, devices, and/or applications. This position is juxtaposed to the current WAI guideline focus which tries to make resources universally accessible to all learners. Many studies, including this study, indirectly or directly

support Kelly et al.'s (2008) argument: "The mantra 'One World, One Web' has a strong appeal to Web developers. They think of it as a design philosophy based on use of internationally agreed upon standards for providing universal access to networked resources and services available on the World Wide Web. But does the available evidence show that practices match this philosophy?" (Kelly et al., 2008). The answer has been no.

With a large segment of our population (i.e., baby boomers) that relies on the Web getting older and acquiring age-related visual problems, web accessibility demands could rise. The other force discussed that could significantly increase the need for web accessibility could be an onslaught of a technological mobile device age. Web accessibility for these devices could eventually affect a much larger audience, including current and potential students. With this growing demand for ubiquitous computing, where devices have become smaller and are Web-ready, will education be able to handle the new needs of providing web information to all of their learners, regardless of their abilities and disabilities? How will education handle the more expansive best practices recommended by W3C for mobile devices? Perhaps future studies will tell.

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APPENDIX

Table 1. *Section 508 Guidelines and Web Content Accessibility Guidelines (WCAG)*

U.S. Section 508 Guidelines	WCAG Guidelines
<p>1. Text equivalent to non-textual information (e.g., are <alt> tags used as descriptions for images)</p>	<p>1.1 Provide a text equivalent for every non-text element (e.g., via "alt", "longdesc", or in element content). This includes: images, graphical representations of text (including symbols), image map regions, animations (e.g., animated GIFs), applets and programmatic objects, ascii art, frames, scripts, images used as list bullets, spacers, graphical buttons, sounds (played with or without user interaction), stand-alone audio files, audio tracks of video, and video.</p>
<p>2. Avoid flickering websites as certain flickering can cause seizures</p>	<p>7.1 Until user agents allow users to control flickering, avoid causing the screen to flicker.</p>
<p>3. When compliance cannot be met, a text page alternative must be provided, however, it is highly recommended to avoid having to utilize text page alternatives as this separates out those with disabilities versus those without</p>	<p>11.4 If, after best efforts, you cannot create an accessible page, provide a link to an alternative page that uses W3C technologies, is accessible, has equivalent information (or functionality), and is updated as often as the inaccessible (original) page.</p>
<p>4. Elements and scripting languages not read by screen readers need to have functional text added so a screen reader can read it</p>	<p>6.2 Ensure that equivalents for dynamic content are updated when the dynamic content changes.</p>
	<p>6.3 Ensure that pages are usable when scripts, applets, or other programmatic objects are turned off or not supported. If this is not possible, provide equivalent information on an alternative accessible page.</p>
<p>5. Information explaining multimedia, such as video streaming – it is difficult to capture effectively what it is communicated visually via a video cast</p>	<p>1.3 Until user agents can automatically read aloud the text equivalent of a visual track, provide an auditory description of the important information of the visual track of a multimedia presentation.</p>
	<p>1.4 For any time-based multimedia presentation (e.g., a movie or animation), synchronize equivalent alternatives (e.g., captions or auditory descriptions of the visual track) with the presentation.</p>
<p>6. Any color important aspects of the website should be identified with text as to their importance/purpose/function</p>	<p>2.1 Ensure that all information conveyed with color is also available without color, for example from context or markup.</p>
<p>7. Stylesheets should not be required in reading documents, as some browsers can turn off stylesheets for navigation</p>	<p>6.1 Organize documents so they may be read without style sheets. For example, when an HTML document is rendered without associated style sheets, it must still be possible to read the document.</p>

8. Image maps need redundant links for those who cannot read image maps	1.2 Provide redundant text links for each active region of a server-side image map.
9. Overall image maps should be client side not server side since server side image maps cannot utilize <alt> tags for screen readers to read	9.1 Provide client-side image maps instead of server-side image maps except where the regions cannot be defined with an available geometric shape.
10. When using tables for data, the columns and rows need to be identified	5.1 For data tables, identify row and column headers.
11. Data tables should be able to be read left to right for screen readers, unless markup is used to identify cells and header cells nested in tables	5.2 For data tables that have two or more logical levels of row or column headers, use markup to associate data cells and header cells.
12. Frames should be avoided, but if they must be used, they need text names to be identified and navigable	12.1 Title each frame to facilitate frame identification and navigation.
	4.1 Clearly identify changes in the natural language of a document's text and any text equivalents (e.g., captions).
	14.1 Use the clearest and simplest language appropriate for a site's content.

Adopted from "A new age of accessibility" by Hudson, 2002, "A new age of accessibility," *Library Journal*, 127(1), 19-21; and from the U.S. Access Board (2008) "Electronic and Information Technology Accessibility Standards (Section 508)" retrieved November 24, 2008, from <http://www.access-board.gov/sec508/standards.htm>, and Thatcher (2002) "Side by side WCAG vs. 508" retrieved on November 24, 2008 from <http://jimthatcher.com/sidebyside.htm>.

From "Checklist of Checkpoints for Web Content Accessibility Guidelines 1.0" from World Web Consortium, 2007b, retrieved on February 6, 2007 from <http://www.w3.org/TR/WCAG10/full-checklist.html>.

Table 2.

Survey Questions and Answers Attributed to Hypotheses and SPSS Numerical Coding.

#	Question	Associated numerical rating with answer and percent (%) response (if applicable)	Hypothesis relationship (if applicable)
Q1	Check your job classification. N=92 Missing=5	0 = No answer (5.2%) 1 = Employee (94.8%) 2 = Consultant (0%) 3 = Independent Contractor (0%) 4 = Volunteer (0%) 5 = Other (0%)	Demographic

SECTION ONE: Regarding your strategic decision-making and technical skills as a webmaster, to what extent:

Q2	is it useful for you to have good technical skills? N=97 Missing=0	0 = Missing (0%) 1 = No extent (0%) 2 = Little extent (1%) 3 = Some extent (11.3%) 4 = Great extent (39.2%) 5 = Very great extent (48.5%)	Additional descriptive data
Q3	is it useful for you to have good management skills? N=97 Missing=0	0 = Missing (0%) 1 = No extent (0%) 2 = Little extent (1.0%) 3 = Some extent (25.8%) 4 = Great extent (42.3%) 5 = Very great extent (30.9%)	H5
Q4	is it useful for you to manage projects? N=97 Missing=0	0 = Missing (1.0%) 1 = No extent (1.0%) 2 = Little extent (1.0%) 3 = Some extent (18.6%) 4 = Great extent (43.3%) 5 = Very great extent (35.1%)	H5
Q5	is it useful for you to work effectively in groups? N=97 Missing=0	0 = Missing (0%) 1 = No extent (2.1%) 2 = Little extent (4.1%) 3 = Some extent (32.0%) 4 = Great extent (33.0%) 5 = Very great extent (28.9%)	H5

Q6	is it useful for you to communicate effectively with others? N=97 Missing=0	0 = Missing (0%) 1 = No extent (0%) 2 = Little extent (0%) 3 = Some extent (3.1%) 4 = Great extent (41.2%) 5 = Very great extent (55.7%)	H5
Q7	do you have a supervisory role in this post-secondary educational institution? N=97 Missing=0	0 = Missing (0%) 1 = No extent (15.5%) 2 = Little extent (25.8%) 3 = Some extent (33.0%) 4 = Great extent (16.5%) 5 = Very great extent (9.3%)	H5
Q8	is it useful for you to recognize and manage personality problems that interfere with job completion? N=97 Missing=0	0 = Missing (0%) 1 = No extent (4.1%) 2 = Little extent (13.4%) 3 = Some extent (44.3%) 4 = Great extent (23.7%) 5 = Very great extent (14.4%)	H5
Q9	do you play a central role in determining the web strategy for your post-secondary educational institution? N=96 Missing=1	0 = Missing (1.0%) 1 = No extent (9.3%) 2 = Little extent (12.4%) 3 = Some extent (33.0%) 4 = Great extent (24.7%) 5 = Very great extent (19.6%)	H5
Q10	do you think that your webmaster work has contributed to the strategic web goals [of your post-secondary educational institution]? N=95 Missing=2	0 = Missing (2.1%) 1 = No extent (3.1%) 2 = Little extent (5.2%) 3 = Some extent (40.2%) 4 = Great extent (35.1%) 5 = Very great extent (14.4%)	H5
Q11	do you think you have been successful in your position as a webmaster? N=97 Missing=0	0 = Missing (0%) 1 = No extent (0%) 2 = Little extent (1.0%) 3 = Some extent (34.0%) 4 = Great extent (51.5%) 5 = Very great extent (13.4%)	Additional descriptive data

SECTION TWO: Regarding web accessibility, to what extent:

Q12	is your website subject to the US Section 508 rules on web accessibility? N=92 Missing=5	0 = Missing (5.2%) 1 = No extent (6.2%) 2 = Little extent (7.2%) 3 = Some extent (26.8%) 4 = Great extent (32.0%) 5 = Very great extent (22.7%)	Additional descriptive data
Q13	do your university/college policies address website development? N=93 Missing=4	0 = Missing (4.1%) 1 = No extent (4.1%) 2 = Little extent (11.3%) 3 = Some extent (34.0%) 4 = Great extent (35.1%) 5 = Very great extent (11.3%)	Additional descriptive data
Q14	do your university/college policies address Section 508 web accessibility? N=90 Missing=7	0 = Missing (7.2%) 1 = No extent (8.2%) 2 = Little extent (14.4%) 3 = Some extent (35.1%) 4 = Great extent (25.8%) 5 = Very great extent (9.3%)	Additional descriptive data
Q15	do your university/college policies address web accessibility development tools and/or techniques, such as the use of templates, Bobby, AChecker, or other automatic verification tools, or assistive technologies, such as screen readers, e.g., JAWS? N=91 Missing=6	0 = Missing (6.2%) 1 = No extent (13.4%) 2 = Little extent (21.6%) 3 = Some extent (33.0%) 4 = Great extent (20.6%) 5 = Very great extent (5.2%)	Additional descriptive data
Q16	do your university/college policies address regular or periodic website analyses to ensure Section 508 conformance? N=88 Missing=9	0 = Missing (9.3%) 1 = No extent (21.6%) 2 = Little extent (22.7%) 3 = Some extent (29.9%) 4 = Great extent (13.4%) 5 = Very great extent (3.1%)	Additional descriptive data
Q17	When making updates to your website, do you consider the importance of	0 = Missing (4.1%) 1 = No extent (3.1%)	H3

	making the site accessible to all users? N=93 Missing=4	2 = Little extent (6.2%) 3 = Some extent (27.8%) 4 = Great extent (34.0%) 5 = Very great extent (24.7%)	
Q18	are you knowledgeable with U.S. Section 508 of the Americans with Disabilities Act (ADA)? N=94 Missing=3	0 = Missing (3.1%) 1 = No extent (4.1%) 2 = Little extent (15.5%) 3 = Some extent (42.3%) 4 = Great extent (28.9%) 5 = Very great extent (6.2%)	H3
Q19	are you familiar with creating websites that are accessible for users with visual impairments? N=93 Missing=4	0 = Missing (4.1%) 1 = No extent (11.3%) 2 = Little extent (12.4%) 3 = Some extent (34.0%) 4 = Great extent (30.9%) 5 = Very great extent (7.2%)	H3
Q20	is the website that you are currently overseeing accessible to users with visual impairments? N=91 Missing=6	0 = Missing (6.2%) 1 = No extent (12.4%) 2 = Little extent (14.4%) 3 = Some extent (30.9%) 4 = Great extent (30.9%) 5 = Very great extent (5.2%)	H3
Q21	are you familiar with designing websites for mobile device accessibility (e.g., iPhones™, personal digital assistants (PDAs), or cell phones, etc.)? N=93 Missing=4	0 = Missing (4.1%) 1 = No extent (30.9%) 2 = Little extent (33.0%) 3 = Some extent (21.6%) 4 = Great extent (6.2%) 5 = Very great extent (4.1%)	H3
Q22	are you knowledgeable regarding available software tools that check your website for accessibility and provide useful feedback? N=92 Missing=5	0 = Missing (5.2%) 1 = No extent (17.5%) 2 = Little extent (18.6%) 3 = Some extent (35.1%) 4 = Great extent (18.6%) 5 = Very great extent (5.2%)	H3
Q23	have you used any of the following web-based ac-	0 = Missing (5.2%) 1 = No extent (35.1%)	H3

	<p>cessibility tools: online Bobby, WebXACT, AChecker, or a similar online tool?</p> <p>N=92 Missing=5</p>	<p>2 = Little extent (12.4%) 3 = Some extent (26.8%) 4 = Great extent (16.5%) 5 = Very great extent (4.1%)</p>	
Q24	<p>have you used any of the following non-web-based accessibility tools, e.g., A-Prompt, desktop Bobby, Dreamweaver with accessibility checks?</p> <p>N=93 Missing=4</p>	<p>0 = Missing (4.1%) 1 = No extent (30.9%) 2 = Little extent (18.6%) 3 = Some extent (30.9%) 4 = Great extent (13.4%) 5 = Very great extent (2.1%)</p>	H3
Q25	<p>have you tested your website using a screen reader, e.g., JAWS?</p> <p>N=92 Missing=5</p>	<p>0 = Missing (5.2%) 1 = No extent (56.7%) 2 = Little extent (16.5%) 3 = Some extent (17.5%) 4 = Great extent (3.1%) 5 = Very great extent (1.0%)</p>	H3
Q26	<p>are you knowledgeable with the first set of guidelines (Priority 1) originating from the Web Accessibility Initiative (www.w3.org/wai)?</p> <p>N=89 Missing=8</p>	<p>0 = Missing (8.2%) 1 = No extent (32.0%) 2 = Little extent (21.6%) 3 = Some extent (18.6%) 4 = Great extent (13.4%) 5 = Very great extent (6.2%)</p>	H3
Q27	<p>are you knowledgeable with the second set of guidelines (Priority 2) originating from the Web Accessibility Initiative (www.w3.org/wai)?</p> <p>N=90 Missing=7</p>	<p>0 = Missing (7.2%) 1 = No extent (36.1%) 2 = Little extent (22.7%) 3 = Some extent (18.6%) 4 = Great extent (11.3%) 5 = Very great extent (4.1%)</p>	H3
Q28	<p>are you knowledgeable with the third set of guidelines (Priority 3) originating from the Web Accessibility Initiative (www.w3.org/wai)?</p> <p>N=90 Missing=7</p>	<p>0 = Missing (7.2%) 1 = No extent (37.1%) 2 = Little extent (25.8%) 3 = Some extent (16.5%) 4 = Great extent (9.3%) 5 = Very great extent (4.1%)</p>	H3

SECTION THREE: Regarding communications with end users, to what extent:

Q29	do you receive messages from users of the website you manage? N=94 Missing=3	0 = Missing (3.1%) 1 = No extent (7.2%) 2 = Little extent (23.7%) 3 = Some extent (36.1%) 4 = Great extent (16.5%) 5 = Very great extent (13.4%)	H4
Q30	is it useful for you to work with end users? N=94 Missing=3	0 = Missing (3.1%) 1 = No extent (3.1%) 2 = Little extent (8.2%) 3 = Some extent (30.9%) 4 = Great extent (36.1%) 5 = Very great extent (18.6%)	H4
Q31	is it useful for you to respond to common end user problems? N=94 Missing=3	0 = Missing (3.1%) 1 = No extent (7.2%) 2 = Little extent (3.1%) 3 = Some extent (20.6%) 4 = Great extent (45.4%) 5 = Very great extent (20.6%)	H4
Q32	is it useful for you to respond in a timely manner to end users? N=95 Missing=2	0 = Missing (2.1%) 1 = No extent (4.1%) 2 = Little extent (4.1%) 3 = Some extent (15.5%) 4 = Great extent (52.6%) 5 = Very great extent (21.6%)	H4

SECTION FOUR: contact and policy information specific to web accessibility issues

Q33	Is there webmaster/developer contact information available on the university homepage? N=96 Missing=1	0 = No answer (1.0%) 1 = Yes (80.4%) 2 = No (13.4%) 3 = Not sure (5.2%) 4 = N/A (0%)	Additional descriptive data
Q34	Is there webmaster/developer contact information available on the college/department/ program of education homepage? N=96, Missing=1	0 = No answer (1.0%) 1 = Yes (70.1%) 2 = No (26.8%) 3 = Not sure (2.1%) 4 = N/A (0%)	Additional descriptive data

<p>Q35</p>	<p>If a university/college website development policy exists, is it linked off of the university homepage? N=96 Missing=1</p>	<p>0 = No answer (1.0%) 1 = Yes (39.2%) 2 = No (35.1%) 3 = Not sure (20.6%) 4 = N/A (4.1%)</p>	<p>Additional descriptive data</p>
<p>Q36</p>	<p>If a university/college website development policy exists, is it linked off of the college/department / program of education homepage? N=94 Missing=3</p>	<p>0 = No answer (3.1%) 1 = Yes (18.6%) 2 = No (55.7%) 3 = Not sure (15.5%) 4 = N/A (7.2%)</p>	<p>Additional descriptive data</p>
<p>Q37</p>	<p>Are there links to Section508 guidelines or other standards such as W3C guidelines, i.e., WCAG, on the university's homepage? N=92 Missing=5</p>	<p>0 = No answer (5.2%) 1 = Yes (12.4%) 2 = No (55.7%) 3 = Not sure (25.8%) 4 = N/A (1.0%)</p>	<p>Additional descriptive data</p>
<p>Q38</p>	<p>Are there links to Section508 guidelines or other standards such as W3C guidelines, i.e., WCAG, on the university's college / department / program of education homepage? N=93 Missing=4</p>	<p>0 = No answer (4.1%) 1 = Yes (9.3%) 2 = No (70.1%) 3 = Not sure (15.5%) 4 = N/A (1.0%)</p>	<p>Additional descriptive data</p>
<p>Q39</p>	<p>Are there any ethical decisions involved when you plan and/or update your website(s) in relation to web accessibility? Please explain your answer: N=93 Missing=4</p>	<p>0 = No answer (4.1%) 1 = Yes (34.0%) 2 = No (38.1%) 3 = Not sure (19.6%) 4 = N/A (4.1%)</p> <p>Second part of question is listed in Qualitative Information section</p>	<p>Quantitative and Qualitative</p>

SECTION FIVE: Webmaster and institutional demographics

Q40	What is your gender? N=96 Missing=1	0 = No answer (1.0%) 1 = male (52.6%) 2 = female (46.4%)	Demographics
Q41	What is your age range? N=96 Missing=1	0 = No answer (1%) 1 = under 18 (0%) not applicable 2 = 18-35 (20.6%) 3 = 36-49 (36.1%) 4 = 50-69 (42.3%) 5 = ≥ 70 (0%)	Demographics
Q42	What is the highest level of education that you have completed? N=95 Missing=2	0 = No answer (2.1%) 1 = High School Graduate (3.0%) 2 = Technical/Community College (4.1%) 3 = Bachelor's degree/equivalent (36.1%) 4 = Master's degree/equivalent (29.9%) 5 = Doctoral degree (24.7%)	Demographics
Q43	Approximately what is your current salary (or if consultant/contractor, payment provided for your webmaster activities for this post-secondary educational institution)? N=92 Missing=5	0 = No answer (5.2%) 1 = \$0 (i.e., volunteer) (4.1%) 2 = \$1-\$30,000 (10.3%) 3 = \$30,001 - \$60,000 (57.7%) 4 = \$60,001 - \$100,000 (22.7%) 5 = > \$100,000 (0%)	Demographics
Q44	How would you describe your post-secondary educational institution's use of Web information technology? N=96 Missing=1	0 = No answer (1.0%) 1 = Extensive (12.4%) 2 = Above Average (28.9%) 3 = Average (49.5%) 4 = Minimal (7.2%) 5 = Non-existent (1.0%)	Demographics
Q45	What year did your post-secondary educational institution first establish a Web presence? N=96 Missing=1	0 = No answer (1.0%) 1 = before 1993 (11.3%) 2 = after 1993 up to 2000 (33.0%) 3 = after 2000 (0%) 4 = unknown (54.6%)	Demographics
Q46	How many years have you done webmaster	0 = No answer (1.0%)	Demographics

	work for this post-secondary educational institution? N=96 Missing=1	1 = less than 1 year (14.4%) 2 = 1 – 2 years (22.7%) 3 = 3 – 5 years (21.6%) 4 = 6 – 10 years (32.0%) 5 = > than 10 years (7.2%)	
Q47	How do you rate your webmaster computing experience? N=96 Missing=1	0 = No answer (1.0%) 1 = no experience (0.0%) 2 = little experience (16.5%) 3 = intermediate experience (38.1%) 4 = extensive experience (24.7%) 5 = expert/professional experience (19.6%)	Additional descriptive data
Q48	What decision-making level do you have in your position regarding strategic web planning? N=93 Missing=4	0 = No answer (4.1%) 1 = task-based (i.e., decisions affecting own job) (6.2%) 2 = office-wide (55.7%) 3 = Department- or School of Education-wide (16.5%) 4 = University-wide (5.2%) 5 = None (12.4%)	Additional descriptive data

SECTION SIX: Qualitative Information

Q49	Please list the biggest challenge of making a website accessible for users with visual impairments?	Not applicable – answers listed in Qualitative Information section	Qualitative
Q50	What factors would influence you to make your current site accessible for users with visual impairments?	Not applicable – answers listed in Qualitative Information section	Qualitative
Q51	Which post secondary educational employees/stakeholders do you think should be responsible for ensuring Section 508 website accessibility compliance? (check all that apply)	<u>Percentage total selected</u> (N=194 total selections) President/Regents (13.4%) Business Administrators (10.8%) Information Technology Directors/Managers (40.7%) Webmasters/Developers (35.1%) Groups selected:	Qualitative

		<p>N=93, 4 missing</p> <p>4.1% no response (4)</p> <p>32.0% listed Info Tech Directors/Managers, and the Webmasters/Developers (31)</p> <p>21.6% listed only the Information Technology Directors/Managers (21)</p> <p>14.4% listed President/Regents, Business Administrators, Info Tech Directors/Managers, and the Webmasters/Developers (14)</p> <p>8.2% listed only the Webmasters/Developers (8)</p> <p>8.2% listed President/Regents, Info Tech Directors/Managers, and the Webmasters/Developers (8)</p> <p>5.2% listed Business Administrators, Info Tech Directors/Managers, and the Webmasters/Developers (5)</p> <p>2.1% listed only the President/Regents (2)</p> <p>2.1% listed President Regents, Business Administrators, and Webmasters/Developers (2)</p> <p>1.0% listed only "Other" as College Level Administrator (1)</p> <p>1.0% listed only "Other" as the CTO employed at their institution (1)</p> <p>Other specified:</p> <ul style="list-style-type: none"> ○ This institution has recently employed a new Technology Officer and is busy being in charge of everything ○ Schools or research organizations who work with the visual hearing or motor impaired ○ Anyone who publishes anything on the web ○ Publications ○ Public Affairs Director ○ Media and Public Relations ○ Faculty and staff ○ Departments 	
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		<ul style="list-style-type: none"> o Program Leaders o Web Committee o College Level Administrators o Have responsibility handed down to specific colleges, etc., with education, on HOW to make the updates. o Web people will have a greater understanding of the requirements, however it would be helpful for administration to understand why accessibility compliance is a good thing and encourage their departments to follow suit. o The President is ultimately responsible. He needs to be sure there are plans/checks and balances are in place to ensure compliance. o Since the Webmaster and Developers are the primary individuals who update the website they should all be aware of how to make a website section 508 compliant. 	
Q52	Please state any other additional skills and abilities that you think were missing from the main question set:	Not applicable – answers listed in Qualitative Information section	Qualitative

Qualitative Responses to Questions 39, 49, 50, and 52

Qualitative Data and Information Generated

Question 39. Are there any ethical decisions involved when you plan and/or update your Web site(s) in relation to Web accessibility? Please explain your answer.

1. Does not have responsibility or lack of resources/time in making Web accessibility decisions:
 - (a) "No, because I will not be the person to make the decision."
 - (b) "There is no ethical decision making for accessibility. There are very few on campus Web developers here, and I do communicate with them the importance of accessibility and accessibility testing. All Web development policies follow guidelines set forth in core University policies, so no separate documents are maintained and accessibility is already addressed in those documents."
 - (c) "I am only the Web master or page master as they call it for the College of Education. The over all decisions, policies, etc., are done by public relations and the overall Web master who is under the public relations division."
 - (d) "I only maintain our e-Campus Web site and am not sure about much of the compliance issues."
 - (e) "I wish I had more time to explore this, but because I am so busy, I don't."

- (f) "Yes, I use the template system the university Web master provides. She tells me it's compliant. We also have a department that helps with accessibility within our college. I assume they are doing everything they can to make the templates work with accessibility guidelines because we also train special education teachers."
- (g) "Not sure, we have a strange process for maintaining our Web site. Because the Web developer position is unionized, decisions are, in many cases, made without consulting my position or input. . .due to a 'class system' at The University and a lot of problems are fixed after decisions are already made—making the process hectic and difficult."
- (h) "Not sure, I maintain the Web site about 20% of my time here. I wasn't involved with the design or construction of the site and have little input."
- (i) "Yes, discussions revolve around universal access in the current economic downturn. The administration makes the final decisions."
- (j) "Not sure, the programs used for Web accessibility are determined at the University's marketing level. Templates are incorporated on our Web pages for content and design—if those abilities exist, I do not manipulate."
- (k) "No, the University's Media Services Office designed the School of Education's site to be accessible; I merely add, delete, and update content. This is why I've left blank items 16-28."
- (l) "Yes, I take an affirmative stance in making Web content accessible. We have several thousand pages of content, and nearly every department has control over its own content (but not over the design). Although I try to educate the content-contributors on the proper use of headings, links, tables, and lists, it is not feasible for me to monitor every change made; I do as much as possible, however. (We are a Web-team of one doing the workload of three—still looking for the other two!)"
- (m) "No, not an ethical decision-making process. More a matter of time available to work on the project. We acknowledge the importance of accessibility and compliance with related guidelines. We just lack resources (esp. time) to get it done. It's not an ethical issue at all."
- (n) "Yes, a growing ethical decision involves close-captioning (CC) Web-based video. There's the cost of close-captioning vs. the cost of not uploading the video at all."
2. Web accessibility is an ethical priority and trying to be compliant:
- (a) "Yes, universal accessibility is on the utmost importance for a public, state university, especially to a department such as the College of Education."
- (b) "Yes, we believe all people should have access."
- (c) "Yes, we make an effort to voluntarily provide accessible Web pages in our Web site."
- (d) "Yes, as a Christian university we want to engage with all people, those with disabilities and those without. However, as a small private university we often struggle merely to create and maintain content. Sadly, accessibility is often neglected."
- (e) "Yes, we profess to be handicap accessible."
- (f) "Yes, with accessibility is the ethically correct way to develop/update, so we need to be more compliant."

- (g) "Yes, I believe everything must be accessible, even if there are no students who might need it. But not everyone has this opinion."
 - (h) "Yes, we make sure that any technology utilized on our Web site is accessible to all users."
 - (i) "Yes, we want everyone to be able to access the Web site no matter what their physical or mental abilities are or are not."
 - (j) "We are a public institution, governed by a different set of accessibility guidelines established by the state. However, ethically, we want persons of all abilities to be able to come to our institution and succeed. Technological impediments to success are unnecessary and morally objectionable."
3. Accessibility is an ethical and legal issue:
- (a) "Yes, pages should comply with legal requirements."
 - (b) "Yes, have to be careful that information on the Web site does not conflict with state or federal laws."
 - (c) "Yes, we make sure the information that is put on our Web page meet our ethical and legal standards."
4. Accessibility is a priority, but not an ethical issue:
- (a) "No, University has already made the decision to make our papers accessible to all. At College of Education level we implement that policy."
 - (b) "No, we aim for accessibility—there has no need to compromise."
5. Goal is to be more compliant:
- (a) "By testing our pages against the World Wide Web Consortium's (W3C) Markup Validator, we can assure our compliance with the XHTML 1.0 Strict standard. We also use the W3C's CSS Validator. Additionally, pages are tested for 508c compliance using the Cynthia Says Portal."
 - (b) "Maintain compatibility with university accessibility guidelines."
 - (c) "Unfortunately, not all of our pages meet these standards yet, but we are working to make all of our new pages do so. Pages that display the '508,' 'XHTML,' and 'CSS' buttons in the lower-right-hand corner have been tested and have passed."
 - (d) "We are currently undergoing a redesign and complete recoding of our university's site. The new design will ensure Section 508 compliance regardless of what other departments may want."
 - (e) "Content that provides significance to a page cannot use client-side scripts or complex styles so the content is accessible."
 - (f) "Due to our upcoming accreditation, we are looking at this extensively."
 - (g) "There is a redesign coming which will address all the guidelines, ethics, accessibility."
 - (h) "Section 508 has not been specifically addressed in our School of Education besides adding alternative text to images."
 - (i) "In posting data reports all names or identifying information is removed."
 - (j) "We continue to use tables to hold pictures related to text in place, which creates problems for text readers but is still allowed by the college Web software. Our current thinking is that the order that a visually handicapped person sees the image tag and related text does not impair understanding of the text."

- (k) "Yes, I feel a responsibility to make the site as accessible as I know how to create."
 - (l) "Yes, I attempt to make sure that the site information is accessible to all."
 - (m) "Inheriting an out-of-compliant site has forced me to make decisions about which pages are brought into compliance before others."
6. Question is not understandable:
- (a) "Our goal is to make our Web site accessible to all and to follow the applicable laws drives our decision-make process. I fail to see where ethics enters into these decisions. Perhaps I do not understand the question."
 - (b) "Please explain your question—are you asking whether we think that making a Web site accessible is a legal question and an ethical question—of course the answer to this is 'yes!'"

Question 49. Please list the biggest challenge of making a Web site accessible for users with visual impairments.

1. Design conflicts:
- (a) "Decision-maker's love of Flash."
 - (b) "Making a site completely accessible while retaining a high-class design experience for end-users."
 - (c) "Sacrificing design, working with Web limitations concerning design."
 - (d) "Conforming to standards while still making a site visually appealing."
 - (e) "Keeping the look of the site fresh and current while still applying 508 guidelines. It could just be me, but mixing the 2 is a challenge, so it's usually just the minimum of 508 compliance that gets put in place."
 - (f) Tables: "Conflict between designer use of tables to make information clear and attractive to majority of users versus issues this practice raises for text reader users;" "Unavoidable use of layout tables for images;" "Accessible mark-up of large data tables."
2. Many stakeholders involved with diverse and/or conflicting needs:
- (a) "Accommodating everyone's needs and requests while still maintaining accessibility."
 - (b) "Multiple stakeholders/priorities involved: educating myself, my Web developer and college faculty and staff about requirements."
 - (c) "General emphasis on the Web as a visual medium and thus the challenge of providing non-visual or otherwise differently visual alternatives without 'breaking' the site for other users."
 - (d) "Getting cooperation from content providers."
 - (e) "Helping people that request Web pages understand the needs of those with visual impairments."
 - (f) "Do you believe your Web site is able to communicate needed information to viewers intuitively?"
 - (g) "Balancing clean design/provide content/non-handicapped user engagement with university color/style requirements with visual impairment requirements."

- (h) "Balancing user desires for various "look and feel" attributes and "ease of editing" attributes with standards-compliant techniques, which may make achieving a particular design more complex, both in planning and code structure."
 - (i) "Maintaining the Web site and coordinating the work of other Web developers to ensure consistency of accessibility."
 - (j) "Understanding individual needs and learning to code to meet those needs while keeping management happy with the end product."
 - (k) "To make the end user experience as rich as possible while trying to make the site accessible for users with visual impairments. The enormity of a University Web site makes coordination and communication difficult amongst each unit that comprises the whole."
 - (l) "Conflicting priorities among stakeholders."
 - (m) "No accountability. To make my responses clear, the School of Education Web site is managed in the School of Education by me, a full-time faculty member. I am not a full-time Web developer or Web master. I simply created and run the current School of Education site. The university, itself, has a separate marketing School of Education Web site [domain was listed], and the responses I've given are not applicable to that site. They may deal with 508 compliance. I do not act as the "Web master" of our smaller School of Education site [domain was listed]. I receive no support from the university and the university does not require anything of me in terms of development. Ensuring each department Web person understands and follows the accessibility guidelines once the site has been handed over to them."
 - (n) "There are many challenges balancing current technology with simpler "user-friendly" technology, but I am a big proponent of assistive technology and access of the Web and media for all. As usual, the biggest problems are political and financial support of this type of development. I am encouraged that you are researching this important area."
 - (o) "I have not worked with our IT people in the setup of this function. I know it exists, do not know the challenges."
 - (p) "Getting the other Web developers (departmental, project, faculty) to comply with alt tags, etc."
 - (q) "Educating my colleagues—getting them to understand how beneficial and important this is."
 - (r) "It is difficult to have everyone that updates the Web site conform to section 508 standards. Keeping track of everyone's updates is a daunting task."
 - (s) "Awareness—people don't view the code and so don't appreciate the need for standards or understand how sloppy code can make accessing a page difficult for the visually impaired."
 - (t) "The coordination of providing reasonable accommodations with faculty and the student. Special training and assistance maybe needed for the faculty member to provide reasonable accommodations to its students."
3. Design templates/content management systems:
- (a) "We currently use a content management system that was specifically selected on account of its handling of accessibility issues. However, with any "off-the-shelf" solutions, there are things it does well and areas where it needs improvement. Overcoming its shortcomings while waiting for manufacturer updates is sometimes frustrating."

- (b) "We, in the School of Ed, use a Web development tool known as "School Center" because it is the tool used by surrounding school districts and it is the tool we teach our students how to use. Our capabilities are dependent on this software. We do NO programming."
 - (c) "Being sure the Web templates supplied by central IT body comply. This process is a form of centralization of Web design faith that our Web developers are well-versed in 508 design requirements and are applying them to the design standards for all university templates."
 - (d) "Distributed maintenance of Web pages across the institution."
 - (e) "Since we use Adobe Contribute for content management, (and allow our departments direct-publish access, since I do not have the time to do my job AND publish their drafts) occasionally some content will be posted that is not ideally accessible. Fortunately, since we use a template, and the template fields are enforced by the software, the layout-level accessibility can be enforced by proxy."
 - (f) "We are required to follow the Web site template for the university. It isn't completely compliant. We can't stray from that template."
 - (g) "I have to depend on the University templates. My pages are created within a content management system. I have no control over the actual page design."
4. Lack of time, resources/tools, training, knowledge, experience, and/or is not job responsibility:
- (a) "I don't get to do that."
 - (b) "Having easily—available tools to test sites with interpreting site test results effectively to make changes."
 - (c) "I have no experience with this."
 - (d) "I have not explored this issue."
 - (e) "Knowing what is available."
 - (f) "Lack of funding for new technologies."
 - (g) "Lack of knowledge."
 - (h) "Lack of knowledge of public and of teachers in K-12 and college (and beyond). When I got this survey, I asked two college student employees what they knew about Section 508. Neither had heard of it. One was a business major. The other is a computer science major! Good luck!"
 - (i) "Lack of knowledge on the part of IT."
 - (j) "Learning how to actually do it; investigating all options to present for consideration."
 - (k) "My biggest challenge is that I don't necessarily possess all of the tools to adequately test, e.g., a computer equipped with a screen reader. Another is staying abreast of what is considered accessible."
 - (l) "User access to PDF readers."
 - (m) "Not knowing if it is really accessible or not without the devices for testing."
 - (n) "Really, it's having the education available to learn HOW to make it accessible for all. Once I learn it—I'd update it all."
 - (o) "Receiving training."

- (p) "There is really no challenge. A good accessible Web site also has the advantage of being a smart semantic Web site. The real challenge is education for users that are allowed to edit Web content since many are secretaries or faculty that may not understand accessibility."
- (q) "Taking the time to learn it. I am lucky if I have enough time to get the Web site designed and developed on time let alone make it compliant. However, I do make sure we have alt tags for all images. Learning how to make video and flash compliant is currently out of my grasp."
- (r) "Testing is time consuming. Luckily we were able to use a expert in the field to do the testing of our Web site with JAWS."
- (s) "This Web design is just one component of my job!"
- (t) "Time and lack of proper tools for testing (screen readers, etc.)"
- (u) "Time and Talent—It seems that every time a new browser is introduced, that the programming changes. This results in a lot of time to make sure all parts continue to work as planned. Along that same line, if there is a problem, then talent kicks in and you have to figure out how to make it work."
- (v) "Need School provided software and templates."
- (w) "The current Web software is outdated. The university is aware of the situation and is finalizing contract details to purchase a new Web software package that would comply with section 508 requirements."
- (x) "Having the importance of the issue raised to the level in which we provide resources and time to develop the various tools."
- (y) "Keeping up with current technologies and updating our written policies and procedures."
- (z) "Repairing old Web site that are non-compliant."
- (aa) "Accommodating the wide range of impairments."
- (bb) "Computer access."
- (cc) "Time necessary to have info in html rather than pdf. We are just learning about accessible pdf files."
- (dd) "Expertise and time resources are severely limited. Web development/maintenance is only a small part of my assignment."
- (ee) "Institutional support."
- (ff) "Coming up with very good text for links, headers."
- (gg) "As above, the time, energy and resources to add accessibility."
- (hh) "Don't know how."

5. Browsers:

- (a) "Lack of consistent support from browsers and software (Web development or assistive devices) for guidelines (Section 508 and WCAG). For example, JAWS does not read link titles—a way to distinguish link titles—a way to distinguish between links with the same text that lead to different pages (e.g., read more. . .). Also, many WYSIWG editors do not write compliant HTML code."
- (b) "Text size limitations of browsers."
- (c) "Being sure they use a browser that can enlarge print."

- (d) "The lack of consistent support by the various browsers for standards, example, IE holding back the potential of CSS."
- 6. Alt tags/transcripts relating to graphics, videos, and other visually-related media:
 - (a) "Ensuring graphics have alt tags. But our content management system has built in checks for this."
 - (b) "Accessible mark-up of video close-captioning, access of multimedia presentations (flash objects, slideshows, etc.), PDF files, streaming audio, and limited staff resources. In the near future, AJAX programming present new challenges as data is fetched directly from databases without reloading a Web page."
 - (c) "Meaningful alt tags for multimedia items."
 - (d) "Reducing the length and mass of <alt> information so as not to be overwhelming, and meticulously making sure all graphics have <alt> tags applied."
 - (e) "Working with video, images, and other high technologies."
 - (f) "When faculty wish to have video materials online."
 - (g) "Working with video."
 - (h) "Making Flash-based presentations, such as slideshows, accessible."
 - (i) "Translating complex visual information into an audible narrative; transcripts for audio/video."

Question 50. What factors would influence you to make your current site accessible for users with visual impairments?

- 1. Institutional priorities/requirements:
 - (a) "Accountability, requirements given by the institution."
 - (b) "Although full accessibility currently may be lacking, it is already a priority in future development."
 - (c) "Being perceived as a leader, being recognized as in full compliance. Professional pride."
 - (d) "Being told to do so (or be more careful, at least)."
 - (e) "I am convinced of the need; we need institution-wide training."
 - (f) "Support from the Dean and/or President."
 - (g) "Institutional support."
 - (h) "If I was told by the college to implement that policy."
 - (i) "Attention from our governing board."
 - (j) "More university mandates and guidelines."
 - (k) "It would be easier and there would be more support if this was a university-wide directive from the president's office."
- 2. Training and resources (i.e., time, tools, funding, and staffing):
 - (a) "A standardized way to implement the accessibility guidelines, specifically list the methods of action and services that we need to use. A written letter/e-mail stating that compliance is required by law would encourage my employer to take action and give training to all Web masters."
 - (b) "Access to necessary software; access to training."
 - (c) "Assuring text to speech capability."

- (d) "Cost, access to adaptive technology."
 - (e) "Free license of JAWS for Web masters of educational institutions, or perhaps stronger legislative (even non-binding) mandates to do so (legislative pressure would convince my superiors that I should be given time and resources to best achieve this goal)."
 - (f) "Funding."
 - (g) "If it were easier to make compliant and not 'break' things that were already in place."
 - (h) "Well. . .we passed before, but I added a new search field for our search engine and forgot to set the label or alt, so I have to fix that. Just being reminded occasionally to test accessibility is always important and this survey did that."
 - (i) "Incorporating tools into Dreamweaver."
 - (j) "Integrated development/testing tools."
 - (k) "We currently have limited University resources."
 - (l) "More assistance with maintenance and time."
 - (m) "Once the [new] software is implemented . . . our department can make changes to bring the Web pages into compliance."
 - (n) "Really, it's having the education available to learn HOW to make it accessible for all. Once I learn it—I'd update it all."
 - (o) "Software."
 - (p) "The capabilities of our Web development software."
 - (q) "Time is always the limiting factor here. I have the skills and experience, but seldom the time to do all of the Web development the way I would like to."
 - (r) "Training options, tech support options."
 - (s) "Learning where we are lacking in accessibility on current site."
 - (t) "More time to devote to the project."
 - (u) "Additional funding and staff to reach a higher standard of accessibility."
 - (v) "Training to use software and special equipment; Funds to purchase software and special equipment."
 - (w) "A more robust content-management system that would ensure compliance where possible."
 - (x) "Better tools built into the design software (i.e., Dreamweaver) that assist me in creating more accessible sites. And not tools that check after the site is built, but assist in the building of the site."
3. Enforcement of laws/responsibilities:
- (a) "Common courtesy - legal ramifications."
 - (b) "Equal opportunity."
 - (c) "I don't see any factors except that it is a 'must.' At Higher education, we must serve all populations including information to sight impaired individuals."
 - (d) "Better serving our/students prospects with various disabilities."
 - (e) "It is what is right to do, no additional influence needed."
 - (f) "It's the right thing to do. It's the law."

- (g) "Making information available for all."
 - (h) "Requirements of law."
 - (i) "Our state has made 508 mandatory."
 - (j) "Compliance mandatory."
 - (k) "Lawsuits/Legal requirements, but above all, because it is the right thing to do."
4. Demand/knowing user needs:
- (a) "Demand for it from students, employees, potential students, administrators."
 - (b) "Student Need."
 - (c) "If we knew how many of our visitors are affected by disabilities/use screen readers."
 - (d) "Increase in online/distance learning; more non-traditional students."
 - (e) "Needs of users."
 - (f) "Number of users."
 - (g) "Observation of difficulties being experienced."
 - (h) "If we had students and faculty who require the accessibility."
 - (i) "Should I receive complaints (questions) about the impaired individual's ability to do so."
 - (j) "Users with visual impairments."
 - (k) "Direct, personal feedback from our students who might have a visual impairment."
 - (l) "This is currently in our Web migration plan to try and make our Web site section 508 compliant."
 - (m) "Increasingly our users tend to drive accessibility. Meeting their needs, beyond just what turns up in automatic site tests."
 - (n) "Pressure from donors; a specific request for support from an individual with visual impairments."
 - (o) "More visually impaired users."
 - (p) "Awareness of the impact on current and potential Web site users."
 - (q) "I actually already have one. We have a visually impaired faculty member who pushes for accessibility on our Web site. Hearing from him (and stories of his students) reminds me of the importance to make our site accessible to as large an audience as possible."
5. Not responsible in job duties:
- (a) "I don't get to do that."
 - (b) "I have not explored this issue."
 - (c) "IT knowing how to do this."
 - (d) "We are currently constrained to using the university's templates, so beyond the basics, I have little discretion."
 - (e) "Direction from my supervisor."
 - (f) "I have to assume the university is doing all it can."

6. Not applicable and/or already accessible:
- (a) "I already advocate for it. Many of the things we do to make the content more accessible is also in line with making it more standards compliant, and I advocate standards compliance as well. Generally, Web content that is made more accessible has a positive effect even for people that AREN'T using screen readers or other aids."
 - (b) "As far as I know, our Web site is accessible for all users. We worked very hard to keep it that way."
 - (c) "I believe it currently is very accessible. Our university has been at the forefront of creating accessible sites and we have a large program designed to train teachers who teach students with VI issues so we are held accountable in a real practical sense daily."
 - (d) "None. As a Web professional, I want to reach the largest audience possible and know that those with visual impairments will be included. I want to be a good steward with our Web presence and take these factors into account before I even start to build a site."
 - (e) "It already is."
 - (f) "I'm already making the effort."
 - (g) "It already is."
 - (h) "Unsure."

Questions 52. Please state any other additional skills and abilities that you think were missing from the main question set.

1. Templates/content management systems:
- (a) "Do not use Web-based nor desk-top based Web accessibility verification tools because Web development is through an IT department template that is supposed to be Section 508 compliant."
 - (b) "We recently switched from HTML files to a Content Management System (Red-Dot) for official university pages. The CMS facilitates compliance and we rely significantly on that."
 - (c) "I have a lot of discretion over content, choice of images and somewhat with layout, but we need to make everything fit the templates, so that limits other layout choices. My biggest challenge is getting users to send updated content, to correct content, and so forth"
2. Training/skill set:
- (a) "I see a lot of people in Web development that don't have a software engineering/computer science background. This puts them at a huge disadvantage when they try to understand the many complexities involved in all aspects of Web development from maintaining the Web server to creating the content. Usually they don't really understand how the whole system works together. It might be helpful to know beyond question 47, what level and type of formal training Web masters have."
 - (b) "How do you obtain these skills and abilities?"
 - (c) "My prior experience working on company Web sites was in the financial industry—quite different from education. Prior experience might be relevant?"
 - (d) "Critical thinking skills, problem solving skills."

- (e) "Marketing background and the ability to think like our various audiences, i.e., potential students (age 15-29), parents and alumni, current students, faculty/staff/administrators on campus; excellent writing and editing skills, including excellent grammar and spelling."
- 3. Funding and resources:
 - (a) "How do we pay/ who pays for making some of our materials accessible (i.e., close captioning)?"
 - (b) "What percentage of your time is designated/dedicated/available for work on your Web site?"
 - (c) "Does your college or university financially support accessible Web design, programming, and development?"
 - (d) "The ability to manage the needs, wants and ever growing expectations of a large organization with a minimal budget and staff."
 - (e) "Questions regarding the amount of time and resources it takes to make content compliant, for example, adding captions to video content?"
- 4. Other Web accessibility technologies:
 - (a) "I would be interested in what other types of software is being used to develop visually impaired Web sites as well as software that creates 508 compliant files."
 - (b) "Although it may not address nearly as large a user population, I would like increased attention to other assistive technologies other than for sight impairment (i.e., motor skill deficiency). While this is not specifically an error of this questionnaire, the questionnaire reflects the general focus of most accessibility efforts. (I do tend to believe that attention to visual impairments is paramount and lacking in most Web designs.)"
- 5. Other: "Do you believe your Web site is able to communicate needed information to viewers intuitively?"

Table 3.

JAWS™ testing using survey based on Stewart et al. (2005)

Screen reader testing of education home pages that received conditional passes by AChecker v.0.8.9 with the use of the survey based on Stewart et al. (2005) questions (missing=0, N=42).

Q#	Question	Answers				
1	Can you access the site?	100% Yes (42)			0% No (0)	
2	*Is skip navigation available?	78.6% Yes (33)			21.4% No (9)	
3	Are pop up windows available?	0% Yes (0)			100% No (42)	
4	How do you rate the construction of the site?	Very Good	Good	OK	Poor	Very Poor
		19.0%(8)	59.6%(25)	0%	0%	21.4%(9)
5	How do you rate the standard layout of the site?	Very Good	Good	OK	Poor	Very Poor
		19.0%(8)	59.6%(25)	0%	0%	21.4%(9)

		Very Good	Good	OK	Poor	Very Poor
6	How do you rate the navigability of the site?	19.0%(8)	59.6%(25)	0%	0%	21.4%(9)
7	How do you rate the usability of the site?	19.0%(8)	59.6%(25)	0%	0%	21.4%(9)
8	How do you rate the labeling of dialogue boxes?	0%	7.1%(3)	61.9%(26)	31.0%(13)	0%
9	Are alt tags used for images?	Yes, and understandable 61.9%(26)	Yes, but confusing 26.2%(11)	Partially 11.9%(5)	Partially, but confusing 0%	Not at all 0%
10	Is keyboard-only navigation available?	Yes, and understandable 100%(42)	Yes, but confusing 0%	Partially 0%	Partially, but confusing 0%	Not at all 0%
11	Are descriptive text links available?	Yes, and understandable 100%(42)	Yes, but confusing 0%	Partially 0%	Partially, but confusing 0%	Not at all 0%
12	Are tables properly labeled?	Yes, and understandable 81.0%(34)	Yes, but confusing 9.5%(4)	Partially 9.5%(4)	Partially, but confusing 0%	Not at all 0%
13	Is the site usable with scripting turned off?	Yes, and understandable 90.5%(38)	Yes, but confusing 4.8%(2)	Partially 4.8%(2)	Partially, but confusing 0%	Not at all 0%