EVALUATING THE ACCESSIBILITY OF ONLINE LIBRARY GUIDES AT AN ACADEMIC LIBRARY

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Abstract: This article describes an exploratory research study assessing the level of Americans with Disabilities Act (ADA) compliance and general accessibility of online information resources at a mid-sized, 4-year, public institution in the state of Ohio. A rubric, available freely online as a living document, was developed based on the Web Content Accessibility Guidelines (WCAG) 2.0, Section 508 of the Rehabilitation Act of 1973, and web design best practices. From 2015-2016, the authors used the rubric containing 14 criteria (12 criteria from the WCAG 2.0, a criterion from Section 508, and a criterion related to universal web design best practices) to assess a random sample of online library guides (18 guides) at this institution.

The authors found that the template developed by the administrator and used by all library guides at the study institution caused 70% of the applicable criteria to fail. The content contributed by individual library guide authors did not pass all of the criteria, but generally performed better than the template. Library guide author contributed content failed an average of seven rubric criteria. Many of the common library guide author errors in this study coincide with those reported by other institutions.

Combining the WCAG 2.0 criteria with additional universal web design best practices criteria within the rubric eliminated most of the universal accessibility concerns that remained after applying the WCAG 2.0; a concern that had been identified in previous literature examining WCAG 2.0 applications to online information resources. It was concluded that the rubric was sufficiently comprehensive and that further exploration of its utility was warranted. This includes asking a heterogeneous group of users to assess the usefulness of the rubric by applying it to library guides outside of this study.

Keywords: Online accessibility, universal design, Americans with Disabilities Act.

Introduction

This article explains and describes a 2015-2016 exploratory research study that examined the efficiency of using a comprehensive rubric to assess Americans with Disabilities Act (ADA) Amendments Act (2008) compliance in online, university library-created information resource guides (hereinafter referred to as LibGuides).

The study was conducted at a 4-year, public university in the state of Ohio by the article's authors (hereinafter referred to as the authors) to examine the utility of the author-compiled, comprehensive accessibility standards/guidelines rubric when applied to a fully online information resource. Once the study was complete, appropriate amendments were made to the rubric to make it clearer and easier to use for those assessing the ADA and universal design compliance of their web materials, particularly those in higher education.

The comprehensive accessibility standards/guidelines rubric (hereinafter referred to as the rubric) is a compilation of standards and guidelines from numerous organization's resources that provide best practice guidance for making web content accessible to those with disabilities. In addition, the rubric provides suggestions related to universal design of online resources to

promote ubiquitous access. The standards and guidelines used to create the rubric include the Web Content Accessibility Guidelines (WCAG) 2.0, created by the World Wide Web Consortium (W3C)'s Web Accessibility Initiative; Section 508 of the Rehabilitation Act of 1973; and web design best practices.

The rubric includes three levels of conformance, based on WCAG 2.0 guidance. Level A is viewed as the minimum conformance standard. To meet Level A conformance, "the web page [must satisfy] all the Level A Success Criteria, or a conforming alternate version is provided" (World Wide Web Consortium [henceforth W3C], 2016, Understanding Requirement 1). Levels AA and AAA have higher-level conformance requirements that must be met, and must also meet the level conformance standards for the lower levels. The rubric explains how criteria are met for each level described above.

The rationale for creating the rubric is explained in the next section.

Statement of the problem

Although legally required, ensuring ADA/accessibility compliance in online materials is incredibly challenging. Many of the requirements providing guidance on how to comply with the law when creating accessible online information materials are not in one place. Also, updates that have been made to the law are not always reflected in online resources. Consequently, the authors discussed creating a central hub of information they could use when designing their online materials, both out of frustration with the lack of an available comprehensive resource, and because of their need for a web design resource they could consult to save time and error in the creation process. To that end, to maximize their own efficiency and create a less frustrating and more reliable assessment tool, the authors created the rubric (available in the Appendix).

Specifically, the authors believe the rubric provides time-crunched information technology and library staff members with a simple yet comprehensive resource to consult when creating and designing ubiquitously accessible materials. Designers and others can also consult the rubric when evaluating

ubiquitous accessibility compliance in currently available web materials. As the authors began researching the literature on the matter, they realized they were not alone in struggling to create and maintain ADA-compliant and universally designed online materials. In a national study investigating various information available online to students with disabilities at degree-granting postsecondary institutions, Raue, Lewis, and Coopersmith (2011) found:

A few of the barriers cited by institutions as hindering implementation of universal design to a moderate or major extent were limited staff resources to provide faculty and staff training on accessibility issues … costs associated with purchasing appropriate technology … and other institutional priorities (p. 4).

The authors also discovered during their research that more than 30 higher education institutions across the United States had been subject to complaints and legislative actions due to lack of ADA compliance within their online materials (Carlson, 2017). It is speculated herein that lack of compliance has more to do with lack of funding and personnel able to make these updates and changes at these institutions rather than a willful dismissal of the need for accessible content. However, as Providenti (in Seale, 2014) states:

Institutions need to take accessibility issues more seriously. While the impetus to do so should fall under the rubric of professional ethics rather than avoiding a legal threat, either reason will suffice. … Ethics may be important but they are also cheap. Litigation, on the other hand is expensive. … Can we afford to ignore web standards when doing so impacts accessibility? (2004, p. 34).

Indeed, the number of U.S. higher education students who report having a disability has increased steadily over the last decade. Explanations for this include expanded access to distance education options (Caldwell, 2006; Seale, 2014), and legislation which provided broader access to higher education for students with disabilities, e.g. the ADA Amendments Act of 2008, and the 2008 Higher Education Opportunity Act (Raue et al., 2011). Additionally, there has been an increase in veterans and adult/non-traditional learners attending U.S. higher education institutions, and these specific populations have a higher-than-average disability registration rate than traditional undergraduate

students (U.S. Department of Education, National Center for Education Statistics [henceforth USDE NCES], 2016).

Based on the most currently available statistics, approximately 11% of enrolled undergraduate students reported having a learning, visual, auditory, or speech disability; or an orthopedic or health impairment (USDE NCES, 2014a). This statistic does not include students who do not report their disability or students who are unaware they have a disability; therefore, this statistic is likely to be much higher than reporting averages can determine. Regardless, 11% is a significant portion of the undergraduate student population in U.S. higher education institutions and one which must be provided with equal access to education therein.

In many countries, there is legislation to protect the rights of persons with disabilities. In the United States, Sections 504 (1973) of the Rehabilitation Act and the ADA Amendments Act (2008) are used in litigation against U.S. higher education institutions when they fail to provide reasonable accommodations to students with documented disabilities (U.S. Department of Education, 2014a, 2014b; U.S. Department of Justice, 2016). DeMaine (2014) defines reasonable accommodations as "those that ensure equal opportunity for participation and access to the benefits of the institution's programs without causing undue hardship for the institution" (p. 538). The authors agree that such legislation ensures that students with documented disabilities are given equal access to education through appropriate accommodations and physical, technological, and other assistance measures.

Although many U.S. institutions have focused a great deal on physical access to education while on campus for students with disabilities, there are many who have not paid as much attention to their web-based resources, as evidenced by the litigation discussed earlier. As the authors recognized in their preliminary research into this topic, there are many institutions who need assistance in complying with web accessibility standards. This led to the creation of the rubric, providing for a central repository of all reasonable standards.

Legal requirements notwithstanding; those who work in higher education have an ethical responsibility to educate all qualified students enrolled in programs of study, no matter the format through which the education is delivered. In the last 10 years, it has become more commonplace in the United States to apply, enroll, and complete a college degree using distance education methods, as well as to use associated tools to support incremental learning in online environments, sometimes referred to as badging (Educause, 2017). The number of students taking online classes is increasing rapidly, as well (USDE NCES, 2014b). Because of the increasing number of online services and born-digital educational materials available in the U.S. higher education environment, it is crucial for these institutions to ensure they provide accessible and compliant online material for a wide variety of users and usage capabilities. The ability to educate oneself is a basic human right and this right should be ubiquitously extended.

At this juncture, it is crucial to state that the authors recognize that similar challenges related to web accessibility of online resources are faced by higher education institutions abroad as well as in the United States (as detailed in the report by Altbach, Reisberg and Rumbley, prepared for the UNESCO 2009 World Conference on Higher Education). However, as stated previously, ADA compliance has become a pressing concern for many U.S. higher education institutions that wish to expand access to materials and avoid federal censure for failing to comply. It is for this reason this article focuses primarily on the needs of U.S. higher education institutions and studies completed therein in this regard, while acknowledging the global availability and importance of the guidelines and standards presented in the WCAG 2.0 in helping U.S. institutions improve compliance and access.

Purpose and aims of the study

Primarily, online academic library materials are created for higher education students, faculty, and university community members to support their information needs and academic requirements. Because it is almost impossible to determine the characteristics of people using this material beyond

incidental data gathering, it is imperative that all library material is created to be universally accessible prior to its availability online. The authors believe this standard should apply to all online materials created for higher education purposes. Consequently, the rubric was compiled from a variety of web accessibility and universal design best practice guides and related resources to assist librarians and others in this endeavor.

The aims of the study included:

- The creation of a rubric to test for accessibility of online resources which provides simpler evaluation criteria by co-locating important points of inspection;

- The evaluation of library subject guides (i.e. LibGuides) at a university that uses Springshare software tool LibGuides 2.0, to determine the accessibility of the online material provided within the LibGuides; and

- The identification of common accessibility mistakes and provision of suggestions to improve accessibility and create a basis for best practices in future design efforts.

A brief review of relevant literature is provided next and presents scholarly support for the authors' conducted study and created rubric. The remainder of this article includes:

a) The methodology section, which explains the theoretical underpinnings of the study, its research methods, and the rubric's creation;

b) The results section, which explains the study's findings and situates these findings in the broader concept of accessibility of online materials, and

c) The conclusion, which reflects on what was learned during and after the study by its authors and discusses future directions for research regarding universal accessibility design in online information materials.

Review of relevant literature

In 2001, the American Library Association (ALA) Council approved the Library Services for People with Disabilities Policy to improve library services to patrons with disabilities (ALA, Americans with Disabilities Act Assembly, 2001). This policy outlines the responsibility of libraries under U.S. disability legislation regarding services, facilities, collections, and other areas. It discusses technological considerations that would align with existing accessibility standards and best practices; therefore, this section will discuss applicable U.S. legislation, accessibility standards, and best practices which are relevant to the study described herein. In addition, it will outline existing studies testing the accessibility of higher education websites and how results of these studies have impacted change in this area.

U.S. legislation

Section 504 of the Rehabilitation Act of 1973 was crucial legislation regarding the civil rights of persons with disabilities in the United States. Unless an undue hardship to the institution would result from compliance, court rulings have enforced that higher education institutions that receive federal funding must provide reasonable accommodations for students with disabilities (deMaine, 2014). The ADA extends the coverage to private higher education institutions, as well.

Because these Acts were written before the modern Internet, they primarily focused on physical spaces (deMaine, 2014). To address the needs created by the Information Age, the Rehabilitation Act was amended in 1998 (Section 508) to cover website accessibility explicitly; however, it pertained to U.S. government websites only (deMaine, 2014). In part, the amendment was based on the WCAG 1.0 written in 1999 (deMaine, 2014). Due to its age, the original Section 508 was antiquated and could not deal with the realities of the modern web. In 2015, there was a Notice of Proposed Rulemaking (NPRM) to update the legislation and language regarding Section 508 (Proposed

Information and Communication Technology, 2015). The update was proposed based on the newer WCAG 2.0 standards because the criteria in Section 508 were covered by the WCAG 2.0. By 2018, the updated Section 508 will require government websites to comply with WCAG 2.0.'s level A and level AA accessibility criteria. Due to changing legislation, studies such as the one presented in this article are critical for those seeking to make online information resources accessible and legally compliant.

Standards, best practices, and concerns related to WCAG 2.0 application

The WCAG 2.0 is based on the principles that information should be perceivable, operable, understandable, and robust (W3C, 2008). The WCAG 2.0 has 12 guidelines containing anywhere from one to ten criteria within each guideline. These guidelines are not reliant on specific technology, thereby accounting for future web design technologies (W3C, 2008). Countries like Canada and Australia have used the WCAG 2.0 to evaluate all government websites (deMaine, 2014). Also, Web Accessibility in Mind (WebAIM), which is known for its expertise in accessibility assessment, uses the WCAG 2.0 and Section 508 of the U.S. Rehabilitation Act of 1973 as evaluation criteria (Web Accessibility in Mind, 2017).

Not everyone is convinced that the WCAG 2.0 adequately meets the needs of persons with disabilities, particularly as it pertains to end-user accessibility. Kelly et al. (2009) provide examples pertaining to WCAG 1.1.1, which requires providing a text alternative for non-textual content. The examples consist of visual advertisements and artwork, which would be part of the sensory exception that states "text alternatives at least provide descriptive identification of the non-text content" (W3C, 2008). Kelly et al. (2009) argue that there should be a 'user-focused approach' embedded in accessible design, especially in online classes, but do not describe how comparable accommodations would be provided for classes that are not online, which would essentially have the same problem. According to Kelly et al. (2009), the WCAG 2.0 is followed without a thought to the context of use by the end user.

However, if the guidelines are followed in this manner (i.e. without thinking about use by end users), the web author is not applying the criteria correctly from a broader accessibility perspective.

Power, Freire, Petrie, and Swallow (2012) conducted a usability test with 32 legally blind participants who ranged from totally blind to very little central vision. They found that 49.6% of the level A or AA compliant websites had accessibility problems. However, many of the errors stated in the Power study would be eliminated by following universal web design and writing best practices. Some of these errors are addressed in the level AAA criterion, such as complicated language (WCAG 3.1.3-3.1.5) and an unclear link destination (WCAG 2.4.9). It was not clear why particular websites passed in the Power study when WCAG error failures were readily apparent. However, Power et al. (2012) suggested disregarding the problem-based approach of the WCAG 2.0 for broader principles until further study of the web use of this demographic was conducted. The authors found the WCAG 2.0 did not cover everything as well, making the suggestion in the Power study somewhat heavy-handed. To overcome this gap in coverage, the rubric contains a criterion requiring web design best practice. Horton and Quesenbery (2014) created a framework based on the WCAG 2.0 criteria, Universal Design theory, and the Design Thinking process, acknowledging the importance of the WCAG 2.0 and using other concepts to account for the gaps. Several of the WCAG 2.0 level AAA criteria were mapped to their framework, including the examples given by Power et al. (2012).

Intersections between WCAG 2.0 and universal design

As shown above, although WCAG 2.0 places a heavy focus on a variety of web design elements, it does not always do so with all users in mind. Implementing web design that persons with and without disabilities could use would not only make sites equitable for all users, but it would also simplify maintenance for web administrators. Enter the inclusion of universal design theory with WCAG 2.0 principles in web design, as suggested by previous researchers and implemented in the rubric included in this study.

According to the Centre for Excellence in Universal Design (2014), universal design is a concept which requires designers to consider a wide variety of users throughout the design process. In theory, one creates web objects that can be used by everyone, in a variety of ways and for a variety of purposes. The principles of universal design align well with the accessibility principles and criteria provided in WCAG 2.0. The principles of universal design are equitable use, flexibility in use, simple and intuitive use, perceptible information, tolerance for error, low physical effort, and size and space for approach and use (Centre for Excellence in Universal Design, 2014).

When creating the rubric, the authors included criteria from both the WCAG 2.0 and web design best practice models (through the lens of universal design) toward consideration of all users of online information resources. Based on what they had learned by reviewing the current literature on the topic, the authors acknowledged that a web design which helps one user could be a barrier for another. Consequently, the rubric criteria establish a design process which promotes accessibility testing in conjunction with knowledge of the universal needs of users. When the end user is unknown, universal design principles, used in conjunction with WCAG 2.0 standards and web design best practices, can help make web content accessible to a wide range of users and consequently support a variety of needs.

Several conventions established by the WCAG 2.0 are effective for a mobile display supporting universal design. When using LibGuides, as many libraries do, the LibGuides are displayed as one column on mobile phones, so reading order (i.e. WCAG 1.3.2) becomes very important (Rosenthal, 2016). In the authors' study, some LibGuide creators provided sensory based instructions, such as "the directions are on the left," which violated WCAG 1.3.3 and was incorrect on a mobile phone. The criterion WCAG 1.4.4 requires that containers adjust their textual content when resized. Rosenthal (2016) found that a certain HTML class was needed for tables with many columns in LibGuides. If this class is not used, the table will overflow its container when using a mobile device (Rosenthal, 2016). As more students in higher education rely on mobile platforms as their primary information providers, it is essential

that display on multiple devices be considered within universal design and as a part of accessibility concerns when creating web content.

Rao (2013) found that many of the design mechanisms based on universal design were successful with students from vastly different cultures and primary languages. Particularly, Rao found that adult learners and students from rural and remote locations found information in multiple formats useful. Multiple formats, e.g. properly captioned video with a text alternative, as Rao created, would pass at least level A of the WCAG 2.0, providing access to students with disabilities as well. Poore-Pariseau (2013) and Rao (2013) found that a diverse group of students appreciated assignments when the students could choose the assignment's format. This practice supports different learning styles and enables students with disabilities to choose a format that best suits their needs.

Accessibility testing and evaluation

Studies have used a variety of samples for accessibility testing, where most were a sample of convenience. Comeaux and Schmetzke (2013) chose 56 universities that had the best library schools according to U.S. News and World Reports in 2001 to be used in their 10-year longitudinal study. The sample was dominated by large universities; therefore, the results would not necessarily be generalizable (Comeaux & Schmetzke, 2013). They examined the main library, the library school homepage, and the web pages contained in the homepage hyperlinks. Comeaux and Schmetzke (2013) claimed most studies up to 2001 tested the homepage only. According to Lazar and Greenridge (as cited in Comeaux & Schmetzke, 2013), the homepage is important as an entry point to the website to justify this practice. Homer and Parmanto (as cited in Comeaux & Schmetzke, 2013) found the homepage was not a measure of the accessibility of the website in its entirety. In 2007, Green and Huprich (2009) followed Comeaux and Schmetzke's lead by using the same sample methodology, where the only difference was choosing 12 sites instead of 56. Vojtech (2016) evaluated 114 websites of state and private universities and colleges in Slovakia and the Czech Republic.

Although Comeaux and Schmetzke (2013) discussed web accessibility policies for universities, a web accessibility policy does not guarantee adherence. The university and its employees must realize the importance of accessibility in expanding access to education, and make every effort to follow its own policies in this regard. One example of a university library accessibility policy provided by Comeaux and Schmetzke (2013) was Pennsylvania State University Libraries. Pennsylvania State University was sued for ADA violations, and the library was included in the complaint (Lush, 2015). Since then, Pennsylvania State University has created an updated accessibility policy and the library website became more accessible. Expanded training regarding online materials design helps authors of said materials comply with the new accessibility policy.

Despite the frequent replication of the Comeaux and Schmetzke (2013) study to assess accessibility in web design, the authors assert that randomly sampling pieces of the web 'whole' will not provide an accurate representation of elements related to accessibility within a website, per the standards listed in the WCAG 2.0. Additionally, it is worthwhile to note that some information would be invisible to researchers if they were not at an institution itself to see the information first-hand.

Some researchers appear to share this perspective. There are studies which have chosen to evaluate all the web pages of an organization, such as the 520 web pages at an unnamed university analyzed in a study by Solovieva and Bock (2014), all content within one online course through Coursera (Fadel, Kuntz, Ulbricht, and Batista, 2016), and the finding aids for online special collections at 68 public universities and colleges in the Association of Research Libraries (Southwell and Slater, 2013). In the authors' study, they were specifically seeking WCAG 2.0 compliance of the LibGuides at the institution selected as the study site, so the methodology in how they selected a sample differs. They chose to use quantitative random sampling methodology to select units of analysis for their study (i.e. individual LibGuides), due to the depth of the evaluation conducted through the use of the rubric, and to make the results

generalizable to other LibGuides at this institution and possibly LibGuides designed using LibGuides 2.0 at comparable institutions.

The authors note again here that increasing accessibility and addressing universal design concerns in online higher education materials is a global concern. However, it is the case that many U.S. higher education institutions are facing increased challenges to ensure ADA compliance in their online materials without an increase in funding. Consequently, the authors focused the majority of their efforts in this exploratory study on U.S. institutions for guidance and clarity in their own work. The authors intend to pursue global considerations related to his area of research and in regard to examining the ubiquity of the rubric at a later date.

More information regarding how the authors' study was conducted and the study's findings will be discussed in the Methodology section.

Methodology

After obtaining Level I (exempt) approval from the study institution's Institutional Review Board (IRB), the authors began their study by collecting study data in fall, 2015, testing randomly selected LibGuides against the rubric through spring, 2016, and conducting statistical analysis and producing findings through fall, 2016. Per IRB requirements, the LibGuides and their authors were assigned unique identifiers within the study for the purposes of confidentiality. Although the LibGuides are publicly accessible, their authors were asked permission to use their LibGuides in the study as a professional courtesy.

The study pool included LibGuides from both the main and branch campus of the study institution. At the time of the evaluation, the branch campus was beginning to implement their instance of LibGuides, so all eight LibGuides that existed at that time were analyzed. During the analysis of the branch campus guides, the authors found that the LibGuides template (hereinafter referred to as template) was used differently by the branch campus; therefore, a direct comparison could not be made. Therefore, the branch campus analysis was

excluded from the study. For the main campus, all existing LibGuides were included in the original population pool, except:

- those that contained hyperlinks to other LibGuides or external websites using linked assets alone;

- one-page LibGuides represented in multiple LibGuides;

- LibGuides developed for testing purposes;

- LibGuides created for internal library use; or

- community LibGuides equally edited by multiple authors.

Twenty percent of the main campus LibGuides were selected by random sampling. To eliminate bias, no more than 20% of a single author's LibGuides were selected. During the analysis, the authors found that one author's LibGuides skewed the results disproportionately, so those LibGuides were eliminated from the original population. A total of 18 LibGuides were randomly selected from the population pool and included in the LibGuide analysis for the main campus.

As explained previously in this article, the rubric was created to analyze the LibGuides for accessibility compliance. Most criteria are based on the WCAG 2.0, where many criteria require good coding practices. However, there are several web design best practices that are not included. A criterion was added to the rubric to address this need. Anderson et al. (2010)'s book suggested many of the web design best practices considered in this study. One criterion of Section 508 of the Rehabilitation Act of 1973, effective 2015-2016, was kept because the authors thought that this criterion was not completely covered by the WCAG 2.0 (i.e. §1194m). Since this criterion was eliminated when the rubric was updated in 2017, it is not discussed in the article.

The levels A (minimum accessibility), AA (improved accessibility), and AAA (optimum accessibility) in the rubric were provided by the WCAG 2.0. When there are not violations of web design best practice, the rubric criterion meets

level A. The original study rubric appears in the Appendix. A hyperlink to the up-to-date version appears in the Appendix as well. Software and web-based tools were needed to analyze some of the criteria. These included Audacity, Colour Contrast Analyzer, JAWS, and Photosensitive Epilepsy Analysis Tool (PEAT). The web-based tools used were the WAVE tool and the W3C Code validator. Some HTML source code was examined manually.

In February 2016, before independent review and analysis, the authors selected three main campus LibGuides to analyze together in a normative session to ensure equal application of the rubric. From February to May 2016, each author evaluated a unique portion of the main campus LibGuides sample. From June to August 2016, the authors reviewed the other's notes to confirm equal application of the rubric. In fall 2016, the data were coded to perform the statistical analysis and elicit findings.

The research questions proposed for the study are:

- What accessibility level do the sample LibGuides pass for each criterion?

- What common errors do sample guide authors make?

- How many criteria do the sample LibGuides typically fail?

- Are some guide authors making consistent errors, or are consistent errors the result of non-author controlled LibGuide elements, such as master design and layout?

The research questions will be addressed in the Results section.

Results

Template and LibGuides failures of the rubric

As stated earlier, the authors of this study were examining the sample LibGuides from two perspectives: 1) non-author controlled failures of rubric criteria (i.e. institutional template and software/LibGuide failures), and 2)

author-controlled failures of rubric criteria. Non-author controlled failures of rubric criteria are discussed next.

Non-author controlled elements are two-fold. First, the authors noted that some failure issues were based on problems inherent to LibGuides. Springshare, the software company which created and maintains LibGuides, has corrected some accessibility issues in a recent update to its software tools. However, these corrections were made after this study concluded, so results discussed herein are those which were germane at the time of the study. Secondary failure issues included template problems and common widgets that could be corrected by the web administrator at the study's institution.

Template failures

For a LibGuide to pass the rubric at minimum and improved accessibility (i.e. Level A and AA), criteria items within the sections Text Alternatives, Adaptable, Distinguishable, Keyboard Accessible, Navigable, Input Assistance, Predictable, and Compatible needed to be met. Based on the analysis, every LibGuide in the study failed more than 70% of the applicable criteria of the accessibility rubric due to template issues.

The **Text Alternatives** criterion in the rubric pertains to text alternatives for non-text elements. Particularly, there must be text describing all images clearly, and the template did not pass this criterion because there was imprecise text describing template images. Specifically, the 'alt' attribute of the image tag of the two logos in the template did not contain all the text in the logo; therefore, sighted users would receive more information than users with visual impairments.

Here follow specific examples regarding failures for the abovementioned criteria. First, the alt attribute of the library's logo in the template should be "The institution name, University Libraries" instead of "University Libraries." In the navigation, there was text beside the glyphicons (icon fonts) used. This practice is appropriate because glyphicons can be helpful for people with print disabilities, such as dyslexia (Cunningham, 2012). However, the glyphicons did

not match the text well, limiting their helpfulness. Second, an image can be attached to a link asset using LibGuides, which assigns the alt attribute to "thumbnail." If the alt attribute is not configurable, guide authors should be advised not to use this feature in LibGuides. There were LibGuides that failed the Text Alternative criterion due to this issue.

The template did not pass the **Adaptable** criterion primarily because of structural problems. First, the heading tags in the footer (the line or block of text appearing at the end of a web page) of the template were not structurally sound. The footer begins with the level six heading tag and the subsequent heading tags were level three. According to the W3C, the heading tags should begin at heading level one in the type of footer used in the template. In addition, it could not be programmatically determined whether the hyperlinks in the footer were dropdown menus. It is essential for blind and low vision users to be aware of this functionality.

Hyperlink formatting caused the template to fail the **Distinguishable** criterion. Through historical use, underlining text has become a convention for hyperlinks; however, it is not inappropriate to underline the hyperlink only when the mouse hovers over it or the hyperlink has focus. To use hyperlink text color only, the hover and focus conditions must be distinguishable from the normal text. The hyperlinks in the body of the template had the appropriate contrast (greater than 3:1) for this scheme. However, this was not the case for one of the navigations menus because the normal condition, white text with a dark blue background, did not have greater than 3:1 contrast with the hover condition, gold text with a dark blue background. This change in color would not be noticeable for individuals with certain types of color blindness.

Many colors failed the specified contrast for the improved accessibility level. The most important examples of contrast failures were the hyperlinks in the body of all LibGuides, which were blue text with a grey background color, and a font smaller than 18 points. In addition, all the level two headings were white text with a green background. Although proper contrast might appear as

improved accessibility for the **Distinguishable** criterion, it a crucial aspect of web design.

Another failure of the **Distinguishable** criterion of the rubric was that the breadcrumb trail occupies the same space as the navigation menu above it when the zoom was set to 200%. The navigation menu and the breadcrumb trail were difficult, if not impossible, to read.

A few items within the template were not accessible using the keyboard, so the template failed the **Keyboard Accessible** criterion. Often, guide authors used the title attribute to provide extra information about a hyperlink (otherwise known as a tooltip). However, the tooltip was not keyboard accessible. Amending code for the template could likely resolve this issue. Also, the LibGuides software uses a tooltip when the author selects the details about an asset to appear while the mouse hovers. Until Springshare makes this feature accessible, authors should be discouraged from its use in all cases except RSS feeds (made keyboard accessible in LibGuides 2.0 when the authors were writing this article). At the time this article was written, the other LibGuides "hover over" assets were not fixed.

The most significant failure of the **Navigable** criterion within the template was using the hyperlink text 'more' with the database assets. The purpose of this link was not obvious in context because it displayed a year when selected.

Additional footer issues outside of those discussed within the **Adaptable** criterion occurred. Specifically, because the footer headings were not descriptive, there was a failure of the **Navigable** criterion at the improved accessibility level. Additionally, it was not visually obvious when most items in the template itself had focus. Often, a thin, dashed black rectangle appeared. In some cases, the format of an element was consistent regarding focus by the keyboard or mouse pointer. In many of the navigation menus, hyperlink focus was not consistent. Some designers suggest consistency and others do not. Regardless, they all agree that focus must be distinct and this was not the case for the navigation menu, which had a dark blue background color. When using the keyboard for navigation, the focus was not visible whatsoever.

Within the study sample LibGuides, there were widgets commonly used by authors. Most of the time, no instructions or labels were provided for controls within the widget, particularly textboxes, which failed the **Input Assistance** criterion of the rubric. The missing labels caused the **Compatible** criterion of the rubric to fail as well. The administrator could provide uniform widgets regardless of their source (e.g. third party) that would help solve this problem. In addition, the Compatible criterion fails because there were many HTML errors that were exposed by using the W3C markup validation service. Template errors included, but were not limited to, obsolete attributes, attributes that contained white space when it was not permitted, and superfluous closing tags (i.e.). Multiple errors occurred when assessing other author-used widgets. Of the most concern was the finding that if more than one widget was used (third party or administrator created) on a web page, a duplicate ID caused a validation error.

The **Predictable** criterion did not pass because there were inconsistencies in hyperlink text and their URL within the template. For example, LibGuides names the landing page of the guide "home" by default and many guide authors do not change the name. At the study's institution, one of the navigation options in the template is "home," leading to the library's homepage. Guide authors should be advised to use more descriptive names for the default tab because "home" is ambiguous. The Interlibrary Loan link was called 'ILL' in the template header, and 'Interlibrary loan' in the secondary navigation, which caused failures in other criteria for optimum accessibility. The ILL hyperlink could be removed to solve both issues.

The **Web design best practice** criterion failed for many reasons. For example, the floating button that returns users to the top of the web page did not function when it appeared in the footer, and there were at least 26 broken URLs found throughout the template.

The template at the study's institution would not need to meet optimum accessibility as defined by the rubric; however, some criteria are essential important for accessibility. For example, all hyperlink text should describe the

hyperlink's meaning. Albeit optimum level criteria, this criterion should be met. Only the failures that should be corrected will be discussed next.

The **Readable** criterion of the rubric did not pass because of the template use of jargon, such as My Library and E-Reserves, without definition. Also, there are abbreviations that are not universally known. For example, some LibGuide users will not know the U.S. state abbreviations, particularly international students. State abbreviation should be replaced with the state name, which will improve screen reader pronunciation as well. Defining acronyms is required by the Readable criterion at this level. Future web design policy at the study's institution should provide a convention for authors regarding acronyms in reusable content to promote consistency.

The **Predictable** criterion did not pass because LibGuides launch new windows even when the user does not initiate it. LibGuides were configured such that all assets that were a hyperlink, such as databases or website links, launched in a new window without informing the user. This issue is particularly important for users with low or no vision. Either through policy or configuration, there should be a clear convention for guide authors when embedding hyperlinks into Rich Text/HTML, and this convention should be understood by the end user. For example, hyperlinks leading to the study institution's website open in the same window. Hyperlinks leading to external websites open in a new window and the user is informed about another window launching. Such solutions may cater to a wider variety of LibGuide users.

Most common non-template LibGuide rubric failures

Before beginning this section, it is worth noting that when each of the LibGuides in the study was evaluated using rubric criteria, the number of times a certain error was repeated in a LibGuide in the study was not counted. The number of unique errors was recorded only. Therefore, the total number of errors could be much more significant. The most common errors of the seven criteria that have over a 70% failure rate of minimum accessibility will be addressed in this discussion.

None of the LibGuide sample authors included labels or instructions for assets like textboxes, checkboxes, or other user input controls within their LibGuides; therefore, this common error fails the Input Assistance criterion. Since the screen reader would not read a label or instructions, screen reader users would not know what to do when they encountered the asset. Because there is a lack of visible textual instructions, it is possible that any user would be confused when encountering these assets. Not including a label accounted for half of the failures of the Compatible criterion, as well. Including a label would not completely solve the Compatible criterion problems, however, as code validation errors were the most common failure of the Compatible criterion. Figure 1 and Table 1 contain the most common errors of the Compatible criterion.

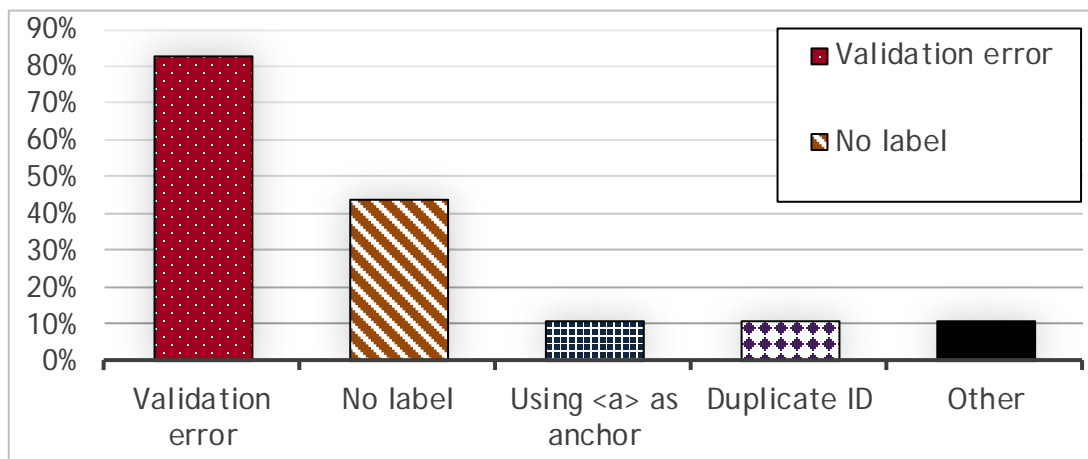*Figure 1. Compatible Criterion Failures*

Table 1. Compatible Criterion Failures

Reason for failure	Percentage of Applicable LibGuides
HTML code validation error	83%
Control element without a label	44%

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Reason for failure	Percentage of Applicable LibGuides
Using hyperlink tag (<a>) as an anchor	11%
Duplicate ID	11%
Other	11%

The most common error for the **Time-based Media** criterion was not providing a text or audio equivalent of time-based media content. If transcripts were included for this content, the LibGuides would pass this criterion. The content does not have to be an exact duplicate—it must only serve the same function. For example, if a student does not want to watch a video asset, providing a text alternative as informative as the video content that works with assistive technology is important. Designing content for a wide range of users is what makes content universally accessible.

There were many reasons that study LibGuides failed the **Adaptable** criterion. The most common error was using an HTML element to achieve a particular "look," rather than the purpose for which HTML is intended. The HTML element must be used for its intended purpose so it works correctly with assistive technology. For example, tables must contain tabular data. Using tables for layout is an archaic practice, made redundant 10 or more years ago, yet this was readily apparent in some of the study LibGuides. Figure 2 and Table 2 contain the most common errors of the **Adaptable** criterion.
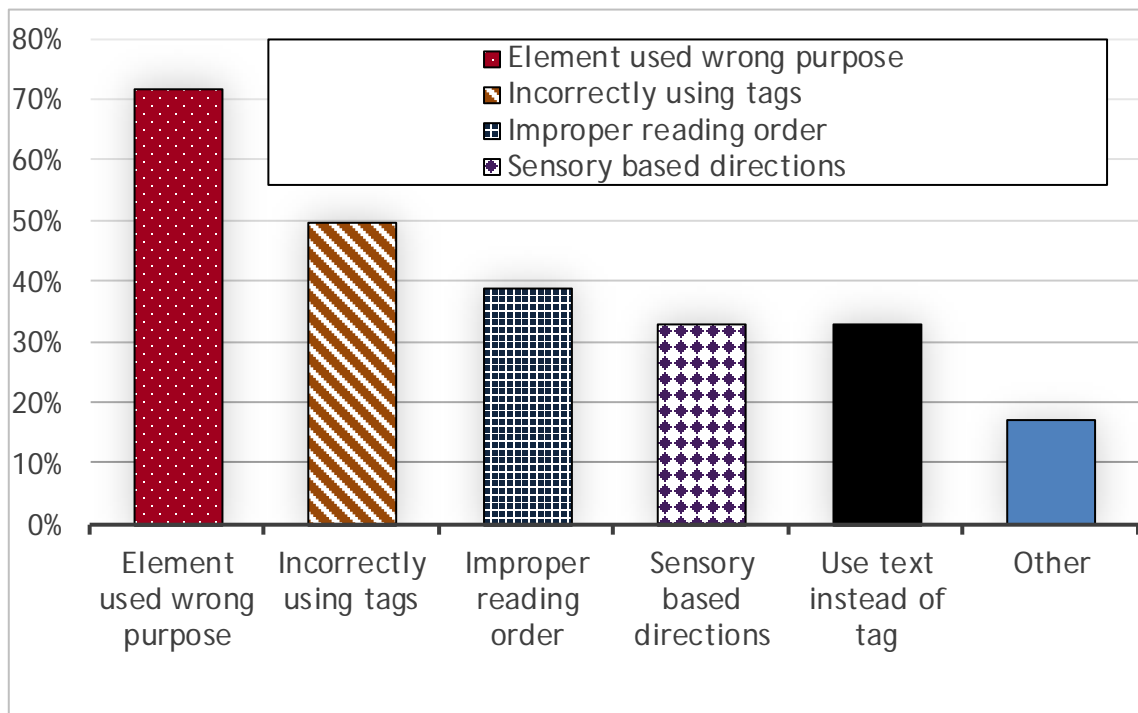
Figure 2. Adaptable Criterion Failures

Table 2. Adaptable Criterion Failures

Reason for failure	Percentage of Applicable LibGuides
Element is used for display purposes, not its function	72%
Incorrectly using tags	50%
Improper reading order	39%
Sensory based directions require sight	33%
Used text when a tag for should be used	33%
Other	17%

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Also, although some guide authors did not use the alt attribute for images, more LibGuides failed the Text Alternative criterion because the alternative text did not describe the function of the image well, if at all. Figure 3 and Table 3 contain the most common errors of the Text Alternative criterion.

The most common error for the Navigable criterion was providing a hyperlink that had no link text, which was surprising. The authors of this article postulate that this occurred when using the rich text editor because there is no functional purpose for a hyperlink that was invisible to the user. In addition, these hyperlinks were tab stops, so the hyperlink would receive focus when tabbing through the content. Because of this, when the user selected the enter key, it would lead the user to an unexpected location.

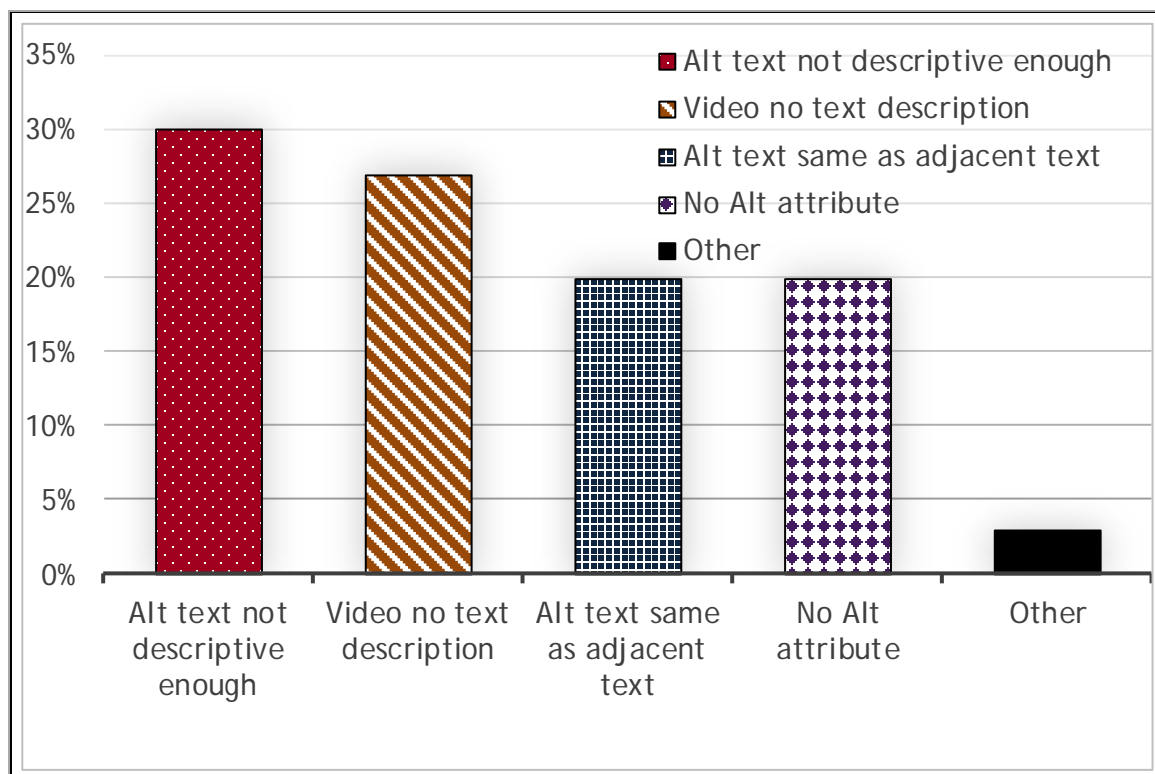*Figure 3. Text Alternative Criterion Failures*

Stitz, T., & Blundell, S. (2018). Evaluating the accessibility of online library guides at an academic library. Journal of Accessibility and Design for All, 8(1), 33-79. doi:http://dx.doi.org/10.17411/jacces.v8i1.145

Table 3. Text Alternative Criterion Failures

Reason for failure	Percentage of Applicable LibGuides
Alt text is not descriptive enough about the function of the image	30%
Video needs a text description	27%
Alt text is exactly the same as the text next to it	20%
Alt attribute is not used for image tag	20%
Other	3%

Every LibGuide failed some established **Web design best practice**. The most common error was improper HTML source code due to using the rich text editor. If the rich text editor is used, it is best practice to type directly wherever possible and to use the paste buttons in the rich text editor when pasting text. When copying from HTML, it is best to paste content as plain text, then use the rich text editor to apply formatting to the text. Formats in the rich text editor that do not cause many problems include headings, bold and italic. However, fonts, text sizes, and line spacing should never be used. Many strange HTML errors can occur when editing existing HTML content. Often, the rich text editor adds unnecessary non-breaking spaces, which can cause the text to overflow its container when a user resizes his or her screen, particularly on a mobile device. When using the rich text editor, it is possible that the tags surrounding a sentence are not deleted when the text is deleted, causing empty span and heading tags.

Another common error was underlining text that was not a hyperlink. Underlining text is a well-known convention for hyperlinks, so users might find

non-clickable underlined text confusing. Other errors included using broken URLs and fixed sizes for images and inline frames (or iframe, an HTML document embedded within another HTML document – such as the HTML to a YouTube video embedded within the LibGuide page's existing HTML).

Web design errors for the LibGuides were grouped into 16 unique web design errors. Essentially, most LibGuides within the study had five unique web design errors. Six LibGuides had less than four unique web design errors. Two LibGuides had more than double the most common number of unique web design errors with a value of 12. Table 4 contains the most common errors of the Web Design criterion.

Table 4. Web Design Criterion Failures

Reason for failure	Percentage of Applicable LibGuides
Bad coding due to the rich text editor	72%
Bad URLs	56%
Underlined text that isn't a hyperlink	50%
Images and/or iframes are a fixed size	50%
Typos	44%
Obsolete tags are used	44%
Adjacent hyperlinks go to the same URL	44%
Text doesn't work well with a screen reader	39%

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Reason for failure	Percentage of Applicable LibGuides
Hyperlink or heading text is the same as adjacent text	39%
Other	50%

Overall rubric compliance of the LibGuides (excluding the template)

There were rubric criteria where the LibGuides performed well. To illustrate, Table 5: Rubric Criteria for the Evaluated LibGuides by Level, show the number of LibGuides that pass the rubric criteria.

Table 5 provides specific detail on how many LibGuides did not pass, how many LibGuides passed for all three levels, and which classified as not applicable (N/A) for the criterion used for evaluation.

Table 5. Rubric Criteria for the Evaluated LibGuides by Level

Criterion	Does not Pass	Minimum Accessibility (Level A)	Improved Accessibility (Level AA)	Optimum Accessibility (Level AAA)	Criteria N/A
Text Alternative	15	3	N/A	N/A	0
Time-based Media	11	1	0	0	6
Adaptable	16	2	N/A	N/A	0
Distinguishable	3	11	2	2	0

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Criterion	Does not Pass	Minimum Accessibility (Level A)	Improved Accessibility (Level AA)	Optimum Accessibility (Level AAA)	Criteria N/A
Keyboard Accessible	5	10	N/A	3	0
Enough Time	0	0	N/A	18	0
Seizures	4	5	N/A	3	6
Navigable	13	2	3	0	0
Readable	0	0	14	4	0
Predictable	0	7	10	1	0
Input Assistance	8	0	0	0	10
Compatible	16	2	N/A	N/A	0
Usable	6	7*	N/A	N/A	5
Web Design	18	0	N/A	N/A	0

* Would not pass for older Internet Browsers

As seen Table 5, the LibGuides performed well for the criteria: **Distinguishable**, **Keyboard Accessible**, **Enough Time**, **Readable**, and **Predictable**. Most of the items within the **Distinguishable** criterion pertained to the formatting of text and use of color. Many LibGuides contained color that was supplied by the template only; thus, did not use color in their LibGuides.

The three failures of minimum accessibility were due to using color alone to convey meaning. Specific details regarding compliance with each criterion for the LibGuides in the study are provided below.

Eleven LibGuides had minimum accessibility regarding the **Distinguishable** criterion and lacked improved accessibility for many reasons. One common reason was that the inline CSS specified either a foreground or background color without specifying the other. In several cases, a contrast problem was observed. Another common reason was the use of images containing important text. Often in the evaluation, it was due to using screenshots instead of typing important text. Text should be presented as text whenever possible.

In general, images should be used in moderation. An important aspect of equitable access to web content is finding a compromise between many user groups. For example, images can be helpful to those with dyslexia; however, too many images are distracting to someone with attention deficit disorder (Cunningham, 2012). When images containing vital information without a textual description are used, the images are not accessible to multiple groups. Users with dyslexia might not be able to read the text in the image and cannot use their own CSS to amend this (Cunningham, 2012). Blind or low vision users will miss the information in the image entirely. When evaluating this criterion, the authors found two LibGuides had improved accessibility and two had optimum accessibility.

Ten LibGuides had minimum accessibility for the **Keyboard Accessible** criterion. Three LibGuides had optimum accessibility because the other LibGuides used the title attribute in one or more hyperlinks. Five LibGuides did not pass this criterion because the guide authors configured an asset in a way that was not keyboard accessible. There was no AA level or improved accessibility when assessing this criterion.

None of the functions of the LibGuides were time-dependent; therefore, all 18 LibGuides had optimum accessibility for the **Enough Time** criterion.

Fourteen LibGuides had improved accessibility for the **Readable** criterion. All LibGuides that were written in English only will pass this level because the template indicated the language. These LibGuides failed optimum accessibility for a variety of reasons. The most common reason was there were acronyms used throughout the LibGuides that were not defined. Four LibGuides had optimum accessibility for this criterion.

Seven LibGuides had minimum accessibility for the **Predictable** criterion. The most common reason for failing improved accessibility was inconsistent hyperlink text leading to the same URL. Ten LibGuides had improved accessibility and one LibGuide had optimum accessibility within this criterion.

The number of criterion that the LibGuides failed was plotted as a histogram (Figure 4. Number of Failed Rubric Criteria for the LibGuides). The mode and median of the data were 7 and the mean is 6.39 (SD = 1.92).

Figure 4. Number of Failed Rubric Criteria for the LibGuides
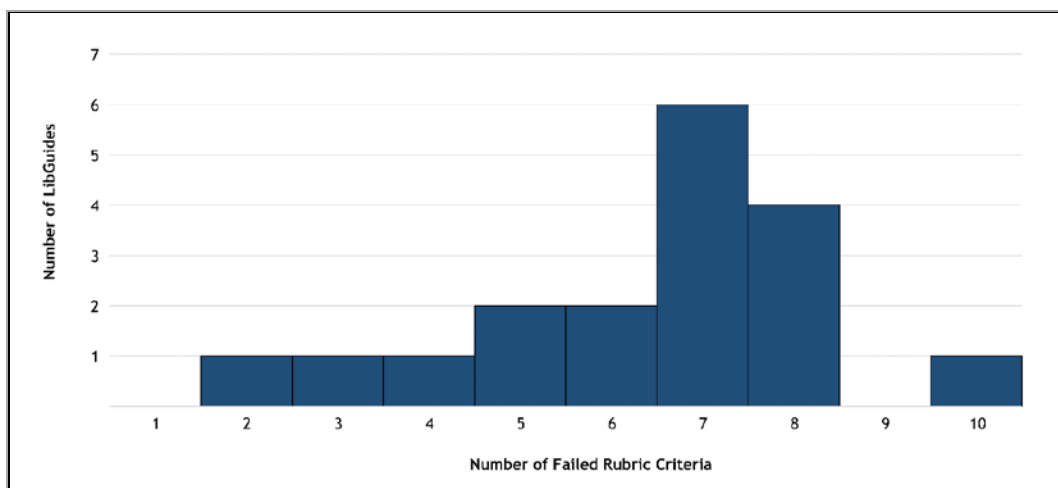
Most LibGuides failed seven rubric criteria (six LibGuides). Four LibGuides failed eight criteria. Two LibGuides failed five and two LibGuides failed six criteria. One LibGuide failed two, three, four, and 10 criteria, respectively.

The number of rubric criteria failures with respect to author did not lead to any statistically significant pattern when plotted within a histogram. There could be a vast difference in the number of errors made. Some authors created LibGuides that were short and simple, while other authors created

LibGuides that contained audiovisual content and were more complex. The authors speculate that short and simple LibGuides will have little to no errors introduced by the author.

Consider a LibGuide that contains assets that pass the rubric criteria and little or no HTML content supplied by the author. Any embedded HTML they provided had no formatting. If there were no images, videos, or text formatting, five rubric criteria and much of the **Distinguishable** criterion were not applicable. These LibGuides might be accessible to many groups; however, they might not be accessible to users with textual disabilities, like dyslexia, when these users could not use a screen reader. These LibGuides would also not cater to user preferences for audiovisual material, which could lead to the LibGuides not being used. It would be terribly boring if all LibGuides were absent of images, videos, or text formatting. The authors believe it is pertinent to point out that among the LibGuides, there was some sharing of content among guide authors within different LibGuides. Consequently, an error in a piece of content in one LibGuide can be propagated through the LibGuides of different authors reusing this content, and this could have contributed to the variability of the number of rubric failures for the authors as well.

General comments

In this study, the LibGuides usually passed minimum accessibility for the **Distinguishable** and **Seizure** criteria. The **Readable** and **Predictable** criteria usually passed improved accessibility and the **Enough Time** criterion usually passed optimal accessibility. The majority of LibGuides did not pass the remaining criteria.

Many of the common errors are those that are crucial to fix from both an accessibility compliance and a universal design theory perspective. For example, providing alternative textual content remains an issue for images. For more than a decade, it has been widely known that textual content must be in the alt attribute of the image tag or in the HTML text near the image

(Southwell & Slater, 2013). This error is not isolated to this study because it was mentioned in other studies discussed in this article. The text descriptions for images must contain the purpose of the image experience, which cannot be detected by automatic means. It requires human intervention.

Text descriptions and text alternatives must be provided for all multimedia content as well. Creating this content will take more time, but it will improve the educational material for all users (Poore-Pariseau, 2013; Rao, 2013). A common error was to embed text in an image when CSS could have been used instead. If library guide users must know the meaning of a textual phrase, sentence, or paragraph, it should be rendered as text. Using CSS would make the text accessible.

Proper HTML code is essential. Many errors related to this theme were found in the LibGuides. If the rich text editor is used, it must be used with an awareness of what is happening to the HTML in the background. Without such awareness, web design best practice and **Compatible** criteria will fail. Using the advanced formatting options in the rich text editor will cause **Adaptable** and **Distinguishable** criteria to fail as well. Although it is vital to use tags properly so that screen readers can interpret them correctly, improper use of HTML, including not using tags for their intended purpose, is a common error. The **Compatible** and **User Input** criteria require at least labels for user control inputs, which are extremely important to users with visual disabilities. The textual instructions described by the User Input criterion are important to everyone, yet the label error was found as a common error in this study and in much of the literature discussed.

Headings and hyperlink construction are very important to screen readers because users skim web pages using these elements (Southwell & Slater, 2013). Common errors included non-descriptive headings, missing hyperlink text, and inconsistent hyperlink text. Albeit an optimum accessibility requirement, the purpose of the hyperlink should be contained in the text due to how it functions in tandem with assistive technology.

Content must be written such that instructions do not require specific senses to understand (e.g. sight). Content must also be written and arranged with knowledge of the reading order of screen reading software. A LibGuide will have a completely different arrangement based on zoom, resolution and device (e.g. mobile). A screen reader will read content in this order, so reading order is important for this reason, as well.

Conclusions based on study findings and future work appear next.

Conclusion

As stated at the beginning of this article, the rubric was created based on the authors' desire to create a comprehensive resource for evaluating their online information materials' adherence to ADA requirements and universal design best practices. As explained, the rubric brought together standards and guidelines from the WCAG 2.0, Section 508 of the Rehabilitation Act of 1973, and web design best practices.

Based on the depth of detail regarding the rubric's creation made available in this article, the above-described study where the rubric was applied, the results and recommendations put forth at the study's conclusion, and the appropriate revisions made to the rubric post-study; the authors will pursue further testing with the rubric. This will include asking heterogeneous groups of users to apply the rubric to library guides outside of this study to ensure that this rubric can be used as a standalone resource when evaluating the compliance of online content with ADA/accessibility requirements.

Although the authors believe strongly in the need for ADA-compliant online information resources, they also believe and have experienced firsthand that sometimes supreme accessibility compliance in online design conflicts with universal design practices. To that end, the authors recommend that designers should ensure first that minimum and improved accessibility requirements (Level A and AA) are maintained, and that they weigh universal design considerations with increasing accessibility considerations as they advance to

AAA criteria. For example, creating material that complies with Level A and AA criteria requirements for people with visual disabilities and impairments is critical for online information resources. However, creating a universal information resource that can be used by everyone will deliver equitable content to all users and simplify content maintenance for the designer. Consequently, when using the rubric to evaluate one's online materials, each criterion and its associated compliance levels should be used to evaluate the resource with universal design in mind, as well.

As seen throughout this article, a common theme in the literature and espoused by the authors of this study is that academic libraries must do more to improve the accessibility of their web content. During the writing of this article, Springshare (the software platform of which LibGuides is a tool) began fixing the accessibility errors in LibGuides 2.0 – the version used by the authors of the LibGuides included in the study. In time, the authors hope that all LibGuides' accessibility barriers will be addressed and corrected by Springshare. However, it is worth noting that even if all barriers to accessibility are removed by Springshare within LibGuides, web administrators and guide authors must still endeavor to create content with accessibility and universal design in mind.

Building accessibility in from the start is much easier than remediation. Lush (2015) had to hire new staff and contractors, as well as work on a project under much pressure in a short period of time, to bring his institution's online resources into compliance. Aside from the web page content, Lush (2015) mentioned there were more than 25,000 assets, so remediation was not a small task. In addition, they had to develop a completely new workflow and accept added responsibility and cost.

As evidenced through the lessons learned by the authors during their study and shared within this article, and in the information shared by Lush (2015) and from many others invested in the accessibility of online materials: creators and designers of online information resources should make accessibility and universal design a part of the construction process whenever possible.

Accessibility of online information resources is critically tied to information accessibility, particularly within higher education. Therefore, the creation and design of these resources must treat accessibility and universal design as critical, too, from prototype to product and beyond.

Future work

In the short term, the authors plan to use the results of the study to assist librarians at the study's institution in bringing their LibGuides into compliance. After making corrections to the LibGuides, usability testing will be performed with a heterogeneous sample of users, including students with various disabilities, to identify barriers that still exist. It should be investigated if the current LibGuides provide hyperlinks to inaccessible material. The remainder of the library's web pages should be tested for accessibility using the rubric, as well.

In the long term, the authors plan to continue their investigation into universal design efforts that expand information accessibility for a wide variety of user types and preferences, not only for U.S. higher education institutions but toward expanding global higher education access, as well. For information to be ubiquitous it must be universally designed, therefore this continued investigation is paramount to the utility of online resources serving an increasingly diverse higher education population. It is the hope of the authors that the rubric discussed in this article will be used by all those creating online materials in higher education frequently, and that it will encourage continued conversations in academia about the universal accessibility of online education and information materials.

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Services and their colleagues at the study's institution for their feedback as this project progressed. They would also like to thank those who labor tirelessly to ensure that information is made free and freely accessible to people from all walks of life, at all levels of accessibility, whenever possible.

References

[1] Altbach, P. G., Reisberg, L., and Rumbley, L. E. (2009). Trends in global higher education: Tracking an academic revolution (report prepared for the UNESCO 2009 World Conference on Higher Education). Retrieved from http://www.cep.edu.rs/public/Altbach,_Reisberg,_Rumbley_Tracking_an_Academic_Revolution,_UNESCO_2009.pdf

[2] American Library Association, Americans with Disabilities Act Assembly. (2001). Library services for people with disabilities policy. Retrieved from http://www.ala.org/ascla/resources/libraryservices

[3] Anderson, E., DeBold, V., Featherstone, D., Gunther, L., Jacobs, D., Jensen-Inman, L., ... Walter, A. (2010). Interact with web standards: A holistic approach to web design. Berkeley, CA: New Riders.

[4] Caldwell, R. (2006). Web accessibility, e-learning, and academic libraries. International Journal of Public Information Systems, 2006, 1-9. Retrieved from http://www.diva-portal.org/smash/get/diva2:389637/FULLTEXT01.pdf

[5] Carlson, L. L. (2017). Higher ed accessibility lawsuits, complaints, and settlements. Retrieved from http://www.d.umn.edu/~lcarlson/atteam/lawsuits.html

[6] Centre for Excellence in Universal Design. (2014). The 7 principles. Retrieved from http://universaldesign.ie/What-is-Universal-Design/The-7-Principles/

[7] Comeaux, D., & Schmetzke, A. (2013). Accessibility of academic library web sites in North America. Library Hi Tech, 31, 8-33. DOI: 10.1108/07378831311303903

[8] Cunningham, K. (2012). Accessibility handbook. Sebastopol, CA: O'Reilly.

[9] DeMaine, S. D. (2014). From disability to usability in online instruction. Law Library Journal, 106, 531–562. DOI:10.2139/ssrn.2428420

[10]   Educause. (2017). Badging. Retrieved from
https://www.educause.edu/badging

[11]   Fadel, L. M., Kuntz, V. H., Ulbricht, V. R., & Batista, C. R. (2016). Information and universal design in online courses. In A. Marcus (Ed.), Design, user experience, and usability: Technological contexts (Vol. 9747, pp. 167-177). Basel, Switzerland: Springer. DOI: 10.1007/978-3-319-40355-7_16

[12]   Green, R. A., & Huprich, J. (2009). Web accessibility and accessibility instruction. Journal of Access Services, 6, 116–136. DOI: 10.1080/15367960802247825

[13]   Horton, S., & Quesenbery, W. (2013). A web for everyone: Designing accessible user experiences. Brooklyn, NY: Rosenfeld Media.

[14]   Information and Communication Technology (ICT) Standards and Guidelines, 82 Fed. Reg. 5790 (January 18, 2017) (to be codified at 36 C.F.R. pts. 1193, & 1194).

[15]   Kelly, B., Sloan, D. Brown, S., Seale, J., Lauke, P., Ball, S., & Smith, S. (2009). Accessibility 2.0: Next steps for web accessibility. Journal of Access Services, 6, 265-294. DOI: 10.1080/15367960802301028

[16]   Lush, B. (2015). Managing accessible library web content. In B. Wentz, P. T. Jaeger, & J. C. Bertot (Eds.), Accessibility for persons with disabilities and the inclusive future of libraries (Vol. 40, pp. 169–189). Bingley, UK: Emerald Group Publishing Limited. DOI: 10.1108/S0065-283020150000040017

[17]   Power, C., Freire, A. P., Petrie, H., & Swallow, D. (2012). Guidelines are only half of the story: Accessibility problems encountered by blind users on the web. In proceedings of the SIGCHI conference on human factors in computing systems (pp. 433-442). New York: Association for Computing Machinery. DOI: 10.1145/2207676.2207736

[18]   Poore-Pariseau, C. (2013). Universal Design in assessments. In S. Burgstahler (Ed.), Universal design in higher education: Promising practices. Seattle: DO-IT, University of Washington. Retrieved from www.uw.edu/doit/UDHE-promising-practices/ud_assessments.html

[19]   Raue, K., Lewis, L., & Coopersmith, J. (2011). Students with disabilities at degree-granting postsecondary institutions. U.S. Department of Education, National Center for Education Statistics, 2011 (NCES 2011-018). Retrieved from https://nces.ed.gov/pubs2011/2011018.pdf

[20]   Rao, K. (2013). Universal instructional design of online courses: Strategies to support non-traditional learners in postsecondary environments. In S. Burgstahler (Ed.), Universal design in higher education: Promising practices. Seattle: DO-IT, University of Washington. Retrieved from www.uw.edu/doit/UDHEpromising-practices/uid_online.html

[21]   Rosenthal, D. (2016, April 28). Are your LibGuides 2.0 (images, tables, & videos) mobile friendly? Maybe not, and here's what you can do about it. Retrieved from http://acrl.ala.org/techconnect/post/are-your-libguides-2-0-images-tables-videos-mobile-friendly-maybe-not-and-heres-what-you-can-do-about-it

[22]   Seale, J. K. (2014). E-learning and disability in higher education (2nd ed.). New York, NY: Routledge.

[23]   Solovieva, T. I., & Bock, J. M. (2014). Monitoring for accessibility and university web sites: Meeting the needs of people with disabilities. Journal of Postsecondary Education and Disability, 27, 113-127. Retrieved from http://www.ahead.org/publications/jped

[24]   Southwell, K. L., & Slater, J. (2013). An evaluation of finding aid accessibility for screen readers. Information Technology and Libraries, 32(3), 34-46. DOI: 10.6017/ital.v32i3.3423

[25]   U.S. Department of Education. (2014a). U.S. Education Department reaches agreement with Youngstown State University to ensure equal access to its web sites for individuals with disabilities [Press release]. Retrieved from http://www.ed.gov/news/press-releases/us-education-department-reaches-agreement-youngstown-state-university-ensure-equ

[26]   U.S. Department of Education. (2014b). University of Cincinnati, U.S. Education Department reach agreement to ensure equal access to UC's web sites for individuals with disabilities [Press release]. Retrieved from http://www.ed.gov/news/press-releases/university-cincinnati-us-education-department-reach-agreement-ensure-equal-acces

[27]   U.S. Department of Education, National Center for Education Statistics. (2016). Fast facts: Students with disabilities. Digest of Education Statistics, 2014 (NCES 2016-006). Retrieved from https://nces.ed.gov/fastfacts/display.asp?id=60

[28]   U.S. Department of Education, National Center for Education Statistics. (2014a). Table 311.10: Number and percentage distribution of students

enrolled in postsecondary institutions, by level, disability status, and selected student characteristics: 2007-08 and 2011-12. In U.S. Department of Education, National Center for Education Statistics (Ed.), Digest of Education Statistics. Retrieved from http://nces.ed.gov/programs/digest/d14/tables/dt14_311.10.asp

[29] U.S. Department of Education, National Center for Education Statistics. (2014b). Table 311.22: Number and percentage of undergraduate students taking distance education or online classes and degree programs, by selected characteristics: Selected years, 2003-04 through 2011-12. In U.S. Department of Education, National Center for Education Statistics (Ed.), Digest of Education Statistics. Retrieved from http://nces.ed.gov/programs/digest/d15/tables/dt15_311.22.asp

[30] U.S. Department of Justice. (2016). Miami University agrees to overhaul critical technologies to settle disabilities discrimination lawsuit [Press release]. Retrieved from http://www.justice.gov/opa/pr/miami-university-agrees-overhaul-critical-technologies-settle-disability-discrimination

[31] Vojtech, R. (2016). Digital barriers in educating students with visual impairment. Procedia - Social and Behavioral Sciences, 217, 935-940. DOI: 10.1016/j.sbspro.2016.02.058

[32] Web Accessibility In Mind. (2017). WebAIM: Site evaluation and reporting. Retrieved from http://webaim.org/services/evaluation/

[33] World Wide Web Consortium. (2016). Web content accessibility guidelines (WCAG) 2.0 – Understanding conformance requirements. Retrieved from https://www.w3.org/TR/UNDERSTANDING-WCAG20/conformance.html

[34] World Wide Web Consortium. (2008). Web content accessibility guidelines (WCAG) 2.0. Retrieved from http://www.w3.org/TR/WCAG20/

Appendix

The rubric is based on the Web Content Accessibility Guidelines (WCAG) 2.0, the U.S. 508 Standard of the Rehabilitation Act of 1973 as effective at the time of the study 2015-2016, and web design best practices. Most of the web design best practices suggested within the rubric are from Anderson et al. (2010).

At the time of writing this article, the rubric has been updated to use the Information and Communication Technology (ICT) Standards and Guidelines, Appendix C to Part 1194 (Section 508 of the Rehabilitation Act of 1973) – Functional Performance Criteria and Technical requirements, Chapter 3: Functional Performance Criteria (2017, p. 5837). The updated rubric also complies with Appendix A to Part 1194, Section 508 of the Rehabilitation Act: Application and Scoping Requirement, E207.2 WCAG Conformance: "User interface components and the content of platforms and applications shall conform to Level A and Level AA Success Criteria and Conformance Requirements in WCAG 2.0" (2017, p. 5835). A living version of the rubric can be found at http://adarubric.pbworks.com/ .

Table 6. Study-implemented Accessibility Rubric

Criteria	Optimum Accessibility (Level AAA)	Improved Accessibility (Level AA)	Minimum Accessibility (Level A)	Does not Pass
1. Text Alternatives: Provide for non-text content within web pages so content can be changed into other forms that people need (1.1.1).	N/A	N/A	1) All non-text content has text alternatives except for the specific conditions in WCAG 2.0 Criteria 1.1.1.	All non-text content doesn't have text alternatives except for the specific conditions in WCAG 2.0 Criteria 1.1.1.
2. Time-based Media: Provide various accessible alternatives (1.2.1-1.2.9).	1) All pre-recorded audio in synchronized media has sign language (1.2.6). 2) All pre-recorded video in synchronized media provides extended audio descriptions when needed (1.2.7). 3) All pre-recorded media have a text alternative (1.2.8). 4) All live audio-only uses a caption service (1.2.9).	1) All live audio in synchronized media have captions (1.2.4). 2) All pre-recorded video in synchronized media have audio descriptions when needed (1.2.5).	1) All pre-recorded media have an alternative content format (1.2.1, 1.2.3). 2) All pre-recorded audio in synchronized media have captions (1.2.2).	All content doesn't meet level A.
3. Adaptable: Create	N/A	N/A	1) All content preserves structure and	All content

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Criteria	Optimum Accessibility (Level AAA)	Improved Accessibility (Level AA)	Minimum Accessibility (Level A)	Does not Pass
content that can be presented in different ways (1.3.1-1.3.3).			relationships regardless of presentation (1.3.1). 2) All content has a logical reading order, which is preserved regardless of presentation. (1.3.2). 3) All instructions don't require use of the senses alone (1.3.3).	doesn't meet level A.
4. Distinguishable: Easier for users to see and hear content (1.4.1-1.4.9).	1) All text and images of text have a contrast ratio of at least 7:1 except for the specific conditions in WCAG 2.0 Criteria 1.4.6. 2) All pre-recorded audio speeches have at least 20 dB between the speech and background audio or the ability to turn the background audio off (1.4.7). 3) All blocks of text are formatted to meet the five conditions in WCAG 2.0 Criteria 1.4.8. 4) Use text instead of an image unless it is pure decoration or essential, such as a logo (1.4.9).	1) All text and images of text have a contrast ratio of at least 4.5:1 except for the specific conditions in WCAG 2.0 Criteria 1.4.3. 2) All text, excluding captions and images of text, can be resized up to 200% with equal content quality without using assistive technologies. 3) Use text instead of an image when possible except for the specific conditions in WCAG 2.0 Criteria 1.4.5.	1) No content uses color alone to distinguish an element (1.4.1). 2) No audio plays longer than three seconds automatically without the typical user controls being provided for it (1.4.2).	All content doesn't meet level A.
5. Keyboard Accessible: All functionality	1) All functionality is keyboard accessible and doesn't trap focus without exception (2.1.3).	N/A	1) All functionality is keyboard accessible except for the specific	All content doesn't meet

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Criteria	Optimum Accessibility (Level AAA)	Improved Accessibility (Level AA)	Minimum Accessibility (Level A)	Does not Pass
available from a keyboard (2.1.1-2.1.3).			conditions in WCAG 2.0 Criteria 2.1.1. 2) No keyboard trap. If there is a need to use non-standard keys to move focus, the user is notified (1.2.2).	level A.
6. Enough Time: To read and use content (2.2.1-2.2.5).	1) Timing isn't essential except in the case of non-interactive synchronized media and real-time events (2.2.3). 2) All interruptions can be postponed except in emergency situations (2.2.4). 3) Likely, authentication isn't necessary for LibGuides, so WCAG 2.0 Criteria 2.2.5. isn't applicable.	N/A	1) Likely there aren't time limits, so WCAG 2.0 Criteria 2.2.1. isn't applicable. 2) Users can pause, stop, or hide all non-essential content that blinks, moves, or scrolls for more than five seconds, or updates automatically unless the user can control the frequency of the update (2.2.2).	All content doesn't meet level A.
7. Seizures: Don't design content known to cause seizures (2.3.1-2.3.2).	1) Doesn't contain anything that flashes more than three times a second (2.3.2).	N/A	1) Doesn't contain anything that flashes more than three times a second or falls below the general and red flash thresholds (2.3.1).	Contains items that flash more than three times a second and doesn't fall below the general and red

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Criteria	Optimum Accessibility (Level AAA)	Improved Accessibility (Level AA)	Minimum Accessibility (Level A)	Does not Pass
				flash thresholds.
8. Navigable: Ways to help users navigate, find content, and determine where they are on each web page, are provided (2.4.1-2.4.10).	1) Users are provided with information about their location within the website, such as the provision of a breadcrumb trail (2.4.8). 2) The purpose of all links can be determined by its text alone (2.4.9). 3) All content is organized by section headings (2.4.10).	1) Multiple ways to locate web pages are provided except when each page represents a step in a process (2.4.5). 2) Headings and labels describe their content or purpose (2.4.6). 3) There is a visual cue that indicates a component has focus (2.4.7).	1) Can skip blocks of repetitive content on multiple web pages (2.4.1). 2) Web page titles describe their purpose (2.4.2). 3) Components receive focus in an order that preserves their meaning (2.4.3). 4) Hyperlink purpose can be determined from the link text in context (2.4.4).	All content doesn't meet level A.
9. Readable: Text content is readable and understandable (3.1.1–3.1.6)	1) All specialized words are defined. If none, not applicable (3.1.3). 2) All acronyms are defined. If none, not applicable (3.1.4). 3) All content is available in a secondary education reading level (3.1.5). 4) A mechanism to pronounce words is available	1) All content that differs from the default language is indicated except for the specific conditions in WCAG 2.0 Criteria 3.1.2.	1) All Web pages have a default human language (3.1.1).	All web pages don't have a default human language.

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Criteria	Optimum Accessibility (Level AAA)	Improved Accessibility (Level AA)	Minimum Accessibility (Level A)	Does not Pass
	when it is needed for meaning (3.1.6).			
10. Predictable: web pages appear and operate predictably (3.2.1-3.2.5).	1) Any change of context is user initiated only or they can turn the feature off (3.2.5).	1) Navigation that appears on multiple web pages occurs in the same relative order unless the user changes it (3.2.3). 2) All components with the same functionality are consistently identified (3.2.4).	1) No presented content changes the context automatically when it receives focus (3.2.1). 2) Context doesn't change automatically when the user changes settings, unless they are advised prior to changing it (3.2.2).	All content doesn't meet level A.
11. Input Assistance: Users are provided with assistance to avoid and correct mistakes (3.3.1–3.3.6).	1) Context-sensitive help is provided (3.3.5). 2) Likely, web forms aren't on course or subject LibGuides, so WCAG 2.0 Criteria 3.3.6. isn't applicable	1) User input suggestions to correct the error are described unless it would jeopardize security or purpose of content (3.3.3). 2) Legal and financial data wouldn't be entered on course or subject LibGuides, so WCAG 2.0 Criteria 3.3.4 isn't applicable.	1) All user input errors are described and identified (3.3.1). 2) All user input controls have labels or instructions (3.3.2).	All content doesn't meet level A.
12. Compatible: With current and future user agents, including assistive technologies	N/A	N/A	1) No code validation errors (4.1.1). 2) All user interface components have names, roles, and are available to user agents (4.1.2).	All content doesn't meet level A.

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Criteria	Optimum Accessibility (Level AAA)	Improved Accessibility (Level AA)	Minimum Accessibility (Level A)	Does not Pass
(4.1.1–4.1.2).				
13. Usable: Provide a hyperlink to software required to interpret content (§1194.21m)	N/A	N/A	There are hyperlinks to software the web page user needs	Missing hyperlinks
14. Web Design Best Practices	N/A	N/A	The guide conforms to web design best practices	The guide does not conform to web design best practices

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