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Surveilling the Web, Mobile, and Language Accessibility of Communication's Digital Presence Within Institutions of Higher Education Globally

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Abstract: This study aims to understand the general web accessibility of digital information networks which may serve as barriers for access to the global discipline of Communication through institutional and departmental websites, specifically for persons with disabilities and those with limited English proficiency (LEP). Our exploratory content analysis relies on computer-aided software to systematically analyze the departmental home pages of websites of institutional members of the International Communication Association (ICA), $N = 77$, representing 26 countries, globally. Findings from this study help us to: (1) better understand the general web, language, and mobile accessibility of discipline-related online information; (2) identify strengths and opportunities for improvement; and, (3) to reflect upon the anticipated barriers impacting persons with disabilities when accessing higher education information online.

Introduction

Scholars have sought to better understand and improve digital access. Web accessibility, an attribute of the digital presence of an organization, has been studied across many domains and contexts, including

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private businesses (Burks, 2013; Gonçalves et al., 2013), public governmental institutions (Goodwin et al., 2011; Hong et al., 2008; Shi, 2006), and institutions of higher education (Caravajal et al., 2018; Hackett & Parmanto, 2005; Harper & DeWaters, 2008). And yet, too often, persons with disabilities continue to experience a "digital divide" (Duplaga, 2017)—a gap between digital resources for people with disabilities and people without disabilities. In 2013, the National Communication Association (NCA) reaffirmed its position on the digital divide by urging for the development of accessible communication technologies, which are widely available and operable by diverse users globally. NCA's position further advocates for active scholarship that highlights the access, usability, and empowerment issues related to the digital divide (NCA, 2013). Such is the nature of this study. Amplified calls for scholarly attention to issues of diversity, equity, and inclusion involves investigating matters which serve as barriers and limitations, in this case digital environments, for persons with disabilities, including the four types of disabilities (visual, auditory, cognitive, and motor) identified by the Centers for Disease Control and Prevention (CDC) (2018) as especially relevant to web accessibility (Bradbard & Peters, 2010).

Existing efforts in higher education are helping to close the digital divide, including a variety of assistive and adaptive tools. The term *assistive technology* (AT) is defined as "any item, piece of equipment, or product system, whether acquired commercially, modified, or customized, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities" (Individuals with Disabilities Education Improvement Act, IDEA, 2004, sec. 602). Adaptive technologies are a type of assistive technology whereby users adapt existing tools for personal use.

Assistive technologies can help students with disabilities to better negotiate collegiate learning environments. ATs offer alternative formats especially related to academic needs, including reading and writing (Heiman & Shemesh, 2012). Assistive technology may include screen hardware/software solutions, such as enlargers and magnifiers, screen readers, text scanners, Braille displays, Braille digital converters, speech synthesizers, and speech browsers (Kumar & Lin, 2013). Persons who have print-reading-related disabilities may rely on Digital Accessible Information Systems (DAISY), which converts books into an interactive format (Leas et al., 2008). Such systems allow users to navigate to specific locations within a text such as chapters, sections, pages, or bookmarked areas. In distance or online learning environments, students with disabilities may use such technologies as AccessNote® (a notetaking tool for those who are blind or visually impaired, created by the American Federation of the Blind), TapTapSee® (an app to help identify everyday objects), and/or NaviDys® (a program to adapt and adjust webpage reading preference settings, including font augmentation, e.g., Dyslexie font). Additional technology can be used for hearing and auditory support. For persons who are deaf or hard of hearing (HOH), the inclusion of accurate captions, transcripts of video or audio information are helpful tools to facilitate user experiences. For example, Otter.ai® provides a live transcribe feature for audio that utilizes artificial intelligence (AI) software. These mobile and online platforms allow users to record, create notes from live transcripts, and record lectures in real time (e.g., by way of Zoom video conferencing), while also sharing notes with others.

Such assistive technologies are major steps forward in bridging the digital divide. And yet, their efficacy is often contingent on the web accessibility of digital information provided through departmental websites and learning management systems. That is, without accessible data, tools to help interpret the data are hindered.

Thus, barriers continue, including the focus of this present study: webpages that are difficult to navigate. The World Wide Web Consortium (W3C) is an international organization that oversees standardization

and operation of the web and produces the globally recognized Web Content Accessibility Guidelines (WCAG) (W3C, 2022). W3C posits four general principles for evaluating the content of web accessibility: *perceivable, operable, understandable,* and *robust*; together these elements are known as the POUR framework. We use the W3C POUR framework to describe our approach and discuss the implications of our findings. The WCAG 2.1 guidelines provide a pathway for making web content more accessible to persons with disabilities (and, consistent with Universal Design [UD] principles, more accessible for all; see Rose, 2000). *Perceivability* means users can use their "vision and hearing senses through the browser or by using assistive technologies such as screen readers" (Geiger et al., 2011, p. 4). *Operability* means users can operate the technology or interface, including the mouse, keyboard, or other assisted technology, to interact with the content. *Understandable* websites offer clear content, including both the information and the operation of the interface. *Robust* content must be discernable by many users, including those relying on assistive technology. W3C subsequently provides guidelines for implementations and evaluative success criteria. W3C provides three performance ratings: A (lowest), AA, and AAA (highest). In January 2017, the U.S. government accepted the WCAG 2.0 Level AA guidelines as the new national standard in the U.S. (Youngblood & Brooks, 2018). We use the Level AA guidelines to assess the online information included in this analysis.

Our exploratory content analysis relies on computer-aided software to systematically analyze the departmental home pages of institutional members of the International Communication Association (ICA). In doing so, we aim to: (1) better understand the general web, language, and mobile accessibility of discipline-related online information; (2) identify strengths and opportunities for improvement; and, (3) to reflect upon the anticipated barriers impacting persons with disabilities when accessing higher education information online.

This paper is organized as follows. We first provide an overview of the relationship between disabilities and web accessibility in the global context. We next summarize relevant literature relating to the importance of web accessibility in higher education. This is followed by a description of the methods and computer-aided software technologies we used to assess web and mobile accessibility. We then present a report of findings with discussion, implications, and future directions for the Communication discipline.

Web Accessibility, Universal Design, and W3C

A limited number of exploratory studies have been conducted on web accessibility. Studies have revealed that websites are not designed for web accessibility, even with standard accessibility statements on their domain pages (Bradbard & Peters, 2010). Universal Design (UD) theory guides the interface of products and online environments for university websites and web accessibility for all persons. The Disability Act 2005 characterizes UD as the design and composition of an environment so that it may be accessed, understood, and used to the greatest possible extent, in the most independent and natural manner possible, in the widest possible range of situations in regard to electronic systems, so that they may be used by any person (Centre for Excellence in Universal Design, 2020).

The approach of website accessibility falls within the seven principles of the UD approach integrated by instructional designers and disability agencies. These principles include 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, 2020). Web accessibility recognizes that visual and auditory disabilities need a design approach which encourages equitable use, the flexibility of design, and simplicity of interface for users. Universal Design offers a singular

solution for persons who are considered abled and for persons with disabilities. UD is different from web accessibility, however, because of legal implementations for institutional funding and operations, the World Wide Web Consortium (W3C) integrates both UD and web accessibility to aid consistency of information organization on educational and corporate websites.

The W3C via the Web Accessibility Initiative developed a series of accessibility standards and guidelines to inform the creation of websites that adhere to POUR principles (perceivable, operable, understandable, and robust). Mason et al. (2021) recently argued that addressing web accessibility problems can improve "experiences for everyone—for people with disabilities and for people without disabilities," (p. 6). Extant literature using experimental methods also supports this observation. Schmutz et al. (2016) found that a website's conformance to WCAG 2.0 guidelines lead to higher task completion rates and lower task completion time in nondisabled populations. Furthermore, participants using websites meeting Level AA guidelines gave higher ratings of usability, aesthetics, and trustworthiness and lower ratings in workload than participants in the other conditions. These findings indicate that web accessibility has important, distinct, and beneficial impacts for all users, not only persons with disabilities. Still, little is known about how the global discipline of Communication, represented by institutional members of ICA, adheres to web accessibility principles.

Web Accessibility in Higher Education

We approach the issue of web accessibility in higher education from a stakeholder management theoretical perspective. Stakeholder theory posits that organizations should ethically manage relationships with internal and external, as well as primary and secondary stakeholder, groups in the pursuit of organizational goals and objectives (Freeman, 1984; Freeman et al., 2004). Previous scholarship has focused on persons with disabilities in digital environments in higher education (see Carroll et al., 2020; Fuller et al., 2009; Vogel & Adelman, 1992; Wynants & Dennis, 2017). Our choice to focus on the departmental home pages of institutional members of the International Communication Association was motivated by the reality that a variety of stakeholders may be impacted by poor web accessibility emerging from these specific home pages, as they often serve as gateways to other important department- and discipline-related information. Current faculty, staff, administrators, and students in need of accommodation, who are engaging in traditional or distance learning, may be impacted by poor accessibility (Gregg, 2007). Furthermore, former students and alumni may, through aging, become susceptible to developing or acquiring conditions or illnesses resulting in a disability that impairs online information processing. Future students who are interested in the discipline of Communication in general may also be impacted. Web accessibility is an important factor in retention and recruitment, alumni engagement, and the daily work and learning environments of individuals within and related to the Communication discipline.

The overall objective of this study is to evaluate the general accessibility of the global discipline of Communication reflected via the home pages of institutional members of the International Communication Association using WCAG 2.0 AA guidelines. To do so, we address the question:

> **RQ1:** What is the general accessibility of the International Communication Association institutional members' departmental home pages?

Disabilities and Web Accessibility in the Global Context

Globally, the United Nations (U.N.) Program on Disability/Secretariat for the Convention on the Rights of Persons with Disabilities (SCRPD) falls under the purview of the Division for Social Inclusive Social Development (DISD) of the United Nations Department of Economic and Social Affairs (UNDESA). The U.N. defines and recognizes persons with disabilities as those "who have long-term physical, mental, intellectual or sensory impairments which in interaction with various attitudinal and environmental barriers hinders their full and effective participation in society on an equal basis with others" (U.N., 2006a, para. 27).

Today, a multi-level legal and regulatory framework has been developed to help ensure web accessibility for persons with disabilities. The United Nations Convention on the Rights of Persons with Disabilities' Article 24 states that member States shall promote disability awareness, and support the use of "appropriate augmentative and alternative modes, means and formats of communication, educational techniques and materials to support persons with disabilities" (U.N., 2006b, para. 4). The U.N. further maintains that persons with disabilities should be able to "access general tertiary education, vocational training, adult education and lifelong learning without discrimination and on an equal basis with others" (U.N., 2006b, para. 5).

There are global efforts, then, to recognize and address barriers faced by many persons with disabilities—a population that continues to grow. Current data estimates that over 1 billion people are living with some form of disability (WHO, 2021). This corresponds to about 15% of the world's population, with up to 190 million (3.8%) people aged 15 years and older having significant difficulties in functioning, and often requiring health-care support services. The number of people living with a disability is increasing, in part due to aging populations and an increase in chronic health conditions (WHO, 2021). These populations may be more pronounced in certain regions. For example, The Centers for Disease Control and Prevention (CDC, 2018) estimates 61 million or 26% of the U.S. population lives with some form of disability, and the number of Americans with disabilities is anticipated to increase as the U.S. population ages. The U.S. Census Bureau (2017) Population Projections projects the number of Americans aged 65 and older will nearly double from 52 million in 2018 to 95 million by 2060. This projection is not exclusive to the United States. The World Economic Forum (2021) reports increasing aging populations in Japan, Poland, Australia, Germany, among others. The anticipated increase in aging populations will result in more individuals with physical, cognitive, and visual impairments who may become reliant on assistive or adaptive technologies to access and engage in digital environments. In terms of college students, one of the fastest growing groups on college campuses is students with disabilities (SWD), but their rates of bachelor's degree completion remain low (Carroll et al., 2020). From a stakeholder management perspective, web accessibility may impact a variety of internal and external higher education stakeholders groups beyond current or future students including both past and present faculty, staff, and alumni. To better understand potential manifestations of such regional differences in web accessibility adherence, we ask:

> **RQ 2:** Are there regional differences in the frequency of web accessibility issues in higher education reflected by differences in the total (a) alerts, (b) errors, and (c) error density among ICA institutions?

In this analysis, three additional features were considered as potential contributors to general web accessibility: language accessibility, mobile accessibility, and content readability. W3C's WCAG Guideline 3.1 (2021) maintains language accessibility is directly related to inclusion, a contributor toward broader web accessibility goals. Low language accessibility may act as a barrier to education messages and resources (West & Miller, 2006). *Accessible language* refers to language that accommodates people of all ages and abilities, including those with cognitive disabilities, persons with low literacy skills, and those with limited English proficiency (LEP) (W3C.org, 2021). Websites included in our analysis were evaluated to determine if the information was available in at least one other language. WCAG Guideline 3.1 is also known as the "Readable" guideline. To assess this metric, our study considers content readability using three indices: *Flesch-Kincaid Reading Ease, Gunning Fog,* and the *Coleman-Liau Readability Formula.* The Flesch-Kincaid scores the difficulty of the language. Gunning Fog estimates the years of formal education needed to understand a text. The Coleman-Liau Readability Formula complements the Gunning Fog by estimating the level of U.S. education likely needed to comprehend a text. All three measures are useful indicators of the understandability dimension of the POUR framework.

Mobile accessibility aligns to the principles of robustness and operability in the POUR framework, due to the proliferation of personal mobile devices, such as smartphones and tablets, and the rise in mobile-based applications (Paglialonga et al., 2018). Situational disabilities are common for mobile users. That is, they may be "unable to listen to audio while browsing in a crowded environment, or if they're browsing from an unstable connection, images might not load" (Bureau of Internet Accessibility, 2021, para. 2). Therefore planning and designs for mobile accessibility ensures users also receive high-quality experiences using mobile devices. The robustness principle in WCAG refers to web content that is compatible with a variety of "user agents," including browsers, or assistive technologies. A solution is considered robust if there is a high degree of compatibility between user agents and assistive technologies. Factors such as page speed and site speed are indicators of mobile accessibility. We assessed the mobile site speed of websites using Google's computer automated Test My Site feature. Mobile site speed is a meaningful indicator of a website's performance. With these important features in mind, we pose our next research question:

> **RQ3:** What is the (a) degree of language accessibility, (b) mobile accessibility, and (c) content readability level of higher education information in ICA member institution websites?

In addition to the general web accessibility of these institutional departmental home pages, we were also interested in better understanding the features and attributes of the websites. We coded the presence of *accessibility policy statements*. Accessibility policy statements are a valuable feature as they are an indicator of an organization's recognition of accessibility and consideration of user experiences. Furthermore, such statements provide users with information about the accessibility of content and demonstrate commitment to accessibility and to social responsibility (World Wide Web Consortium, 2020). Perhaps most importantly, accessibility policy statements include information on assistive and adaptive technologies available to users and often include information for monitoring or reporting issues if users experience difficulty accessing specific content areas. Because these statements can be important, we ask and answer:

> **RQ4:** Are accessibility policy statements available to persons with disability when interacting through the home pages of the Communication discipline?

To show how we answered the research questions posed in this study, the following section of the manuscript documents the strategies for sampling the units of analysis, describes the computer-aided software used to assess the variables presented, and documents the process by which intercoder reliability was obtained.

Methods

Units of analysis for this study were sampled from the International Communication Association (ICA) institutional member database. The dataset was accessed through the membership directory of the ICA website in October 2021, with coding and analysis continuing through November of 2021. Researchers relied on the institutional affiliations of the "points of contact" shared by ICA members in the ICA member database. We relied on computer-aided software to process the URLs of the home pages of ICA member's higher education (HE) institutions. We chose to focus only on department home pages as a metric for general web accessibility. Home pages are often the most accessed pages on a website and are the gateway to the rest of a website's content (Mason et al., 2021). Home pages not only tend to receive the most attention, but research indicates a correlation between issues detected on a home page and other website pages (Web AIM, 2020). Additional descriptions of the measures and methods employed in this analysis are described below.

Web Accessibility. Web AIM WAVE software, available through the Center for Persons with Disabilities at Utah State University, was used to assess the general accessibility of the websites included in this sample. WAVE® is a free online evaluation tool developed by Web Accessibility in Mind (WEB AIM), a nonprofit organization whose mission is to "expand the potential of the web for people with disabilities by providing the knowledge, technical skills, tools, organizational leadership strategies, and the vision to empower organizations to make their own content more accessible to people with disabilities" (Web AIM, 2020, para. 4). WAVE assesses whether a website is accessible and WCAG-compliant by evaluating all content within a webpage, not just visible content.

Four researchers processed each website home page URL through WAVE AIM software which presents the results in red, green, or light blue. For the purpose of this study, only red errors were coded and evaluated. Researchers strictly analyzed and coded red error messages to better understand the most prominent and immediate critical accessibility errors in higher education institution websites. We considered the WAVE analysis of *red errors* as these are indicators of identifiable accessibility issues that are most likely to undermine POUR web accessibility principles. We also considered WAVE *alerts*, represented by yellow icons. Alerts are not meant as indicators of accessibility compliance, but do indicate elements on a webpage which warrant further review. Each webpage received a *total error count*, with higher counts indicating an increased potential for disruptive accessibility failures. Additionally an *overall error density score* was calculated for each webpage, this represents the ratio between errors and page elements. Larger error densities indicate a lower prevalence of accessibility errors, relative to the total elements within each webpage. A general description of the accessibility errors identified in the sample, an explanation of their connection to WCAG 2.1 Success Criteria, and how these errors likely impact end users are documented in Table 1.

TABLE 1
General Description of Accessibility Errors Identified in the Sample With Connection to WCAG 2.1 Success and Performance Criteria

Error Type	Description	Relation to WCAG 2.1 Success Criteria	WCAG Mapping to Section (508) Functional Performance Criteria (PFC)
Contrast Errors/Very Low Contrast	Very low contrast between text and background colors; Adequate contrast of text is necessary for all users, especially users with low vision.	1.4.3 Contrast *(Minimum)*	Errors are likely to impact individuals with limited vision; or those without the ability to perceive color.
Empty Links	A link contains no text; If a link contains no text, the function or purpose of the link will not be presented to the user—this may create confusion for keyboard and screen reader users.	2.4.4 Link Purpose *(In Context)*	Errors are likely to impact individuals with limited manipulation; in addition to those with limited language, cognitive, and learning abilities
Linked Image missing ALT Text	An image without alternative text results in an empty link; Images that are the only thing within a link must have descriptive alternative text. If an image is within a link that contains no text and that image does not provide alternative text, a screen reader has no content to present to the user regarding the function of the link.	1.1.1 Non-text Content 2.4.4 Link Purpose *(In Context)*	Errors are likely to impact individuals without vision, with limited vision, without hearing, with limited hearing, in addition those with limited language, cognitive, and learning abilities
Broken ARIA References	Indicates an aria-labeledby or aria-describedby reference exists, but the target for the reference does not exist; Aria labels and descriptions will not be presented if the element referenced does not exist in the page	1.3.1 Info and Relationships 4.2.1 Name, Role, Value	Errors are likely to impact individuals without vision, with limited vision, in addition to those with limited language, cognitive, and learning abilities
Missing ALT Text	Indicates an image's alternative text is not present; Each image must have an alt attribute. Without alternative text, the content of an image will not be available to screen reader users or when the image is unavailable.	1.1.1 Non-text Content	Errors are likely to impact individuals without vision, with limited vision, without hearing, with limited hearing, in addition those with limited language, cognitive, and learning abilities
Empty Buttons	Indicates a button is empty or has no value text; When navigating to a button, descriptive text must be presented so that screen reader users understand the function of the button.	1.1.1 Non-text Content 2.4.4 Link Purpose *(In Context)*	Errors are likely to impact individuals without vision, with limited vision, without hearing, with limited hearing, in addition those with limited language, cognitive, and learning abilities
Missing form Labels	Indicates a form control does not have a corresponding label; If a form control does not have a properly associated text label, the function or purpose of that form control may not be presented to screen reader users.	1.1.1 Non-text Content 1.3.1 Info and Relationships 2.4.6 Headings and Labels 3.3.2 Labels or Instructions	Errors are likely to impact individuals without vision, with limited vision, without hearing, with limited hearing, in addition those with limited language, cognitive, and learning abilities
Empty Headings	Indicates a heading contains no content; Some users, especially keyboard and screen reader users, often navigate by heading elements. An empty heading will present no information and may introduce confusion.	1.3.1 Info and Relationships 2.4.1 Bypass Blocks 2.4.6 Headings and Labels	Errors are likely to impact individuals without vision, with limited vision, in addition to those with limited language, cognitive, and learning abilities
Broken ARIA Menu/ Links	Indicates an ARIA menu does not contain required menu items; ARIA menus are application menus—like those used in software menu—with specific keyboard interactions; These aren't used for navigating links on a web page and must contain at least one menu item, menu item checkbox, or menu item radio element.	2.1.1 Keyboard 4.2.1 Name, Role, Value	Errors are likely to impact individuals without vision, with limited vision, in addition to those with limited language, cognitive, and learning abilities

Note: Error types listed in order of prominence in study; Descriptive information and relation to WCAG 2.1 framework were extracted from WAVE AIM (2022, web); Mapping to Section 508 Perfomance Criteria conducting using https://www.section 508.gov/content/mapping-wcap-to-fpc/

Content readability. WebFX®, an online automated software, was used to assess the readability of the home pages of ICA member institutions included in this study. As with prior variables, computer-aided technology was used to conduct the readability analysis. Each website URL was processed through WebFX Readability Analysis tool. Three indices were selected: the *Flesch-Kincaid Reading Ease Index, the Gunning Fog Index,* and the *Coleman–Liau Readability Formula*. The Flesch-Kincaid reading ease index is based on a ranking scale of 0–100, and the higher the score, the more reading ease (Kincaid et al., 1975). Low scores indicate text that is complicated to understand. A score of 65 is considered to be a good target, and scores between 60 and 80 should generally be understandable to lay audiences. A website with an average grade level around 7 means that the website should be easily understood by persons 12 to 13 years old (WebFX, 2020). A secondary index was used for comparability. The Gunning Fog Index counts the number of exact words and syllables, then divides the total number of words in the sample by the total number of sentences in order to calculate an Average Sentence Length (ASL). A Gunning Fox Index score of 7 or 8 is ideal, while anything higher than 12 is considered too complex. The Coleman–Liau (CL) Readability Formula was created to help the U.S. Office of Education calibrate the readability of all textbooks for the public school system. This readability assessment approximates the usability of a text. Unlike the Gunning Fog Index, the CL Formula does not require analysis of the characters that create the words (such as syllable counts)—only their length in characters.

Mobile accessibility. Google's Test My Site® feature, provided by Think With Google®, allows users to measure their website's performance across devices, from mobile to desktop, and provides a list of specific fixes that can help the site connect more quickly with others online. Similar to other variables, the website URLs were processed through the Test My Site platform, which provides feedback about current website speed. Site and page speed are critical measures of the quality of a user's experience and tie directly to how engaged a user is and how likely they are to return to the site. Page speed is the speed of an individual page within a website and site speed is the speed of all pages contained on a website. Websites are considered good if they load in less than 2.5 seconds, need improvement if between 2.5–4 seconds, and poor if taking 4 seconds or longer to load. This tool also provides additional insight as to whether there have been recent changes in the processing speed of the websites: speeding up, slowing down, or no recent change (Think with Google, 2020).

Additional Accessibility Considerations. This analysis includes two additional factors related to web accessibility: *language accessibility* and the inclusion of *accessibility policy statements*. In order to assess language accessibility, we noted whether the institutional websites offered the information in at least one other language or provided links to translation software to aid in comprehension. These were independent evaluations that were not assessed using computer-aided technology. Intercoder reliability was established by two coders cross-referencing records on 30% (n = 24) of the data set initially coded by a third researcher. Reliability for these measures was established by using Scott's Pi, which discounts the level of "observed agreement" by the level of "expected agreement" due to chance and is the accepted standard for intercoder reliability for nominal data in communication studies (Potter & Levine-Donnerstein, 1999). Although Scott's Pi has been argued to be appropriate only for nominal variables and with two coders, Craig (1981) suggested an expansion to three or more coders, as in this study, is acceptable. Reliability results showed a high degree of agreement on the factors of *language accessibility* (a = .96) and the inclusion of *accessibility policy statements* (a = .96).

A variety of descriptive and univariate quantitative statistical tests were conducted in order to answer the RQs advanced in this study. The following section documents the results of these tests beginning with the descriptive statistics used to characterize the sample.

Report of Findings

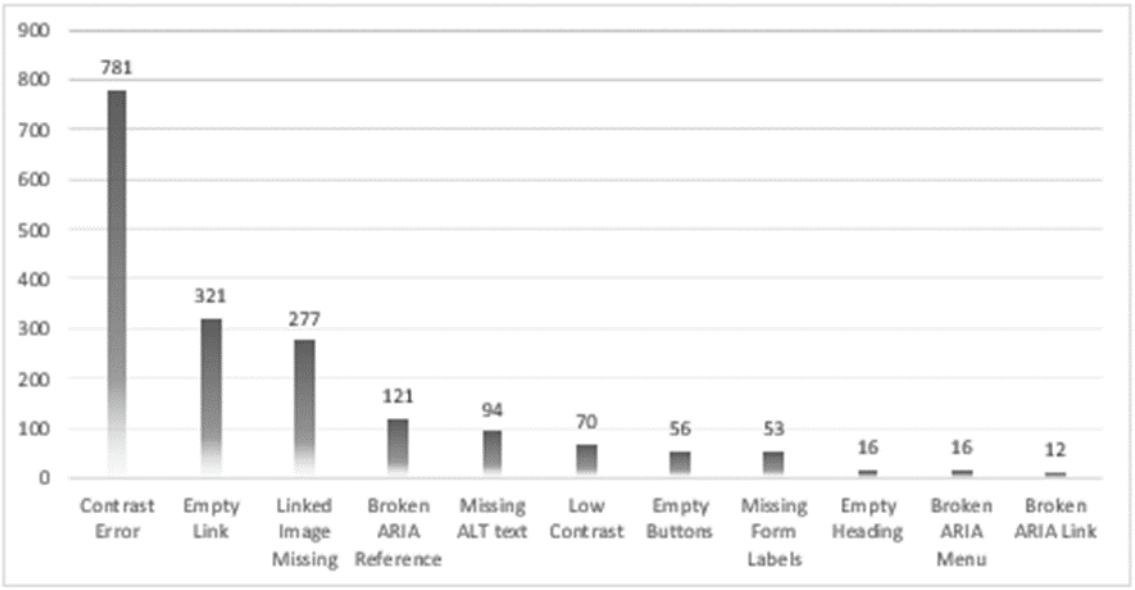
The higher educational institutions of approximately 305 individual ICA members were identified for possible inclusion in this study (i.e., the sampling frame). If multiple scholars were affiliated with the same institution, the institution was only analyzed once. Websites were omitted if they were inoperable or were incompatible with the computer-aided analysis software used in this study. This resulted in a total sample of $N = 77$ institutional home pages representing the discipline of Communication across 26 countries. The Higher Education Market Report TC 2261 (2020) was used to classify the regions of global higher education representation. The sample is 53.2% Europe (EUR, $n = 41$), 16.8% Asia Pacific (APAC, $n = 13$), 2.5% Latin America (LA, $n = 2$), 24.6% North America (NA, $n = 19$), and 2.5% Middle East and Africa (MEA, $n = 2$). A map of specific countries is available below.

FIGURE 1
Geographical Map of ICA Member Institutions Represented in This Sample

Note: Map created using Online Software Mapchart.net/world

RQ 1 & *RQ 2* sought to understand the general accessibility of online information reflected by the departmental home pages of ICA member institutions. To begin, 74% ($n = 56$) of the websites included in this analysis had detectable WCAG Guidelines Level AA accessibility failures on the home pages. Results presented in Table 2 indicate that a variety of W3C critical failures are currently present on the department home pages, including low contrast ($n = 3{,}086$), empty links ($n = 665$), missing form labels ($n = 475$), links missing ALT text ($n = 369$), and missing ALT text ($n = 252$).

TABLE 2
Identified Web Accessibility Errors Types in ICA Institutional Member Department Home Pages



Note: WAVE AIM™ software was used to identify the most prominent error types likely to impact accessibility of digital information that need to be reviewed using WCAG Level AA Guidelines.

To more fully answer *RQ2*, and in order to explore regional differences, the HE regions were collapsed from five to three due to low sample size in specific regions (i.e., LA, MEA regions). To address this issue, the LA region was collapsed with the NA region and the MEA region was collapsed into the APAC region, resulting in three regions for comparability. Researchers used a MANOVA with region as the fixed factor and total errors, total alerts, and error density as the dependent variables. The results revealed no significant differences $F(6,142) = 1.16$, $p = .33$. Results presented in Table 3 show that higher education institutions in the MEA and APAC region report the highest number of errors on institutional home pages, while the EUR region averaged the highest number of alerts.

In order to answer *RQ3*, a series of univariate analyses were computed with region as the fixed factor and the reading indices as the dependent variables. No significant differences were found on the Flesch-Kincaid Readability Index, $F(2,74) = 1.22$, $p = .30$, the Coleman-Liau Index, $F(2,74) = 2.50$, $p = .08$, nor the Gunning Fog Index, $F(2,74) = 2.33$, $p = .10$. Further review of the Flesch-Kincaid scores indicates the home pages may be difficult or hard to understand for some audiences. A score of 65 is considered to be a good target, and scores between 60 and 80 should generally be understandable to lay audiences. ICA member institutions' scores varied between 28–40 across all regions. The Gunning Fog averages are in an acceptable range, while the Coleman-Liau, which equates to the grade level of U.S. education, indicates a person would likely need a 17 or 18 grade level to process the information within the home pages. This may impact early undergraduate recruitment efforts, those with limited English proficiency (LEP), or individuals emerging from nontraditional, primary education systems.

TABLE 3
Regional Differences ICA Institutional Members' Website Content Readability, Web Accessibility, & Other Accessibility Attributes

	EUR Region *n* = 41 *M* = *SD* =		LA & NA Region *n* = 21 *M* = *SD* =		MEA/ASAP Region *n* = 15 *M* = *SD* =	
Content Readability						
Coleman Liau Index	17.47	6.44	18.20	1.63	13.85	7.98
Flesch-Kincaid Reading Ease	29.58	26.15	28.70	13.35	40.49	29.39
Gunning Fog Index	8.81	3.14	7.97	2.52	6.89	2.88
Web Accessibility						
Total Errors	13.71	22.73	10.67	21.55	15.64	18.83
Total Alerts	58.39	94.46	32.62	38.91	40.07	34.90
Error Density Score	.35	.57	.16	.25	.74	1.55
Additional Accessibility Attributes						
Language Accessibility	87.8% Yes (*n*=36)	12% No (*n*=5)	23% Yes (*n*=5)	76% No (*n*=16)	13% Yes (*n*=2)	86% No (*n*=13)
Accessibility Policy Statements	53.6% Yes (*n*=22)	46% No (*n*=19)	47.6% Yes (*n*=10)	47% No (*n*=10)	.6% Yes (*n*=1)	93% No (*n*=14)

Note: Computer automated analysis of the website's URL home pages relied on WebFX™ Readability Test software to determine the readability indices as well as total word counts and text complexity. WAVE AIM™ software was used to assess *Total Errors* represent critical errors likely to impact accessibility of online information that need to be resolved using WCAG Level AA Guidelines; *Total Alerts* refers to web elements that warrant further review, *Error Density* divides the total number of errors from the total number of page elements; Significant difference[a] is equal to $p<.01$; Scores for language accessibility and accessibility policy statements refer to the % of each present in each category of website extension.

A univariate analysis of variance was computed to assess the general mobility of the home pages. Significant differences were found $F(2,48) = 5.93$, $p < .01$, *partial eta*$^2 = .21$ between the regions. Further review of the mean scores shows MEA/ASAP regions processed information more slowly ($M = 4.89$, $SD = 2.54$), compared to the EUR region ($M = 2.79$, $SD = 1.16$) and the LA and NA regions ($M = 2.87$, $SD = 1.46$). Following this, we also examined the overall site speed. Google's Test My Site measures the speed of all the pages that make up a site based on world data collected via the Chrome User Experience Report (CrUX). The CrUX report is updated monthly and is publicly available. If the URL was not listed in the CrUX database, the institution was dropped from this portion of the analysis. As a result, 29 home pages were removed from this portion of the analysis. The results found that 87.5% of the institutional home pages from the MEA and APAC regions were not processing quickly, which may affect how long visitors wait on the page to load before moving on to other areas. Across all regions, there had not been a great deal of change in the processing speed in recent months, with no changes in site or page processing speeds reported in 58.3% of the EUR region, and 64% in the LA and NA regions.

RQ4 further explored the prevalence of *accessibility policy statements*. Higher education institutions in the regions of the Americas (47.6%) and European regions (58.3%) were found to include accessibility policy statements on institutional home pages, compared to higher education counterparts in other regions (6%). Implications and discussions of these findings will be further reviewed in the following section.

Discussion, Limitations, and Conclusions

The concentration of this study was to address the content considerations of information networks which may serve as barriers for access, thus marginalizing certain individuals, specifically persons with disabilities, or in some cases those with limited English proficiency (LEP). Findings from this study revealed that 74% of departmental home pages of ICA member institutions sampled have indicators of WCAG guidelines Level AA accessibility failures on their home pages. This finding alone may suggest detrimental effects on a variety of higher educational stakeholders, including both past and present students, faculty, staff, and alumni. Seventy-four percent is a clear majority of the sample, but is a smaller proportion than error rates found in other contexts, including popular environmental websites (95.3%; Mason et al., 2022) and popular health websites (91.3%; Mason et al., 2021. Furthermore, a 2021 WebAIM report evaluated home pages for the top 1,000,000 websites worldwide and found a 97.4% critical error rate on home pages. So while the current rate of indicators of errors on departmental home pages of ICA member institutions is not ideal, it is better than recent comparable studies addressing specific types of online information (e.g., health and environmental) and general online web content. Comparably, institutions of higher education in the Communication discipline performed better than general web accessibility studies previously cited in the public and private sectors. Of course, room for improvement remains.

Although the language complexity and reading difficulty were noted in the general readability findings, simply addressing the common W3C critical errors would greatly enhance the user experience for stakeholders interacting through discipline-related home pages. For example, low contrast errors, combined with empty links and missing form labels, were the most prominent errors. Contrast errors are most likely to impact the perceivability POUR principle. Individuals with visual acuity barriers are most likely to be impacted by this error; therefore, addressing this one type of accessibility error would likely impact a broad array of web users interacting through departmental website home pages.

As we further move toward the visual and digital world, accessibility failures can be easily identified, addressed, and resolved to improve the user experience of broad audiences interacting through these platforms. For example, empty links particularly affect persons who are blind or with limited vision. Links inform users what will happen if they click on a link with their mouse or select a link with their screen reader. If the link's text describing the functionality is missing, screen reader users will not know where the link will take them and they are less likely to click or trigger the link. Missing form labels may also be difficult to perceive and will impact navigation through websites and/or instructional materials. These errors are most likely to impact the POUR framework of not only perceivability but also operability. While the availability of assistive technology may aid in the transition into higher education learning environments, additional advocacy for web accessibility and universal design is needed. These specific findings lend support to Communication scholars and administrators for refinement and, if needed, enhancement of specific accessibility attributes within their department's digital presence.

Limitations

With these findings in mind, it is important to acknowledge that all computer-automated tools, including WAVEAIM, WebFX, and Think with Google, have limitations. The computer-aided software used for this analysis indicates potential accessibility errors and does not mean the content is necessarily inaccessible to the end user. These findings should not be generalized to broader academic institutions. For example,

this analysis only considers the departmental home page of ICA institutional members. As a result our findings are a limited representation of the broader Communication higher education landscape. Future analysis of data in this context may opt to use different sampling procedures to gather data outside the home pages of departmental websites. While website home pages are important and serve as gateways to other areas of a website, additional focus on the contact pages of websites—designed to facilitate communication between users and organizations—may reveal barriers resulting from other accessibility error types than were identified in this study. Institutional constraints may be a contributing factor to the accessibility errors identified. For example, institutional branding may not conform to WCAG standards and therefore impact the frequency and degree of WAVE AIM color contrast error indicators.

Our analytical approach did not account for all possible accessibility-related content features. As a result, certain accessibility attributes such as the captioning of embedded videos, scrolling images, and the document accessibility of downloadable .pdfs were excluded. Moving forward future research could focus on a wider array of accessibility features of departmental websites and may reveal more prominent error types which may impede learning, and/or potentially disrupt organizational stakeholder relations efforts. These content features provide opportunities for further analysis and review moving forward.

Finally, there are multiple ways to evaluate web accessibility—computer automation is but one (see Billingham, 2014; Lee et al., 2014). Opposed to using computer-automated analysis techniques scholars may opt for an alternative method (i.e., user experience approaches). A user experience approach informed by expert evaluation involves persons with disabilities (PwDs) or those with LEP evaluating web accessibility through direct, personal experience. This approach is likely to reveal more diverse and rich qualitative data points for interpretation and consideration.

Practical Implications

In light of these findings, it is clear there are opportunities for improvement related to public information, educational service offerings, and the outreach of departments of Communication, and closely related disciplines, globally. Several professional development training associations have emphasized conformance to WCAG web accessibility POUR principles via course design and management such as: *Quality Matters®, Online Learning Consortium®,* and *MRCC Group©*. Extant literature has found that faculty who received professional development (e.g., five, 1-hour training sessions) significantly increased their frequency of UD application across the semester in all major areas (e.g., presenting material in multiple formats, making course materials more accessible) (Davies et al., 2013; Schelly et al., 2011).

Findings also suggest additional opportunities for better messaging about digital accessibility. It is easy to incorrectly assume that with the number of assistive technologies now available (e.g., Braille digital converters, live transcriptions) the digital divide has been closed. This mistaken belief can impede progress and actually widen the gap. Findings like what we have shared here can help to inoculate against these misperceptions, communicating the idea that despite improvements in assistive technologies, basic accessibility failures are impeding access. Scholars have made the case that inoculation messaging (messages that raise and refute counterarguments, creating weak challenges to motivate resistance to stronger challenges encountered later; see Compton, 2013; McGuire, 1964) can help digital users work through technology frustrations (Compton, 2012), but before that, we need to help those in charge of creating digital content and systems fix the actual technology barriers, making the digital experience less frustrating in the first place.

An advantage that higher education institutions of Communication hold, compared to their private sector counterparts, is a broad institutional framework of support through administrative, marketing, and digital support personnel. As such, the practical and social value of these findings provides a pathway for immediate, actionable remedy. To address W3C web accessibility critical errors, institutional members of ICA can request support from designated university web support personnel to resolve the identified errors that may not be conforming to basic WCAG Accessibility Level AA guidelines—citing findings such as those presented here and using inoculation or another persuasive messaging strategy. The tools and software used for this analysis are free, user friendly, and accessible online, and the results are independently replicable. Collectively, letters of request with supporting evidence from these computer-aided software platforms can provide a pathway for university administrators and support personnel to quickly make changes and resolve issues, thereby generating immediate outcomes for persons with disabilities and others reliant on these web interfaces. Adopting a clear focus for planning and review into annual or semi-annual departmental evaluations would be a beneficial strategy to ensure highly accessible information moving forward.

With 74% of departmental home pages of ICA member institutions sampled in this study indicating potential WCAG Level AA accessibility failures on the departmental home pages, it is clear that we need to increase our efforts to not only recognize barriers, but more importantly, remove these barriers. It is appropriate for the Communication discipline to take the lead in these efforts—to protect educational access and opportunity for all higher education stakeholders.

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