A Dissertation

entitled

Evaluating the Effectiveness of Online Faculty Development in Creating Accessible Content

by

Anthony Paul Walters

Submitted to the Graduate Faculty as partial fulfillment of the requirements for the Doctor of Philosophy Degree in Curriculum and Instruction: Educational Technology

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An Abstract of

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With the growth of online learning, as well as the use of technology to supplement in-person learning, technology has enabled many opportunities for creating highly interactive and highly accessible learning environments. However, it is important to design learning environments to be accessible to diverse learners and learners with disabilities. Educational institutions must comply with legislation such as the Americans with Disabilities Act, as well as moral and ethical concerns related to inclusive institutional cultures. As a result, educational institutions should provide professional development and the resources necessary to help faculty members develop accessible course content. Furthermore, the theory of Universal Design for Learning provides a framework for ensuring access to learning opportunities as a part of the course design process. UDL helped to ensure all learners can benefit from accessible learning experiences.

This research study explored the use of online professional development and its role in creating accessible online learning environments. A questionnaire was distributed to faculty members to determine if the participation in professional development resulted

in positive beliefs towards accessibility. In addition, faculty skills for creating accessible content were evaluated. Courses taught by participating faculty members were evaluated for accessibility using Blackboard Ally, and faculty members were asked about their familiarity with UDL.

The research study determined that there was not a significant difference between faculty members who took online professional development compared to those who did not take professional development in relation to attitudes towards accessibility, as well as faculty skills in creating accessible content. The research study identified a significant difference in accessibility of online content, using Blackboard Ally accessibility scores, between faculty members who participated in professional development in contrast to those who did not. The study identified a broad familiarity of UDL principles amongst the faculty members who participated in the study.

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List of Abbreviations

ADA.....Americans with Disabilities Act of 1990
ANOVA.....Analysis of Variance

CAST.....Center for Applied Special Technology

IRB.....Institutional Review Board

LMS.....Learning Management System

QM.....Quality Matters

UD.....Universal Design
UDL.....Universal Design for Learning

WA.....Web Accessibility
WAI.....Web Accessibility Initiative
WCAG.....Web Content Accessibility Guidelines
WHO.....World Health Organization
W3C.....World Wide Web Consortium

Chapter One

Introduction

Online and Web-assisted learning has expanded the reach of educational programs to reach previously underserved learners. The trend towards online education has broadened educational access. Despite this, learners with physical or intellectual disabilities may encounter barriers that impede their learning. “Millions of individuals in the United States have disabilities that affect their use of the Web. Many of these individuals use assistive technology to enable them to navigate websites or access information contained on those sites” (US Department of Justice, 2012, n.p.). For instance, Rose and Gravel (Cited in Gordon, Gravel, & Schifter, 2019) discuss, “Learners with disabilities are most vulnerable to such barriers, but many students without disabilities also find that curricula are poorly designed to meet their learning needs” (p. 5).

Designing accessible content is an important step in ensuring that web-based learning materials are accessible to all users. Specific concerns related to ensuring accessibility of web-based learning materials include the provision of captions for audiovisual resources to ensure equal access for deaf and hard-of-hearing populations. The use of proper heading layouts and image descriptions for individuals who have vision problems, ensuring that color and contrast are appropriate, so items are legible, and promoting universal design for all learners.

Designing accessible content provides benefits for diverse student populations, as students can interact with learning materials in a variety of ways. For example, closed captions for a video are primarily intended to help deaf or hard-of-hearing learners,

captions can also be beneficial for other students. For instance, captioned videos allow for English language learners to understand what is being presented, which may be beneficial to those who are working in noisy settings.

The provision of accessible content in online learning environments helps to improve the teaching and learning process for students with disabilities enrolled in online courses. For instance, Hashey and Stahl (2014) explain: “The decisions educators make regarding online instructional resources are perhaps more critical to students’ success than decisions about print-based materials because learning occurs exclusively through and within this environment” (p. 71). Therefore, accessibility should be at the forefront of instructors when developing online courses. However, “This ease of access is simply not the case for many web-based tools and content” (Hashey & Stahl, 2014, p. 71). This example emphasizes that instructors should be skilled in identifying and assessing the accessibility of online content in order to produce a learning environment that is beneficial to all users.

The provision of accessible content represents a legal obligation. According to legislation such as the Americans with Disabilities Act (ADA), institutions who receive federal funding must ensure that all students with disabilities must have equal access to all learning materials in a class. Failure to provide accessible materials could lead to fines and lawsuits being levied against the institution. For instance, in 2015, the University of California at Berkeley was determined by the US Department of Justice to have violated the ADA. “Berkeley’s free online educational content was inaccessible to blind and deaf people because of a lack of captions, screen reader compatibility and other issues” (Straumshein, 2017, n.p.).

A related issue for institutions is balancing their need to provide accessible content while maintaining fiscal prudence. When the University of California at Berkeley was sued by the Department of Justice for hosting inaccessible content, the institution was required to change how they had made content available to the public:

> In many cases the requirements proposed by the Department [of Justice] would require the university to implement extremely expensive measures to continue to make these resources available to the public for free. We believe that in a time of substantial budget deficits and shrinking state financial support, our first obligation is to use our limited resources to support our enrolled students (Koshland, n.p. 2016).

The actions taken by the University of California at Berkeley involved removing public access to content that was inaccessible. The university worked to create a new content repository with accessible content which required users to register and authenticate in order to access the content. (Koshland, n.p, 2017).

A proactive approach to learning environment design to accommodate all learners could resolve issues with content inaccessibility. The theory of Universal Design for Learning, or UDL, is used to design learning environments that are universally accessible to users with disabilities and meets the needs of diverse learners. UDL emerged from scientific research conducted by the Center for Applied Special Technology (CAST). According to CAST (2010), "UDL is an approach that minimizes barriers and maximizes learning for all students" (0:43).

At a large Midwestern research university, a faculty professional development session was developed by the instructional design staff to instruct faculty on how to

create accessible web content. The developmental session covers topics related to legal compliance, the basics of UDL, and skills required to develop accessible course content. The professional development description is as follows:

> **ADA Compliance and Online Courses** is a three-week, fully online course that prepares faculty and teaching assistants at The University of Toledo to address accessibility when designing and developing their online courses. The course covers topics that range from accessibility law to course design considerations for inclusivity, as well as the formatting of course content and other documents for accessibility. Participants will gain knowledge and skills about accessibility through a wide range of activities, including discussion, sharing, peer mentoring, self-reflection, and hands-on practice (The University of Toledo, 2020, n.p.)

The course learning objectives focus on understanding the importance of web accessibility, legal compliance, developing accessible course materials, creating accessible web content within the Blackboard LMS, and evaluating the accessibility of web content. (The University of Toledo, 2020).

An additional component of developing accessible course content is the use of Blackboard Ally (Ally). Ally is a tool that assists faculty with creating accessible learning materials within a Learning Management System (LMS) such as Blackboard Learn. Ally is based on the Web Content Accessibility Guidelines (WCAG) 2.1 Standards (Blackboard, 2018). According to Blackboard, Inc. (2018), "Blackboard Ally helps institutions build a more inclusive learning environment and improve the student experience by helping them take clear control of course content with usability, accessibility, and quality in mind" (n.p.). To help faculty with accessible content creation,

Ally provides faculty with indicators next to file attachments, images, and other media that show how accessible the content is to end users. If a faculty member clicks on an indicator, they can view details explaining accessibility concerns.

For example, Ally indicates if a document needs a clear heading structure, or that images are missing alt attributes (descriptions of images that explain what the image is to someone with vision disabilities, or for users viewing content on a text-only web browser). In addition, Ally provides students enrolled in a class with access to alternative file formats. Ally can also translate documents for students in different languages.

Statement of the Problem

Creating web-accessible learning materials is a requirement that many faculty members are unaware of, and many faculty members do not have the technical knowledge required to create accessible learning materials. Regarding this issue, Vollenwyder et al. (2019) discuss: "A further challenge is the formation of adequate knowledge and skill for the actual implementation by all involved web practitioners. Effective Web Accessibility requires a thorough understanding of how design and implementation of a solution can address the needs of users with disabilities" (p. 353).

Students with disabilities represent a significant demographic in education that is frequently underserved by educational institutions. According to the World Health Organization (WHO) (2011), "There are over one billion people with disabilities in the world, of whom between 110-190 million experience very significant difficulties. This corresponds to about 15% of the world's population" (p. 1).

In addition, research pertaining to Universal Design for Learning (UDL) is limited, and this study will help to expand knowledge on the subject. Scott, Temple, and

Marshall (2015) discuss, “Despite the fact that UDL can be a strong tool in coursework design, there are few studies which have examined the specific use of UDL principles in post-secondary environments, and fewer studies which have characterized by true experimental designs” (p. 102).

The issue of ensuring accessibility and equality in education can be a difficult proposition. For example, Gordon, et al. (2009), state, “The law on the books calls for access to the general curriculum for students regardless of ability or disability, but realizing that vision requires more than simply telling people what the law requires” (p. xii). Therefore, while faculty, administrators, and public policy makers may be familiar with accessibility laws, they may struggle with developing a vision for its implementation.

Barriers to accessibility. While the Web has increased access to knowledge, service, and education for learners and the general population, users with disabilities may encounter barriers and are prevented from enjoying equal access to public services and accommodations.

Mancilla and Frey (2021) have indicated the following barriers that institutions and individuals face when creating accessible Web content: “The top four barriers noted were a lack of: (1) institutional and/or faculty support for inclusivity, (2) time, (3) resources and funding, and (4) training and faculty skills.” (p. 10). Meanwhile, the National Center on Disability and Access to Education (2021) has acknowledged that “Two issues sure to counter any motivation to do the work of web accessibility are the fear of failure and humiliation (if you get it wrong), or the unease that accompanies trying something new” (n.p.).

For example, blind and low vision individuals who use screen readers (text to speech) to navigate content, cannot recognize untagged images, or text that has been imported as an image (for example, a scanned document). Poor contrast or excessive use of colors and patterns can make content difficult to read. Individuals with reduced motion may find navigating with a mouse difficult, and they can have difficulty if applications are not optimized for navigating by keyboard. Those who are deaf or hard of hearing cannot access audiovisual content if accurate captions or transcripts are not provided. Persons with intellectual disabilities may require additional time to navigate pages and make decisions, and their access may be stymied due to timed content (US Department of Justice, 2012).

Regarding such barriers, the Department of Justice (2012) notes: "In most instances, removing these and other website barriers is neither difficult nor especially costly, and in most cases providing accessibility will not result in changes to the format or appearance of a site" (n.p).

Statistics Related to Disabilities. For students enrolled in institutions of higher education for the 2015-2016[1] academic year, 19.4% of undergraduate students in the United States had a disability. For students enrolled in graduate level programs, 11.9% of students were reported to have a disability. (DeBray, et al, 2019, p. 276). However, there are many students who do not report having disabilities or do not seek out accommodations or other services from disability services offices, so it is likely the actual number of students with disabilities is higher than what is reported (Aquino & Bittinger, 2019).

[1] The 2019 edition of the Digest of Educational Statistics (US Department of Education) shows the 2015-2016 academic year as the latest year of available data.

The COVID-19 Pandemic, Remote Learning, and Accessibility. In 2020, the global COVID-19 pandemic forced both K-12 schools and institutions of higher education to cancel in-person classes, and shift to remote learning. The shift to remote learning produced mixed results for students with disabilities. For instance, the pandemic allowed students to have easier access to course materials, access to live and recorded lectures, as well as reducing the need for students with physical disabilities or the immunocompromised from having to commute to in person classes. Puang (2021) reports: "The pandemic has accelerated the conversation about disability accommodations on college campuses, as requests long labeled impossible, such as remote learning and recorded lectures, were universally adopted overnight." (n.p.)

On the other hand, the rapid shift to remote learning created a need to move materials online in a very expedient fashion. As a result, course materials were often posted online without being fully made accessible. This may be due to faculty either not having the time or the skills necessary to make course materials accessible to students with disabilities. Anderson (2020) states students with disabilities "have been put on the backburner 'en masse,' as instructors scramble to transfer two months' worth of teaching content to a digital format" (n.p). Furthermore, Anderson (2020) also mentions issues encountered because of the switch to remote learning, such as content being unable to be accessed by screen readers, and a lack of captioning or interpretive services for live or pre-recorded video.

In K-12 remote learning, the American Foundation for the Blind (2022) reported that "Nearly 60% of the educators reported that their students who are blind or have low

vision could not access at least one of the digital learning tools they were expected to use in class, and 35% reported their students could not access at least two tools" (n.p).

Purpose of the Study

This research study explored the efficacy of providing online professional development for faculty in developing accessible online course materials. This study evaluated faculty attitudes, beliefs, skills, and abilities related to the creating of accessible online course content.

Research Questions

- Is there a difference amongst faculty attitudes towards accessible content for those who have completed web accessibility professional development in contrast to those who have not?
- Is there a difference amongst faculty skills in creating accessible content amongst faculty who have completed web accessibility professional development in contrast to those who have not?
- Is there a difference in the level of web accessibility of courses taught by faculty who have completed Web accessibility professional development.in contrast to those who have not?
- Does faculty awareness of Universal Design for Learning (UDL) have an impact on the level of web accessibility of courses taught by faculty?

Operational Definitions

Below is a list of commonly encountered terms in this research study and their definitions.

Accessibility

A concept that relates to the ability of individuals with disabilities to fully participate in education, employment, or desired lifestyle.

Alternative format

An alternative format is a version of a physical or digital item that is accessible to users with disabilities. Examples include a tagged PDF file, a Braille or large print book, or a captioned video file.

Americans with Disabilities Act of 1990 (ADA)

The Americans with Disabilities Act of 1990 was a law passed by the U.S. Congress to provide for the elimination of discrimination against individuals with disabilities and to ensure their full participation in society (U.S. Department of Justice, 2017).

Blackboard Ally (Ally)

Blackboard Ally is a software package that works within a supported Learning Management System to evaluate content uploaded to the system. Ally provides alternative formats to students and provides reports and suggestions to improve accessibility to faculty.

Blackboard Learn

Blackboard Learn is a commercial Learning Management System for teaching online courses and supplementing face-to-face courses that is developed by Blackboard, Inc.

Learning Management System (LMS)

A Learning Management System is a software package that facilitates the delivery of course materials and instruction in an online environment.

Neuroscience

A discipline within the natural sciences that studies the structures and functions of the brains. Neuroscience is focused on how learning activities affect the development of neural networks (Meyer, Rose, & Gordon, 2014).

Rehabilitation Act of 1973

> The Rehabilitation Act prohibits discrimination based on disability in programs conducted by Federal agencies, in programs receiving Federal financial assistance, in Federal employment, and in the employment practices of Federal contractors. The standards for determining employment discrimination under the Rehabilitation Act are the same as those used in title I of the Americans with Disabilities Act (United States Department of Justice, 2009, n.p.).

Quality Matters (QM) Rubric

"Based on research-supported and published best practices the QM Rubric is a set of standards used to review the design of online and blended courses. The Rubric is complete with Annotations that explain the application of the Standards and the relationship among them" (QM Program, 2018, p. 2).

Universal Design (UD)

"Universal design means simply designing all products, buildings and exterior spaces to be usable by all people to the greatest extent possible" (Mace, Hardie, & Place, 1996, p. 2)

Universal Design for Learning (UDL)

An educational design framework that "leveraged the flexibility of digital technology to design learning environments that from the outset offered options for diverse learner needs" (Meyer, et al., p. 5).

Web accessibility (WA)

"Web accessibility means that websites, tools, and technologies are designed and developed so that people with disabilities can use them. More specifically, people can: perceive, understand, navigate, and interact with the Web; contribute to the Web" (W3C, 2019c, "What is Web Accessibility?" para. 1).

Web Content Accessibility Guidelines (WCAG)

Developed by the World Wide Web Consortium (W3C), the Web Content Accessibility Guidelines has "a goal of providing a single shared standard for web content accessibility that meets the needs of individuals, organizations, and governments internationally." (W3C, 2019b, "Introduction, para. 1). The WCAG applies to both web page content (e.g., text, images, and videos) and the underlying source code.

Organization of the Study

Chapter One provides the study introduction, the research problem, purpose, research questions, and operational definitions. Chapter Two provides a review of related literature and research studies. This chapter also outlines the conceptual and practical foundations of this research study. Chapter Three outlines the research methodology, variables, data collection, and data analysis methods. Chapter Four contains the study results. Chapter Five includes a discussion of the research results, further recommendations for future research, and the study conclusion.

Chapter Two

Literature Review and Conceptual Foundations

The literature review discussed previous research studies related to web accessibility in online learning environments, as well as the theoretical and practical foundations that form the basis of the study. The first section includes relevant publications and studies related to web accessibility published between 2007 and 2020. Relevant keywords included Web Accessibility, Americans with Disabilities Act (ADA) compliance, online accessibility, and Universal Design for Learning (UDL). Studies selected have focused on educational, governmental, and commercial sectors, and these studies have examined perceived issues with accessibility in order to develop strategies and implement solutions in order to overcome perceived issues and gaps in accessibility.

The second section discussed the theoretical and practical foundations related to this study. The theoretical foundation focused on the development of UDL and its foundations in neuroscience and Universal Design (UD). The theoretical foundation also an overview of the instructional design process and selected case studies related to UDL. The practical foundations outline the legal, technical, and ethical concerns related to accessibility in educational technology and online education. This evaluation included legislation such as the ADA and the Rehabilitation Act. Additionally, this section examined accessibility standards outlined by the Web Content Accessibility Guidelines (WCAG) and accessibility requirements for Quality Matters (QM).

Review of Selected Studies

Vollenwyder, et. al. (2018). In "Salient Beliefs Influencing the Intention to Consider Web Accessibility," Vollenwyder, et al. (2018) identified a series of twelve

salient beliefs related to the development of accessible Web content. The work of Vollenwyder, et al. (2018) used the Theory of Planned Behavior (TPB). Central to TPB is the concept of intention, and how attitudes, norms and behavioral controls shape one's intention to perform specific behaviors (p. 354). Examples of the salient beliefs discussed in the research study included personal effort, social responsibility, business opportunity, product quality, user advocacy, legal compliance, self-perception as specialist, awareness and priorities, requirement conflicts, technical compatibility, limited resources, and knowledge and skill (p. 354).

The study undertaken by Vollenwyder, et al. (2018) consisted of an online questionnaire distributed to 345 web practitioners worldwide in the private sector, private sector, governmental organizations, science and education, and non-governmental organizations (p. 355). The study showed that all beliefs were significant in influencing behavior, except for legal compliance and technical compatibility (p. 356). Vollenwyder, et al. (2018) indicated that "User advocacy emerged as the most important salient belief, influencing the formation of attitude as well as subjective norm regarding the consideration of Web Accessibility" (p. 356). The study authors indicated that a majority of participants had favorable attitudes towards Web Accessibility. Additionally, Vollenwyder, et al. (2018) emphasized that "although user-centered design methods are well-established in web development, users with disabilities are presently rarely involved in these processes" (p. 356-357). Ultimately, organizations should include users with a variety of abilities in the development of web-based content as a component of promoting the development of accessible web content.

Lorca, DeAndrés, and Martínez (2017). The study "The Relationship Between Web Content and Web Accessibility at Universities: The Influence of Social and Cultural Factors" explored how national cultural values affected the accessibility of university web content at a selection of European universities. According to Lorca, et al. (2017), "The main objective of this research is to test whether universities, which make stronger efforts to improve the quality of their web contents, also take into account WA issues to ease the access to such contents" (p. 312).

Their methodology included the use of the Web Content Accessibility Guidelines (WCAG) to determine the level of web accessibility for university web pages examined by the study, as well as the use of the Webometrics Rating (WR) to determine overall quality of web content. The cultural values explored by the study included the level of individualism, power distance, uncertainty avoidance, and level of masculinity. The study results determined that "Websites of universities from Anglo-Saxon countries are clearly more accessible than the others. Nordic universities seem to have lower levels of WA than those from Latin and Germanic countries," but no significant differences were found between Latin and Germanic universities" (p. 324).

Scott, Temple, and Marshall (2015). In a study by Scott, et al. (2015), the authors examined "Whether three online courses in a graduate-level program are aligned with the UDL principles, and whether teachers enrolled in the online courses perceive that the course design helped to improve their preparation" (p. 104). The authors designed three graduate teacher education courses utilizing the core UDL principles, which included multiple means of representation, expression, and engagement. A 32-item survey instrument was developed and distributed to pre-service and in-service teachers

and was used to evaluate the subjects' perceptions on the course's alignment with UDL principles (p. 106).

"The findings revealed a consensus across participants with respect to whether the online graduate courses aligned with the UDL principles. Specifically, participants rated highly each of the UDL guidelines embedded in the course" (Scott, et al., 2015, p. 108). Scott, et al. (2015) also mentions, "The findings may suggest that the utilization of the UDL principles in online college coursework is promising, and that participants strongly agree having UDL principles infused into online courses may positively impact their learning and preparation" (p. 108).

Boothe, Lohman, and Owiny (2020). The study authors' focus was on the application of UDL principles in an undergraduate special education program. Boothe, et al. (2020) discuss that, "For this action research study, we focused on the "how" of learning through the multiple means of action and expression principle. University faculty can change the way they meet diverse needs in their courses by adjusting the ways students demonstrate their understanding." (p. 4). The authors encouraged students to choose how to demonstrate their knowledge of special educational standards set forth by the Council for Exceptional Children (CEC). Boothe, et al. (2020) stated, "As special education teacher educators, we must design instruction that supports teacher candidates in meeting these CEC standards to ensure candidates are appropriately prepared for special education classrooms according to national standards" (p. 4).

Based on the results of their study, Boothe, et al. (2020) noted, "Responses regarding the use of UDL included the concepts that providing choices allows teachers to embrace all the different ways students prefer to learn; in addition, providing choices to

education students helped them to realize they can offer more choices in their own classrooms" (p. 12). In addition, the authors noted that participants were willing to include UDL principles in their classrooms, being more flexible and open to other ideas, as well as being more engaged with the content and learning activities. Ultimately, Boothe, et al. (2020) felt that participants were able to meet their project goals and could create instruction that allows for multiple means of engagement and expression.

Mancilla and Frey (2021). In this study, the authors surveyed university administrators and other select individuals at 273 institutions of higher education and focused on five areas of ensuring accessibility to online instructional resources, which included institutional policies, administrative processes, technology tools, course development practices, and professional development needs (p. 6). The survey results showed that some accessibility practices required more effort than others. The results identified key barriers to incorporating fully accessible online and hybrid courses. Barriers to developing fully accessible online courses include lack of time, funding, and lack of institutional policies regarding accessible course materials.

According to Mancilla and Frey (2021), "It is critical for campus administrators to establish a culture of inclusivity that undergirds all online course development efforts and prioritizes the digital accessibility of instructional materials" (p. 11). As a result, it is crucial that university administrators provide faculty with the tools and training necessary to ensure the development of accessible online educational resources.

Cao and Loiacano (2019). In this study, the authors acknowledge the limited depth of knowledge and awareness of web developers related to the creation of accessible online content. As such, the study authors sought to understand the extent to which web

developers are familiar with accessibility requirements in their educational backgrounds. Cao and Loiacano (2019) acknowledged "Different types of disabilities present unique barriers to users and unique challenges to website and app developers because users need different accessibility features" (p. 34), and that accessible web design promotes ease of use for all users, even users who do not identify with having a specific disability.

Cao and Loiacano (2019) indicated that participants rated their exposure to the concept of Web Accessibility, of which "42% of the participants report that their level of exposure to accessibility is a moderate amount and 28% report that their level is a little" (p. 38). Additionally, the authors investigated the participants' level of exposure to three sets of accessibility guidelines, which included the ADA, Section 508 and the WCAG (Web Content Accessibility Guidelines). Cao and Loiacano (2019) reported that "it is observed that many of the participants are not familiar with accessibility guidelines at all (57%) and only 26% are familiar with one accessibility guideline" (p. 39), which the authors acknowledged was very low.

These research studies have demonstrated the importance of applying Web Accessibility within online learning environments. Furthermore, these studies also documented the challenges faced by faculty and institutions of higher education related to the implementation of Web Accessibility such as a lack of resources and training. These studies also have emphasized the importance of instructional design and application of UDL theories in the creation learning environments that were accessible to learners of all users. This approach can be accomplished through the design of materials to appeal to variability in learning processes exhibited by diverse learners.

Conceptual Framework

Theoretical Foundations

This research study on the use of professional development to improve Web Accessibility for courses taught by faculty was based on the theoretical foundations of Universal Design for Learning (UDL). UDL was in turn based on the theories of Universal Design (UD), which was developed to promote universal accessibility in the built environment. Furthermore, UDL was also grounded in the principles of neuroscience, which is the study of how neural networks in the brain interact as a part of the learning process. Variability of learners was a key focus of UDL, and Web Accessibility represented an important outcome of creating learning environments that were responsive to the needs of learners, as well as the environmental and cultural factors that influenced the learning context. Gronseth (2018) has provided the following explanation for the relationship between UDL and accessible web content: "Inclusive design for online and blended courses connects the Web Content Accessibility Guidelines (WCAG) and Universal Design for Learning (UDL) framework in order to address learner variability as an intentional part of course design" (p. 14).

Universal Design for Learning. UDL is a foundational theory and design principle for designing learning environments which are accessible to diverse audiences of learners. According to CAST (2018b), "Universal Design for Learning is a framework to improve and optimize teaching and learning for all people based on scientific insights into how humans learn" (n.p.). Both UDL and Web Accessibility are focused on reducing barriers for learners and promoting universal access for all learners. For example, Gronseth, (2018) explains, "Designing for all learners from the outset is at the core of the

Universal Design for Learning (UDL) framework, a set of curricular principles and guidelines that identify how to incorporate flexibility in the design and delivery of instruction" (p. 15).

UDL promotes the development of learning spaces that are accessible to a wide range of learners. UDL allows students to interact with content and their peers without barriers to accessibility. Meyer, et al. (2014) mention "Being able to largely predict specific types and ranges of variability in learners enables us to build corresponding kinds of flexibility into learning tools and experiences, thus making customization at the point of instruction feasible" (p. 87). Rose and Gravel (Cited in Gordon, et al., 2009) argue "UDL is an approach that addresses and redresses the primary barrier to making expert learners of all students: inflexible, one-size-fits-all curricula that raise unintentional barriers to learning" (p. 5).

Meyer, et al. (2014), identified the three guiding principles of UDL:

- Provide multiple means of engagement (the "why" of learning).
- Provide multiple means of representation (the "what" of learning).
- Provide multiple means of action and expression (the "how" of learning). (p. 89).

Meyer, et al. (2014) expands these three principles into nine guidelines structured into three layers. The top layer represents the highest-level learning goals focused on self-regulation, comprehension, and executive functions. The middle layer represents strategies for building expertise, and the bottom layer represents the removal of unnecessary barriers to learning (p. 111). Meyer, et al. (2014) explain that "each of the nine guidelines emphasizes areas of learner variability that could present barriers, or in a well-designed learning experience, present leverage points and opportunities for

optimized engagement with learning" (p. 111). Table 1 below provides an outline of the principles of UDL.

Table 1
UDL Guidelines

	Multiple means of engagement	Multiple means of representation	Multiple means of action and expression
Purpose	The Why of Learning	The What of Learning	The How of Learning
Network	Affective Networks	Recognition Networks	Strategic Networks
Access	Provide options for recruiting interest	Provide options for perception	Provide options for physical access
Build	Provide options for sustaining effort and persistence	Provide options for language and symbols	Provide options for expression and communication
Internalize	Provide options for self-regulation	Provide options for comprehension	Provide options for executive functions
Goals	Expert Learners who are purposeful and motivated	Expert Learners who are resourceful and knowledgeable	Expert Learners who are strategic and goal directed

Note. Adapted from "The UDL Guidelines", CAST (2018b), *Universal Design for Learning Guidelines.* Version 2.2. Copyright 2022 by CAST, Inc.

The UDL principle of providing multiple means of representation emphasizes the need to implement Web Accessibility in online course environments. Regarding the emphasis on multiple means of representation for diverse learners, CAST (2018b) emphasizes the reduction of barriers in learning. "It is important to ensure that key information is equally perceptible to all learners by 1) providing the same information through different modalities [and by] 2) providing information in a format that will allow for adjustability by the user" (n.p).

Rogers-Shaw, Carr-Chellman, and Choi (2018) explain, "The use of Universal Design for Learning (UDL) is effective in enhancing a learner's ability to acquire, generate, and use new knowledge. Its coincidence with technological developments and

advances has afforded the opportunity for greater inclusivity" (p. 20). UDL allows for inclusive learning environments for all learners, rather than focusing on individual deficits.

Ableser and Moore (2018) note, "While UDL aims at a broad range of learners, digital accessibility focuses on learners who have particular needs related to sensory, physical, and/or cognitive impairments" (n.p.). UDL and Web accessibility are complementary—UDL provides the theoretical framework, and Web Accessibility provides the tools and skills necessary to make content accessible to diverse learners.

UDL requires multiple means of engagement for diverse students in a learning environment. Boothe, et al, (2018) explain, "Multiple means of engagement and the affective network focus on actions taken by both students and faculty to increase active participation in learning course material" (p. 4). Ultimately, providing multiple means of engagement and expression is a method of empowering students to make their own choices in demonstrating their mastery of learning content. This is made evident by Boothe, et al. (2020), who explain, "By allowing students to choose how to demonstrate their understanding, it is the expectation of the authors that students were more actively engaged in learning and gained a better understanding of the course content while completing their final projects" (p. 3-4). Boothe, et al, (2020) indicates, "Multiple means of action and expression is focused on the outcome or how students demonstrate they understand the content being taught" (p. 3). Students can express themselves through multiple media to demonstrate knowledge or application of skills.

The purpose of UDL in educational experiences is to ensure access for all users. This development allows for users of all abilities to access an education and partake as

equals in a community of learners. Tobin and Behling (2018) discuss, “In doing so, we also make it easier for our learners to achieve their goals, with a significant side benefit of making it easier for us to teach courses and deliver student-and faculty-facing services as well (p. 1). Furthermore, “UDL asks educators to reframe their understandings of knowledge and the way that knowledge is operationalized within the learning environment” (Rogers-Shaw, et al., 2018, p. 22).

The goal of UDL is to promote equal access and equity in learning environments. This goes beyond the provision of specific academic accommodations to promote equal accessibility amongst students. The WHO recognizes, “Many of the barriers people with disabilities face are avoidable and the disadvantage associated with disability can be overcome” (p. 2). Therefore, it is important for instructors to be aware of barriers that may present difficulties for learners, and to focus on ways to design content that is accessible to all users. Steinfeld and Maisel (2012) mention, “Much of life is about overcoming barriers. Every organism, from lowly one-celled animals to human beings, exists by interacting with its environment. This interaction includes moving from one place to another, creating a space for the self, lifting a load, or learning how to use a tool” (p. 1). As individuals interact with their environment, it is important to pay attention to barriers and how they affect access to learning and the environment. It is also important to keep in mind that while a single barrier may be surmounted easily by one person, others may find the same barrier to be insurmountable.

Accessibility in online course environments is a critical part of the instructional design process. Henry (2007) discusses, “When accessibility is considered early and throughout design, it can be seamlessly and elegantly integrated with overall product

design" (p. 9). When accessibility is a guiding factor in implemented as part of the design process, the end results are more satisfactory to the end user. Users can expect a consistent look and feel as they work through the result. The principles of UDL emphasize evaluation and continuous improvement, as opposed to a focus on deficiencies or failure. Meyer, et al. (2014) explains, "Monitoring progress and making adjustments are a normal part of our work as both learners and teachers—and a natural way to grow" (p. 108).

Regarding including accessibility in course design, Henry (2007) reports, "If accessibility is only addressed late in product design, it can be very costly to make required changes. Furthermore, accessibility 'tacked on' at the end is usually much less effective for people with disabilities and less beneficial for others" (p. 9). Accessibility should be a consideration at all stages of the design process, from conceptualization to the evaluation of the final product.

Rogers-Shaw, et al. (2018) points out that "essential to understanding and incorporating UDL principles is acknowledging that, although systematic design and planning is a key to effective online instruction, one strategy does not necessarily meet the needs of every student" (p. 22). Therefore, UDL provides instructors with opportunities to experiment with different methods of presentation and assessment in order to optimize the learning experience for as many students as possible.

Meyer, et al., (2014) emphasize the development of flexible, expert learning systems and environments to support the needs of learners at multiple skill levels and to help learners stay relevant in a changing environment. "Expert learners come in many guises, and our educational environments should nurture and validate them all. This

vision is a significant shift from the traditional mentality of education systems as they currently exist. The framework of universal design for learning can enable that shift" (p. 47). Concluding their discussion on UDL theory and practice, Meyer, et al. (2014) explain,

> Integrating UDL into curriculum practices involves planning from the outset for systematic variability among learners along key dimensions: how they perceive information, how they act on it, and how they are motivated by a task. Whether teachers are explicitly designing curriculum or choosing and assembling curricular elements, the practice of UDL rests on addressing learner variability through its three principles (p. 86).

UDL represents a fluid approach to instructional design that is reflective of the skills and needs of learners, as well as the context in which learning occurs. UDL emphasizes the importance of learning communities, and developing accessible learning environments to accommodate variability in all learner is a process of continuous improvement.

Universal Design. The theory of UDL has its roots in Universal Design (UD) in architecture and space planning. Meyer, et al. (2014) discuss, "We see that poor design can exclude some people from participation and restrict available paths and strategies. In the design of a Rubik's Cube™, just as in any good learning design, supporting user variability is critically important. This is called Universal Design" (p. 29). Additionally, Steinfeld and Maisel (2012) discuss, "The concept of universal design emerged through the disability rights movement, […]. Early experience with the concept has led leaders in

the field to expand beyond those origins and to identify connections with design for aging, social sustainability, and user centered design" (p. xiv).

UD is a design philosophy in architecture identified by Mace, Hardie, and Place at North Carolina State University College of Design. Mace, et al. (1996) discuss, "Universal design means simply designing all products, buildings, and exterior spaces to be usable by all people to the greatest extent possible. It is advanced here as a sensible and economical way to reconcile the artistic integrity of a design with human needs in the environment" (p. 2). Expanding on the concept of UD, Steinfeld and Maisel (2012) discuss, "Crafting the built environment to reduce the undesirable impact of real and metaphorical barriers in order to facilitate social participation is a relatively new field of study, with roots in the civil rights movement and efforts to achieve social justice" (p.1).

The philosophy of UD has its roots in the broader civil rights movement, which was concerned with social justice and achieving equality for all. Steinfeld and Maisel (2012) add, "The barrier-free design movement actually began in the late 1950s in the United States as advocacy groups found that universities were not accessible to returning war veterans and young adults who had contracted polio during the postwar epidemic" (p. 35-36).

Additional aspects of UD include being responsive to and working with those who use the space on a regular basis. Steinfeld and Maisel (2012) provide additional context for the evaluation of UD and its role in the present day: "Universal design has much to contribute to solving any social problem in which usability, health and wellness, and social participation play a major role in design response" (p. 36). In short, design is

not solely in the realm of architects and engineers. Design is a representative process of the sociocultural elements of the communities that inhabit the designed space.

UD deemphasizes the nature of individual disabilities, and it places the focus on environmental obstacles and barriers. Mace, et al. (1996) emphasize, "The designer motivated to eliminate environmentally induced handicaps can assist in empowering people with all types of physical or cognitive disabilities to integrate as fully as possible into the mainstream of daily life" (p. 3).

Ultimately, UD requires designers to reconsider their design methodology and intended audiences. Steinfeld and Maisel (2012) explain, "Universal design is about dealing with barriers as artists or scientists would. It demands creative thinking and a change in perspective. It is not sufficient merely to apply design criteria in accessibility regulations in a mechanistic way. Often a change in perspective is needed" (p. 23). UD is more than simply applying accessible items to an existing design.

Rather, UD represents a shift towards creative thinking in overcoming challenges and eliminating barriers to access in public spaces in order to create usable spaces for all. Inclusive public spaces help to facilitate interaction and the development of community in public spaces. UD represents equal access to for all users to interact within a public forum and gives those marginalized an opportunity to interact comfortably with others.

In some fashion, the approach of UDL mirrors the approach of design in the physical world. The result of the Americans with Disabilities Act (ADA) was to create facilities that are accessible to all individuals, and not just those who possess disabilities. Title III of the ADA emphasizes that "public accommodations must remove barriers in existing buildings where it is easy to do so without much difficulty or expense, given the

public accommodation's resources" (US Department of Justice, 2009, n.p.). Tobin and Behling (2018) discuss, "The fight for equal access rights to the built environment may seem to be largely won, thanks to the advocacy of people with disabilities and their allies. The end result has been to make the physical world more accessible for everyone – not just for people with disabilities" (p. 3). In effect, the goal of UDL is to make learning environments accessible to everyone, and not just those with disabilities, and to reduce barriers in the learning environments, like how the ADA pushed for the removal of accessibility barriers in the physical realm.

While UDL mirrors the development of accessible physical environments, there are some key distinctions to be made. For instance, Edyburn (2010) discusses "the interactions between individuals and the built environment (e.g., stairs, doorways, countertops) are static and limited. In contrast, the interaction between a reader and a text involves complex physical, cognitive, and social interactions to make sense of the information" (p. 36). Learning environments are complex systems based on human interaction and are shaped by the dynamics formed between the interaction of learners, teachers, and learning content. Furthermore, instructional design considerations must consider learning objectives, assessments, goals and learner behaviors.

Neuroscience. In addition, neuroscience has contributed to the development of UDL theory. According to CAST (2018b), "UDL was inspired by such advances in cognitive neuroscience research and offers a framework that integrates what we know about the learning brain to inform the design of environments that support all learners" (p. 1). Meyer, et al. (2014) state, "Modern neuroscience views the brain as a complex

web of integrated and overlapping networks. And learning is seen as changes in the connections within and between these networks" (p. 51).

Mareschal, Buttersworth, and Tolmie (2013) explain, "The goal of educational neuroscience is to work out how all learners can be helped to achieve their learning potentials and to make learning more effective for all learners" (p. 2). Mareschal, et al, (2013) point out that education seeks out the answers for two primary questions involving the sources of individual differences in learning, and what contexts are optimal for the learner (p. 2). These two questions align with the study of UDL by addressing individual differences in learning, as well as providing foundational contexts for learning.

As the study of neuroscience advances, it is possible to understand more about the workings of the human mind and apply these discoveries to promote learning environments that are productive and inspirational for learners. For instance, Mareschal, et al. (2013) discuss, "These new [research and imaging] methodologies have enabled us to explore both individual differences in children and education in new ways, suggesting a direct bridge from neuroscience to education" (p. 6).

CAST (2018a) states, "Recognizing our brains are goal-driven is important for educators, because if we don't make learning goals explicit to our learners, they have no way of knowing what the target is, how to reach it, or when they've achieved it" (n.p.). Mareschal, et al. (2013) emphasize, "Educational psychologists and cognitive neuroscientists have recognized that it is possible to build more integrated models of learning, which do better justice to this complexity by bringing together social and cognitive or cognitive and neural processes" (p. 7). CAST (2018a) discusses, "the concept of neuro-variability is important for educators, because it reminds us that learners

do not have an isolated learning 'style,' but rely on many parts of the brain working together to function within a given context" (n.p.).

The study of brain learning, or the development of memory represents a foundational relationship between neuroscience and education. According to Howard-Jones (2009), "Among neuroscientists, there is a common acceptance that human learning, as in the formation of memory, occurs by changes in the patterns of connectivity between neurons – or 'synaptic plasticity.' There are two key ways in which this can occur, known as long-term potentiation (LTP) and long-term depression (LTD)." (p. 81). Howard-Jones (2009) also states, "In addition to producing micro changes at the cellular level in terms of connectivity, learning can also produce gross structural changes in the brain" (p. 81).

Regarding learning and the structure of the brain, Meyer, et al. (2014) identifies three primary neural networks that are involved in the learning process. These networks include affective networks, recognition networks, and strategic networks:

- Affective networks that monitor the internal and external environment to set priorities.
- Recognition networks that sense and perceive information in the environment and transform it into useful knowledge.
- Strategic networks that plan, organize, and initiate purposeful actions in the environment (p. 54).

These neural networks are heterarchical and specialized in relation to the learning process. UDL helps connect the basics of neuroscience to principles related to learning. "This new view of neuroscience is deeply relevant to education, not only because it deals

directly with issues of learning, but because it provides a foundation for understanding the nature and origins of learning variability" (Meyer, et al., 2014, p. 51).

Expanding on the relationship between neuroscience and learning, Meyer, et al. (2014) discuss, "Through Universal Design for Learning, we provide a structured framework to account for much of the variability of all the individuals in a given learning environment to design the environment to be flexible" (p. 56). The learning environment is important in ensuring successful learning outcomes for students.

Affective networks are the parts of the brain that identify priorities, and these networks also shape experiences and actions. According to Meyer, et al (2014), "Our brains are purposeful, goal-driven networks that have evolved to bias our perceptions and actions in ways that make them very much more subjective than objective" (p. 58). As such, affect leads to the prioritization of which is more important to oneself. Affect also has a significant impact on how individuals learn.

Recognition networks, which are located in the posterior cortex lobes, are the parts of the brain that identify colors and environmental patterns. Meyer, et al. (2014) discuss: "[Recognition networks] recognize the visual color patterns that signal ripe fruit, the sound patterns that signal running water, the smells that distinguish rotted food, the taste of sugar. They enable us to recognize voices, faces, letters, and words, as well as more complex patterns" (p. 66). Different parts of the brains process visual and auditory recognition, and recognition networks are highly specialized.

The specialization of recognition networks poses key points about individuals and learning. "First, the evidence on specialization sharpens our understanding of how complex the tasks we assign to students really are. Typically, brain images reveal that

seemingly simple tasks place widely varied, distributed demands on the brain." (Meyer, et al., 2014, pp. 67-68). Additionally, the ways in which individuals differ is myriad and infinite. Meyer, et al. (2014) further explain, "It is especially important to design lessons so that systematic variability is anticipated from the outset. When this is not done, unexpected demands and difficulties are imposed on all students, and their effects are not equal" (p. 68).

Recognition networks are heterarchical. Meyer, et al. (2014) report that "our brains don't just passively receive information in that bottom-up way. Instead, our brains are constantly and persistently anticipating and predicting what patterns we will see, hear, smell, taste, or touch, and those expectancies profoundly affect what patterns we actually do perceive" (p. 69).

Recognition networks represent a high level of variability amongst individuals, even though all human brains utilize the same structures for recognition. Meyer, et al. (2014) note that "while most humans show increased activity localized to the back of the brain when they are recognizing an object visually, the exact magnitude, location, and distribution of that increased activity is variable" (p. 71).

The highest level of recognition networks manages executive function. According to Meyer, et al. (2014), "These areas are specialized for setting broad or longer-term goals for action, making plans for effective strategies, monitoring progress toward goals, and making course corrections as necessary" (p. 76). Executive function relates to an individual's ability to plan long term plans and strategies to accomplish learning goals. Additionally, context and affect result in immense variability in the brain's handling of both simple and complex tasks.

Meyer, et al. (2014) discuss, “Recognition is actually a highly complex set of processes and is highly variable from person to person. This understanding may convince those who create learning environments to embed maximum flexibility so that flexibility (sic) so that no learners are constrained in their learning opportunities” (p. 71). Recognition varies amongst different learners, and individuals have different strengths when it comes to different areas of recognition. Therefore, it is important for learning designers to keep in mind differences in recognition to help support weaknesses while nurturing strengths in different learners.

The third network identified by Meyer, et al. (2014) is the strategic network. Strategic networks represent the brain’s capacity for planning and organization. These networks develop strategies for completing specific tasks from the simple to the very complex. Meyer, et al. (2014) discusses: “the strategic networks are highly specialized in several ways. The most familiar is specialization for various body movements (p. 74).

Strategic networks are heterarchical, with many layers of networks necessary to perform basic and complex actions. The lowest level is the primary motor cortex which stimulates action in muscles. Higher level areas work to sequence muscle movements into actions. Meyer, et al. (2014) explains that “this part of strategic networks sequences and coordinates a large number of simple movements into an effective series of actions that accomplish goals such as speaking, walking, jumping, dancing, or playing basketball” (p. 75-76).

Strategic networks exhibit a high degree of variability. Meyer, et al (2014) explain that “recent brain imaging experiments provide a novel illustration of individual differences in strategy. When two individuals are confronted with the same problem but

solve it using different cognitive strategies, brain images reveal two very different patterns of activity" (p. 77). Meyer, et al. (2014) further explain the concept of variability in the context of learning. "Differences in strategic networks manifest themselves in various ways in the classroom. For example, early learners differ dramatically in their ability to acquire and automatize routines such as forming letters, typing, spelling, and multiplying" (p. 77).

Neural networks are adaptable based on environments, and changes in neural network demonstrate the process of learning. Neuroscience also helps to explain the variability between learners. In connecting neuroscience with learning and UDL, Meyer, et. al (2014) explain:

> One of the most important revelations emerging from brain research is that the notion of broad categories of learners—smart/not smart, disabled/not disabled, regular/not regular—is a gross oversimplification that does not reflect reality. By categorizing people this way, we place an undue burden on individuals to adapt themselves in all their wonderful diversity to inflexible learning environments. Chief among these expectations is that our learning environments be designed with a deep understanding and appreciation for individual variability. That is a fundamental premise of universal design for learning and the educational systems made with UDL principles in mind (p. 82).

Practical Foundations. The World Health Organization (WHO) (2011) notes that people with disabilities have more limited access and encounter barriers to accessing public services such as education. Individuals with disabilities have access to fewer resources, a lack of adequate funding for assistance programs, and fewer opportunities to

participate in public policy discussions. The implementation of UDL and Web Accessibility lead to practical considerations related to inclusivity, legal compliance, and best practices for implementing accessible technologies. Therefore, it is important for higher education institutions to evaluate how UDL and accessibility requirements fit within their missions.

As a result, faculty and staff should work on workable strategies for implementing basics of UDL, as well as the legal and technical underpinnings of accessibility requirements. Ultimately, the goal is to promote learning for all students, and to help students regardless of background or ability. Expanding on this idea, Bracken and Novak (2019) discuss: "Only when our [higher educational institutions] are universally designed to meet the learning requirements of all learners, will student graduates realize their true learning potentials in the wider worlds of social well-being, creativity, and employment" (p. 3).

Regarding the evolution of disability rights and the emergence of universal design philosophy, Steinfeld and Maisel (2012) discuss,

> Despite all the antidiscrimination laws and changes in public policy, examples of significant barriers exist in high-income communities, and the barriers to independence and autonomy in low-income settings are very severe. Social integration, acceptance, and understanding of disability have not yet been achieved in human civilization. There is a typical trajectory in architecture as societies develop more advanced perspectives on disability. The first stage is the architecture of exclusion, usually by neglect. The second is one of dependence through the development of institutions. The third stage is independence through

> the development of a legal framework and physical environment that eliminates discrimination and removes barriers to independence. We are now moving toward a new stage in many societies: the architecture of social participation, with the goal of equality in opportunity through universal design (p. 21).

In short, the legislation supporting the inclusion of those with disabilities is not enough to ensure accessibility for all users. Therefore, it is important to develop a cultural understanding of the need to make accessible content as a matter of ethics. In addition, accessibility is a necessary social conversation amongst members of society.

Legal and Ethical Compliance. Institutions of higher education traditionally upheld the existence of elite classes within society. Bracken and Novak (2019) acknowledge, "[Higher education institutions] continued to replicate this status quo, and whether unwittingly or purposefully, erected barriers that blocked participation from individuals or groups who differed from those traditional students who excelled with predictable, inflexible, 'one-size-fits-all" curriculum and instruction" (p. 1).

However, in recent years, higher education institutions have taken on a more democratic role in society, and institutions have placed more emphasis on inclusivity. Bracken and Novak (2019) further acknowledge that society benefits from the inclusion of diverse learners. Furthermore, Bracken and Novak (2019) explain: "To optimize student learning, educators need to take advantage of the affordances inherent in enabling technologies to reconceptualize how all students, but especially those who may traditionally have been marginalized, can engage effectively with quality learning experiences" (p. 2).

Educational institutions and their representative faculty members have an ethical and legal obligation to ensure that educational materials, whether physical or digital, are accessible to learners with disabilities, and that learners with disabilities have equal access and opportunity to participate in educational activities. The legal requirements are outlined under Section 504 of the Rehabilitation Act and the Americans with Disabilities Act of 1990, which ensures that institutions who receive federal educational funds do not discriminate based on disability, and institutions must make reasonable accommodations for such students.

Furthermore, legal considerations for accessibility should be a key component in evaluating learning technology products and services, and procurement processes should work to ensure that products and services chosen comply with accessibility guidelines. These laws include the Americans with Disabilities Act and Sections 504 and 508 of the Rehabilitation Act.

Section 504 states "No qualified individual with a disability in the United States shall be excluded from, denied the benefits of, or be subjected to discrimination under any program or activity that either receives Federal financial assistance or is conducted by any Executive agency or the United States Postal Service" (United States Department of Justice, 2009, n.p.). Additionally, Section 508 "establishes requirements for electronic and information technology developed, maintained, procured, or used by the Federal Government.

Section 508 requires "Federal electronic and information technology to be accessible to people with disabilities, including employees and members of the public" (United States Department of Justice, 2009, n.p.). Sections 504 and 508 require that

educational institutions that receive federal funding to prohibit discrimination based on disability, and that technology products must be accessible to individuals regardless of disability.

Section 508 also places the responsibility of creating accessible content on faculty and instructors. Bradbard and Peters (2010) discuss, "Section 508 could be interpreted as applying to individual faculty members who are an integral part of such universities. Thus, individual faculty members could be held liable (or responsible) for complying with the legal mandates of Web accessibility for the individual Web sites they create and use for instructional purposes" (p. 2-3). As a result, instructors must be familiar with how to design and make content accessible to students. It is important for educational institutions to provide support for instructors on how to create accessible content.

The Americans with Disabilities Act (ADA) extends the conditions set forth in the Rehabilitation Act to all public facilities. The ADA also prohibits employment discrimination for individuals with disabilities. "On July 26, 1990, President George H. W. Bush signed into law the ADA, a comprehensive civil rights law prohibiting discrimination on the basis of disability" (U.S. Department of Justice, 2012, n.p.).

The ADA protects the rights of individuals with disabilities with accessing employment and participating in places of public accommodation. Furthermore, the ADA requires that "Employers make reasonable accommodation to the known physical or mental limitations of otherwise qualified individuals with disabilities, unless it results in undue hardship" (U.S. Department of Justice, 2009, n.p.). Additionally, the ADA stipulates "In order for an entity to meet its legal obligation under the ADA, an entity´s alternative must provide an equal degree of access in terms of hours of operations and

range of information, options, and services available" (U.S. Department of Justice, 2012, n.p.). Therefore, educational institutions must provide accommodations or design public spaces in such a way to accommodate as many diverse users as possible.

The ADA allows for individuals who have been denied employment or the ability to fully participate in a place of public accommodation legal recourse for discrimination. Affected individuals may file a complaint with the U.S. Equal Employment Opportunity Commission or through lawsuits in private courts. The Department of Justice (2012) states, "Being unable to access websites puts individuals at a great disadvantage in today´s society, which is driven by a dynamic electronic marketplace and unprecedented access to information" (n.p.).

The text of the ADA does not mention web sites specifically. However, "The United States Department of Justice (DOJ), the agency responsible for regulating and enforcing the ADA, has long considered Web sites that offer goods or services to consumers to be 'places of public accommodation,' which must be accessible to the disabled" (Arenth, 2019, p. 12-13). Web resources of any institution offering services to the public must be designed to be accessible to all users. Arenth (2019) mentions, "It is a lack of accessibility that has given rise to lawsuits by the disabled against Web site owners, whether as an individual suit or by class action. Under the ADA, these suits seek injunctive relief (i.e., remediation of the Web sites) and attorneys' fees" (p. 13).

State or subnational disability rights laws, the United Nations Convention of the Rights of Persons with Disabilities, and the European Accessibility Act (EAA), which governs accessibility requirements in European Union member states, may present additional legal obligations for creating accessible online educational environments.

Since laws may vary based on jurisdiction, it is imperative that individuals research applicable law and note differences in applying legal requirements for Web Accessibility.

> The Internet has been governed by a variety of voluntary standards or structures developed through nonprofit organizations using multinational collaborative efforts [and] it has been the policy of the United States to encourage self-regulation with regard to the Internet wherever possible and to regulate only where self-regulation is insufficient and government involvement may be necessary (US Department of Justice, 2012, n.p.).

The US Department of Justice (2012) further notes that while voluntary regulation has been sufficient when compliance correlates well with profitability, compliance with ensuring Web Accessibility has often come up short.

It is important for educational institutions to be proactive in ensuring the accessibility of organizational web sites, due to the potential threat of lawsuits for failing to accommodate individuals with disabilities. Arenth (2019) mentions, “To be proactive, a company should first check its Web site and take steps to evaluate its site for compliance with WCAG 2.0 and general accessibility to the vision and hearing impaired before it gets sued” (p. 14).

If organizations take proactive steps in ensuring accessibility, they may be more likely to receive a disposition in their favor. Regarding this matter, Arenth (2019) discusses, “The results in some ADA Web site cases suggest that a court may look favorably upon a defendant that has initiated ADA Web site compliance efforts that are independent of a lawsuit serving as the catalyst of that effort” (p. 14).

Overall, the impact of the ADA is quite overarching in an increasingly digital society, as the Internet becomes a primary method for individuals to interact with public organizations and private individuals. Ultimately, the goal of the ADA is to provide accommodation and equal access for all individuals, regardless of physical or intellectual disabilities:

> The ADA´s promise to provide an equal opportunity for individuals with disabilities to participate in and benefit from all aspects of American civic and economic life will be achieved in today´s technologically advanced society only if it is clear to State and local governments, businesses, educators, and other public accommodations that their websites must be accessible (US Department of Justice, 2012, n.p.).

Legal obligations are not the only driving factor influencing the development of accessible web content in online higher education. For instance, Lorca, et al. (2017) note, "The finding that universities are committed with WA in all environments except that of the Developed Latin countries suggests that in these countries, the passing of regulations is not enough to ensure a proper access to web contents to persons with disabilities" (p. 326). Therefore, decisions relating to Web Accessibility should be considered both an ethical and legal obligation, as well as a best practice of web design and the design of online educational environments.

Web Content Accessibility Guidelines. Another practical consideration regarding the creation of accessible web content is the Web Accessibility Initiative (WAI), which is sponsored by the World Wide Web Consortium (W3C). As part of the WAI, the W3C

publishes a list of standards known as the Web Content Accessibility Guidelines or WCAG. According to the W3C (2019a),

> The WAI, in partnership with organizations around the world, pursues accessibility of the Web through five primary activities: (1) Ensuring that core technologies of the Web support accessibility, (2) developing guidelines for web content, user agents, and authoring tools, (3), facilitating development of evaluation and repair tools for accessibility, (4) conducting education and outreach, (5) coordinating with research and development that can affect future accessibility of the Web (n.p.).

The WCAG provides standards for the design of accessible Web content. The "WCAG is developed through the W3C process in cooperation with individuals and organizations around the world, with a goal of providing a single shared standard for web content accessibility that meets the needs of individuals, organizations, and governments internationally" (W3C, 2019b, n.p.). The first standard published by the W3C was WCAG 1.0 in 1999. "It included 14 guidelines, ranging from the need to provide text equivalents to considering clarity and simplicity on the web. Each guideline had between one and 10 supporting checkpoints" (Bureau of Internet Accessibility, 2019, n.p.).

WCAG 1.0 was succeeded by WCAG 2.0 in December 2008, which broadened the application of WCAG 1.0 and "introduced the four guiding principles of accessibility, stating content must be perceivable, operable, understandable, and robust, supported by success criteria for meeting those principles. WCAG 2.0 reigned as the gold standard for a long time and was supplemented with WCAG 2.1 in June 2018" (Bureau of Internet Accessibility, 2019, n.p.)

Additionally, “Web Content Accessibility Guidelines (WCAG) 2.1 defines how to make Web content more accessible to people with disabilities. Accessibility involves a wide range of disabilities, including visual, auditory, physical, speech, cognitive, language, learning, and neurological disabilities (W3C, 2018, Sec. 0.1)

The WCAG 2.1 is used by many organizations such as software developers, corporate organizations, educational institutions, and governmental bodies to design Web content that meets accessibility standards. The W3C (2018) states, “In order to meet the varying needs of this audience, several layers of guidance are provided including overall *principles*, general *guidelines*, testable *success criteria* and a rich collection of *sufficient techniques*, *advisory techniques*, and *documented common failures* with examples, resource links and code”. (Sec. 0.2)

Principles: At the top are four principles that provide the foundation for Web accessibility: *perceivable, operable, understandable, and robust.*

Guidelines: Under the principles are guidelines. The 13 guidelines provide the basic goals that authors should work toward in order to make content more accessible to users with different disabilities.

Success Criteria: For each guideline, testable success criteria are provided to allow WCAG 2.0 to be used where requirements and conformance testing are necessary such as in design specification, purchasing, regulation, and contractual agreements. In order to meet the needs of different groups and different situations, three levels of conformance are defined: A (lowest), AA, and AAA (highest).

Sufficient and Advisory Techniques: For each of the *guidelines* and *success criteria* in the WCAG 2.0 document itself, the working group has also

> documented a wide variety of *techniques*. The techniques are informative and fall into two categories: those that are *sufficient* for meeting the success criteria and those that are *advisory*. The advisory techniques go beyond what is required by the individual success criteria and allow authors to better address the guidelines. (W3C, 2018, Sec. 0.2).

The W3C emphasizes that the four components work together to help developers make content more accessible. They note, "Authors are encouraged to view and apply all layers that they are able to, including the advisory techniques, in order to best address the needs of the widest possible range of users" as well seeking advice in ensuring that content is accessible for all users in a community as much as possible (W3C, 2018, Sec. 0.2).

Following the results of *Gil v Winn-Dixie*, which was the first ADA web accessibility suit to go to a bench trial in 2017, it is important for organizations to meet established standards for Web Accessibility. As Arenth (2019) discusses, "It was significant as the first case in which a judge ordered a business to comply with a particular standard by which to bring its site ADA compliant" (p. 14). As a result, "The DOJ, and now many courts since the *Gil* decision, have accepted the WCAG 2.0, Level AA, which were developed by the World Wide Web Consortium (a private industry group), as the applicable standard for Web site accessibility compliance" (Arenth, 2019, p. 14).

While the WCAG 2.1 serves as a foundational guideline to ensure accessibility and legal compliance, the W3C (2018) does acknowledge that even if all standards are met at the AAA level, it may not ensure equal access for all users (Introduction, Sec. 0.2).

Additionally, the WCAG has been critiqued for not providing greater accommodation for individuals with cognitive disabilities (James, Draffan, & Wald, 2017).

Quality Matters Program Requirements. Accessibility is a key component of the Quality Matters (QM) program. General Standard 8 of the Quality Matters Rubric for Higher Education, Sixth Edition, addresses accessibility of online courses. QM (2018) states, "The course design utilizes the principles of Universal Design for Learning (UDL), and reflects a commitment to accessibility, ensuring all learners can access all course content and activities, and to usability, ensuring all learners can easily navigate and interact with course components" (p. 39). General Standard 8 is composed of six specific review standards, of which three are essential standards[2]. The essential standards relate to the ease of use of course environments and tools, a high level of readability for text and graphics, and the provision of accessible files and web pages in order to meet the needs of all learners (QM Program, 2018). Generally, the QM rubric focuses on the design of the online course and promotes continuous improvement. (QM Program, 2018, p. 5).

The specific review standards for General Standard 8, Accessibility and Usability, are outlined here:

8.1. Course navigation facilitates ease of use.

According to the QM program (2018), "Navigation refers to the process of planning, controlling, and recording the movement of a learner from one place to another in the online course." Some elements of effective navigation include predictable course

[2] Essential standards are three-point standards that are considered to be high priority by Quailty Matters (QM). A course must earn all three-point (essential) standards in order to receive QM certification.

menu structures, easy to understand link descriptions, and the use of heading styles in web page content. (p. 38).

8.2. The course design facilitates readability.

The QM (2018) Rubric mentions, “Course design elements maximize usability by facilitating readability and minimizing distractions.” Some applications of this standard include formatting content to serve specific instructional purposes, consistent heading and body styles, and balancing text and graphics with white space (p. 38).

8.3. The course provides accessible text and images in files, documents, LMS pages, and web pages to meet the needs of diverse learners.

QM (2018) emphasizes the use of UDL guidelines to reduce barriers to access. “If a course or website is fully accessible, most learners will be able to access content, complete activities, and interact with others without the need for accommodations” (p. 38).

8.4. The course provides alternative means of access to multimedia content in formats that meet the needs of diverse learners.

“The Specific Review Standard is met if equivalent textual representations of multimedia content are located or linked within the course.” Examples of alternate means of access includes captioning or transcripts of audiovisual files, and textual descriptions of tables and figures. (QM Program, 2018, p 40).

8.5. Course multimedia facilitates ease of use.

“For this Specific Review Standard to be met, course multimedia are easy to view, operate, and interpret.” Instructors are encouraged to use appropriate image sizes,

clear audio, and dividing longer multimedia into smaller chunks. (QM Program, 2018, p. 40).

8.6. Vendor accessibility statements are provided for all technologies used in the course. (QM Program, 2018b, p. 38-41).

Regarding this standard, QM notes, "For this Specific Review Standard to be met, the courses include a link to the vendor accessibility statement for each required technology" (p. 40).

Of these Specific Review Standards outlined above, Standards 8.1, 8.2, and 8.3 are considered Essential standards worth three points each, and Standards 8.4, 8.5 and 8.6 are considered Very Important standards. For a course to pass a QM review, all essential standards must be met. Very Important and Important standards are not required to be completed for a course to become a QM certified course. (QM Program, 2018). As captioned multimedia items are not required for a course to obtain QM certification, it is possible a course can be QM-approved and not be fully accessible to all learners.

Best Practices for Promoting Accessibility. Developing a culture of promoting inclusivity and accessibility at an institution is a key component of promoting accessible learning and working environments. While legal factors such as the ADA are important for organizations to follow and uphold, legal compliance represents only a portion of creating a culture of accessibility. Legal and technical frameworks only leave a small impact on the desire to create accessible online spaces at an institutional level. For example, Vollenwyder, et al., (2019) state, "Despite the availability of the second edition of the WCAG since 2008 and their incorporation in legal obligations, Web Accessibility often remains at an unsatisfactory level" (p. 253-354).

Steinfeld and Maisel (2012) discuss, “Accessibility often is adopted only after a lawsuit, complaint, or other adverse event. Organizations that consciously plan are more successful in avoiding these events. Practicing universal design, in fact, is a proactive strategy that will reduce the probability of future problems with response to diversity of all types” (p. 86). Therefore, an institutional commitment to ensuring accessibility and building a culture of accessibility is important for encouraging accessible design.

Steinfeld and Maisel (2012) have identified seven key organizational components for promoting a culture of accessibility. These components include adopting a social model of function and ability, establishing the support of top-level administration, prioritizing inclusivity, taking a proactive approach to accessibility, making accessibility a shared task, ensuring the availability of organizational resources for promoting accessibility, and providing expertise in accessible design and practice (p. 85-86).

Regarding organizational culture and diversity, Steinfeld and Maisel (2012) discuss, “[the organization] must recognize that every aspect of its operations and its products and services needs to accommodate differences in function and ability as well as gender, race, sexual orientation, religion, ethnic background” (p. 85). Additionally, Meyer et al. (2014) explain, “Since education must be human-centered to be effective, any meaningful plan for change will begin and end with people” (p. 176). Consideration for accessibility must be person and organizationally centered in order to build a culture of accessibility.

Arenth (2019) also explains, “As the onslaught of ADA Web site accessibility claims continues to rise, taking steps now to recognize the challenges and issues these claims present and taking steps to mitigate them, is just good business practice” (p. 14). It

is important for businesses to be proactive in developing accessible web content in order to mitigate their liability in the event of a lawsuit. Fortunately, accessibility guidelines such as WCAG 2.1 and QM Standard 8 are valuable resources for designing accessible web content.

Gronseth (2018) discusses how the standards of the WCAG and the foundations of UDL work together to promote accessible course design. UDL serves as a theoretical foundation to address the design of learning content and accessibility to address multiple means of content representation, engagement with the content, and the variability of learner actions and expressions. Complementing the instructional components of UDL, the WCAG represents the technical standards of accessible design, related to the perception and understandability of the content.

Gronseth (2018) discusses, "The benefits of practices grounded in WCAG and UDL are far-reaching and applying them can produce online and blended course experiences that are intentionally designed for all learners (p. 20). Additionally, Gronseth (2018) outlines a few best practices for using UDL and the WCAG to ensure accessible course design. "A recommended place to start is in the area of navigation by considering the clarity and consistency of how materials are organized on a course website" (p. 20). This guideline helps to promote a consistent user experience and a predictable learning environment as students progress through the course.

The second best practice suggested by Gronseth (2018) is, "Instructors and course designers should reflect on possibilities for how course content can be communicated through multiple format options. For instance, content delivered through readings could be similarly communicated via multimedia resources, such as infographics, podcast

episodes, and video clips" (p. 20). This approach allows for a variety of methods for students to interact with the content. However, it is important all content is designed to be accessible to all users through methods such as alternate text and captions. Gronseth (2018) indicates, "A third action step towards more inclusive design in online and blended courses involves incorporating multiple means for how learners demonstrate what they have learned" and promotes project-based learning as a way for students to express their ideas and talents (p. 20).

Mancilla and Frey (2021) emphasize the importance of building a supportive institutional culture and the provision of resources necessary to ensure the promotion of a culture of accessibility and the support necessary for faculty to develop accessible online content. For instance, Mancilla and Frey (2021) state, "Leaders can also create a supportive infrastructure for course developers and faculty members by allocating fiscal and human resources. (p. 11)" Such resources can include authoring software, third party captioning vendors, or student captioners. Mancilla and Frey (2021) indicate, "Administrators can also support online course development through hiring personnel with specialized skillsets in multimedia, instructional design, graphic design, and instructional technology to assist faculty in developing accessible materials" (p. 11).

Ultimately, all course design efforts should be designed to be accessible to all users to the greatest extent possible. Further consideration for accessible course design should account for the variability of learners and the cultural and social contexts in which learning occurs.

Chapter Three

Methodology

Study Population

The population of this study was faculty members who taught online courses using Blackboard Learn at a large midwestern regional research university. Inclusion criteria included the use of Blackboard Learn for hosting course materials. Faculty members who did not use Blackboard Learn, or who used educational materials hosted on sites outside of Blackboard Learn were excluded from the study.

Two research groups were established for this study. The first group consisted of faculty who had completed online professional development related to building accessible online courses. Since the number of faculty members who had completed the course was a small portion of the total faculty, research invitations were sent to all participants of the course. The second group included randomly selected faculty from the population who had not participated in professional development related to Web Accessibility.

Variables and Instrumentation

A survey instrument was distributed to the selected faculty members. The survey instrument included questions related to general technical ability, awareness of accessibility requirements, and specific skills related to creating accessible web-based course materials. The survey instrument included three parts.

The first part consisted of 24 items adapted from the survey instrument developed by Vollenwyder, et al. (2019) regarding attitudes and behavioral predictors towards Web Accessibility. Vollenwyder, et al. (2019) outlined a series of salient beliefs related to

Web Accessibility that were examined such as personal effort, social responsibility, business opportunity, product quality, user advocacy, legal obligations, self-perception as specialist, awareness and priorities, requirement conflicts, technical compatibility, limited resources, and knowledge and skills. These beliefs were then categorized as attitudes, subjective norms, perceived control, actual control and background factors. (p. 354). Users were asked to indicate their agreement with each item on a four-point scale, with 1 indicating "strongly disagree" and 4 indicating "strongly agree". The questions were adapted to incorporate language that is more suitable for instructors at the studied institution.

The second part of the survey instrument asked users to evaluate their level of awareness regarding accessibility policies. This part of the instrument was based on questions developed by Mancilla and Frey (2021). Such questions included awareness about student support services, institutional accessibility policies, and support for implementing accessible course design.

The third part of the survey instrument asked users to evaluate their capability with creating accessible course technologies, as well as identifying technologies that present challenges for them, and areas that users would indicate additional training needs.

Demographic information included in the survey instrument included the faculty status of the respondent, and how many semesters they had taught online. Respondents are also asked if they had used the Blackboard Ally tools within their course.

Faculty members were asked if they were familiar with the concepts related to UDL, and the accessibility levels of their course materials were evaluated using Blackboard Ally. The accessibility of individual courses taught by faculty were evaluated

using the Blackboard Ally dashboard scores within the LMS. Overall accessibility was scored on a scale of zero to 100, with a score of zero indicating a low level of accessibility, and 100 indicating a high level of accessibility.

Table 2
Research Questions and Corresponding Analyses

Research Question	Independent Variable	Dependent Variable	Instrument	Measurement	Statistical Tests Used
RQ1	Accessibility training participation (Y/N)	Faculty attitudes and beliefs	Adapted from Vollenwyder, et al. (2017)	Likert items; Dichotomous items	Chi-Square; Mann-Whitney U
RQ2	Accessibility training participation (Y/N)	Faculty skills and technical abilities	Adapted from Mancilla and Frey (2021)	Dichotomous items; Three-point matrix	Chi-Square; Mann-Whitney U
RQ3	Accessibility training participation (Y/N)	Online Course Accessibility	Blackboard Ally	0-100% Blackboard Ally Accessibility Score	ANOVA
RQ4	UDL familiarity (Y/N)	Online course accessibility	Blackboard Ally	0-100% Blackboard Ally Accessibility Score	ANOVA

Note. This table shows the relationship between the research questions, variables, evaluation instruments, scoring, and statistical analysis methods.

Data Collection and Analysis

The questionnaire was distributed to randomly selected faculty members amongst the population, as well as to faculty members who had completed the ADA Compliance and Online Courses faculty development course. The questionnaire was sent to 74 participants of the professional development course, and to 216 randomly selected faculty members within the total population. The total number of respondents was 290. Of the 290 invitations sent, 31 individuals accessed the survey, and 23 individuals completed the

survey. The response rate was 10.6%, with a completion rate of 74.1%. Survey invitations were distributed using the Qualtrics XM platform, with periodic reminders sent out over five weeks.

The questionnaire was distributed during the height of the COVID-19 pandemic, which forced many social, educational, and research activities into digital spaces. Consequently, the uptake of digital events and interactions led to burnout and survey fatigue amongst the population. For example, de Koning, et al. (2021) acknowledged the increased survey distribution during the COVID-19 pandemic "Has led to potential survey respondents being approached more frequently within a short period, leading to a type of survey fatigue in which these respondents refuse to complete surveys at all" (p. 2).

Questionnaire items used for Research Question One included both scaled and dichotomous items. The items measured different aspects related to attitudes and beliefs regarding the development of accessible online environments. In addition, users were asked to identify various accessibility policy positions. A Mann-Whitney U test was performed to compare group performance on scaled items, while a Chi-Square test was performed to compare group performance on dichotomous items.

A Mann-Whitney U statistical test is appropriate for comparing distributions between two group of ordinal dependent variables. For dichotomous items, a Chi-Square test is appropriate for comparing group performance against binary dependent variables. (Laerd Statistics, 2015).

Questionnaire items for Research Question Two included scaled, multiple-response, and dichotomous items. The multiple-response items were scored as

dichotomous item pairs. These items measured individual faculty member's skills and understanding of twelve key skills for designing accessible courses. Participants were asked to identify which specific practices they utilized in their courses, which included descriptive hyperlinks, alternative text, alternative formats (e.g. audio, video, text, images), headings, readable PDF files, table design, captioning/transcripts document design, font colors and contrasts, plain language (e.g. familiar language, active voice, concise sentences), keyboard accessibility, and consistent navigation menus.

Participants were asked to identify the level of effort to carry out the specified accessibility practices, along with which items pose the most challenge, and areas in which instructors felt they needed additional training. Dichotomous items were scored using a Chi-Squared statistical test to identify differences between the two study groups, while a Mann-Whitney U statistical test was used to calculate differences in performance between the two study groups on the scaled questionnaire items. A Mann-Whitney U statistical test is appropriate for comparing distributions between two group of ordinal dependent variables. For dichotomous items, a Chi-Square test is appropriate for comparing group performance against binary dependent variables. (Laerd Statistics, 2015).

Research Question Three included a continuous dependent variable (Blackboard Ally Accessibility Scores), and a categorical independent variable (faculty participation in the ADA Online Accessibility course). The two groups identified were independent, i.e., a single member would not be included in both the experimental group and the control group. Since this research question utilized a continuous dependent variable, and

a categorical independent variable, an Analysis of Variance (ANOVA) statistical test was identified as an appropriate statistical test to use (Laerd Statistics, 2015).

Research Question Four included a continuous dependent variable (Blackboard Ally Accessibility Scores) and a categorical independent variable (faculty self-identification of being familiar with UDL principles). The two groups identified were independent of observation. Since this research question utilized a continuous dependent variable and a categorical independent variable, an Analysis of Variance (ANOVA) statistical test was identified as an appropriate statistical test to use (Laerd Statistics, 2015).

Limitations and Delimitations

This research study was bound by the following limitations and delimitations: One limitation would be the use of self-reported data on the part of faculty members related to technical ability and ability to create accessible content. Additionally, Blackboard Ally is a software program that is undergoing continuous development with new features being released on a consistent schedule. Additionally, Ally is not able to calculate accessibility scores for all items. Furthermore, accessibility checkers such as Blackboard Ally may not accurately identify all accessibility issues within a content item or document (Lieberman, 2018). Therefore, it may not be possible to fully evaluate all course content to ensure accessibility.

Additionally, the study evaluated the accessibility of courses taught between the Spring 2020 and Spring 2022 semesters. If individual faculty members had participated in the ADA Compliance and Online Courses professional development within that time, their average score would include courses taught both before and since their participation

in the professional development course. As a result, this arrangement could affect mean accessibility scores for faculty members.

This study was delimited to evaluating material uploaded to Blackboard Learn amongst randomly selected faculty, and this study was not intended to evaluate the accessibility of instructional materials hosted outside of the Blackboard Learn (LMS) environment. The results of data obtained at this institution may not be applicable to other institutions of higher education, due to cultural differences amongst different institutions and small number of participants.

Research Ethics

This research survey was submitted to the Social, Behavioral, and Educations Institutional Review Board (IRB) for approval. A designation of "exempt" was applied to this study by the IRB, as participants were not expected to provide sensitive or privileged information, and only information related to their use of Blackboard Ally and related technical skills will be required. A cornerstone of research ethics is the principle of informed consent. Users who participated in this research study were presented with an informed consent document that details the study purpose, as well as individual rights for participating in the study.

This research study was also bound by regulations set forth by the Family Educational Rights and Privacy Act of 1974 (FERPA). As this research focuses on faculty technology use, no personally identifiable student data is expected to be collected, and no privileged information such as grades would be collected.

Funding Disclosures

This research study was unfunded, and the researcher did not have any financial conflicts of interests. All required financial conflict of interest forms were completed.

Chapter Four

Results

Participant Demographic Information

The research participants were asked to describe the following demographic identities: Faculty status, number of semesters taught online, completion of the ADA Compliance and Online Courses professional development course, usage of the Blackboard Ally accessibility tool, and familiarity with UDL. Table Three below shows the breakdown of participants by faculty status.

Table 3
Faculty Status of Research Participants

Faculty Status	n	%
Full-Time Instructor	19	61.29
Part-Time Instructor	10	32.26
Graduate Teaching Assistant	2	6.45
Totals	**31**	**100.00**

Participants were also asked to provide the number of semesters they had taught online. Table Four below shows descriptive statistics related to this value, including the mean, range, standard deviation, and minimum and maximum values.

Table 4
Number of Semesters Taught Online

Number of Participants	31.0
Mean	14.4
Standard Deviation	12.3
Minimum	0.0
Maximum	40.0

Other demographic information collected from participants included whether they had participated in the ADA Compliance and Online Courses professional development course, whether faculty have used the Blackboard Ally to improve accessibility of course

material, and whether faculty were familiar with the principles of UDL. Table Five below shows participant responses to these items by participants.

Table 5
Faculty Use and Familiarity

Question	Yes/No	N	(%)
ADA Course Completion	Yes	18	58.06
	No	13	41.94
Blackboard Ally Use	Yes	15	48.39
	No	16	51.64
UDL Familiarity	Yes	22	70.97
	No	9	29.03

Questionnaire Reliability

The questionnaire reliability was measured using the Cronbach Alpha test for internal consistency. Internal consistency defines how well the questionnaire measures the single latent trait. A high level of internal consistency indicates the instrument measures a single latent trait. (Tavakol & Dennick, 2011, p. 53). The questionnaire was divided into three parts and a Cronbach Alpha value was obtained for each part using Winsteps. For part one $\alpha = 1.00$. For part two, $\alpha = 0.95$, and for part 3, $\alpha = 0.99$.

Overall, these values do indicate the questionnaire is internally consistent and measures the intended latent traits. Generally, values of 0.6-0.9 indicates the instrument measures the intended train sufficiently (Creswell, 2012). However, Tavakol and Dennick (2011) explain that scores between 0.90 and 1.00 may indicate that some items are redundant and could be removed and the instrument could be shortened.

Research Question One: Attitudes, Beliefs and Practices

Participants were asked a series of questions related to attitudes and beliefs held by individual faculty members, as well as awareness related to accessibility skills and practices. The dependent variable was whether faculty members had completed the ADA

Compliance and Online Courses professional development. Table Six below shows the descriptive statistics for scaled items from Parts One and Two of the questionnaire (Please refer to Appendix A for the full text of the questionnaire).

Table 6
Faculty Descriptive Statistics for Scaled Response Items

Item	Participation	N	Mean	Std. Dev.	Std. Err.	Confidence Interval		Min	Max
Q1 WA makes work complex	Yes	12	3	0.739	0.213	2.53	3.47	2	4
	No	15	3	0.845	0.218	2.53	3.47	2	4
	Total	27	3	0.784	0.151	2.69	3.31	2	4
Q2 Support others with WA	Yes	12	3.75	0.452	0.131	3.46	4.04	3	4
	No	14	3.29	0.914	0.244	2.76	3.81	1	4
	Total	26	3.5	0.762	0.149	3.19	3.81	1	4
Q3 Students Expect WA	Yes	12	3.25	0.622	0.179	2.86	3.64	2	4
	No	15	3.4	1.352	0.349	2.65	4.15	1	5
	Total	27	3.33	1.074	0.207	2.91	3.76	1	5
Q4 Legal obligations for WA	Yes	12	3.42	0.669	0.193	2.99	3.84	2	4
	No	14	2.71	1.069	0.286	2.1	3.33	1	4
	Total	26	3.04	0.958	0.188	2.65	3.43	1	4
Q5 Institution prioritizes WA	Yes	12	3.08	0.669	0.193	2.66	3.51	2	4
	No	14	3	0.555	0.148	2.68	3.32	2	4
	Total	26	3.04	0.599	0.117	2.8	3.28	2	4
Q6 Technical constraints	Yes	12	2.5	1	0.289	1.86	3.14	1	4
	No	13	2.08	0.76	0.211	1.62	2.54	1	3
	Total	25	2.28	0.891	0.178	1.91	2.65	1	4
Q7 Lack of knowledge and skill	Yes	12	2.58	1.165	0.336	1.84	3.32	1	4
	No	13	2.54	0.66	0.183	2.14	2.94	1	3
	Total	25	2.56	0.917	0.183	2.18	2.94	1	4
Q8 Complex tasks are unpleasant	Yes	12	2	1.044	0.302	1.34	2.66	1	4
	No	13	2.08	0.494	0.137	1.78	2.38	1	3
	Total	25	2.04	0.79	0.158	1.71	2.37	1	4

Item	Participation	N	Mean	Std. Dev.	Std. Err.	Confidence Interval		Min	Max
Q9 Supporting others is pleasant	Yes	12	3.75	0.452	0.131	3.46	4.04	3	4
	No	13	3.69	0.48	0.133	3.4	3.98	3	4
	Total	25	3.72	0.458	0.092	3.53	3.91	3	4
Q10 Do what users expect from me	Yes	12	3.58	0.515	0.149	3.26	3.91	3	4
	No	13	3.38	0.506	0.14	3.08	3.69	3	4
	Total	25	3.48	0.51	0.102	3.27	3.69	3	4
Q11 Compliant with Legal Obligations	Yes	12	3.83	0.389	0.112	3.59	4.08	3	4
	No	13	3.92	0.277	0.077	3.76	4.09	3	4
	Total	25	3.88	0.332	0.066	3.74	4.02	3	4
Q12 Institution has priority for WA	Yes	12	3.67	0.492	0.142	3.35	3.98	3	4
	No	13	3.69	0.48	0.133	3.4	3.98	3	4
	Total	25	3.68	0.476	0.095	3.48	3.88	3	4
Q13 Requirements make it difficult to choose WA	Yes	12	1.58	0.669	0.193	1.16	2.01	1	3
	No	13	2	0.816	0.226	1.51	2.49	1	4
	Total	25	1.8	0.764	0.153	1.48	2.12	1	4
Q14 Technical Constraints	Yes	12	2.08	0.9	0.26	1.51	2.66	1	4
	No	13	2	0.577	0.16	1.65	2.35	1	3
	Total	25	2.04	0.735	0.147	1.74	2.34	1	4
Q15 Do not have the time and money to choose WA	Yes	12	2.33	1.155	0.333	1.6	3.07	1	4
	No	13	3	0.913	0.253	2.45	3.55	1	4
	Total	25	2.68	1.069	0.214	2.24	3.12	1	4
Q16 Do not have the knowledge and skill to choose WA	Yes	12	2.25	1.138	0.329	1.53	2.97	1	4
	No	14	2.36	0.745	0.199	1.93	2.79	1	3
	Total	26	2.31	0.928	0.182	1.93	2.68	1	4
Q17 Consideration of WA is Pleasant	Yes	12	2.83	0.937	0.271	2.24	3.43	1	4
	No	14	2.79	0.699	0.187	2.38	3.19	2	4
	Total	26	2.81	0.801	0.157	2.48	3.13	1	4

Item	Participation	N	Mean	Std. Dev.	Std. Err.	Confidence Interval		Min	Max
Q18 Consideration of WA is Desirable	Yes	12	3.17	0.937	0.271	2.57	3.76	1	4
	No	14	3	0.784	0.21	2.55	3.45	2	4
	Total	26	3.08	0.845	0.166	2.74	3.42	1	4
Q19 People approve of my choice for WA	Yes	12	3.5	0.674	0.195	3.07	3.93	2	4
	No	14	3.14	0.663	0.177	2.76	3.53	2	4
	Total	26	3.31	0.679	0.133	3.03	3.58	2	4
Q20 Up to me to choose WA	Yes	12	2.67	0.888	0.256	2.1	3.23	1	4
	No	14	3	0.877	0.234	2.49	3.51	1	4
	Total	26	2.85	0.881	0.173	2.49	3.2	1	4
Q21 Confident in choosing WA	Yes	12	3.25	0.965	0.279	2.64	3.86	1	4
	No	14	3.14	0.663	0.177	2.76	3.53	2	4
	Total	26	3.19	0.801	0.157	2.87	3.52	1	4
Q22 Consideration of WA in future	Yes	12	3.25	0.965	0.279	2.64	3.86	1	4
	No	14	3.07	0.829	0.221	2.59	3.55	2	4
	Total	26	3.15	0.881	0.173	2.8	3.51	1	4
Q28 Course evaluated	Yes	10	1.5	0.707	0.224	0.99	2.01	1	3
	No	11	2	1.095	0.33	1.26	2.74	1	5
	Total	21	1.76	0.944	0.206	1.33	2.19	1	5
Q29 Institutional priority	Yes	12	1.83	0.577	0.167	1.47	2.2	1	3
	No	13	1.54	0.66	0.183	1.14	1.94	1	3
	Total	25	1.68	0.627	0.125	1.42	1.94	1	3

Note. Yes = Completed ADA Compliance and Online Courses professional development
No = Did not Complete ADA Compliance and Online Courses professional development

Table Seven below shows the Mann Whitney U statistical test results for each scaled item, and the significance values (p. <0.05).

Table 7

Mann-Whitney U Scores for Scaled Items

Item	N	Mann-Whitney U Score	Significance ($p < 0.05$)
Q1	27	90.000	1.000
Q2	26	60.000	0.231
Q3	27	101.000	0.614
Q4	26	52.000	0.106
Q5	26	78.000	0.781
Q6	25	59.000	0.320
Q7	25	73.500	0.810
Q8	25	86.500	0.650
Q9	25	73.500	0.810
Q10	25	62.500	0.406
Q11	25	85.000	0.728
Q12	25	80.000	0.936
Q13	25	100.500	0.225
Q14	25	77.000	0.979
Q15	25	104.000	0.168
Q16	26	96.000	0.560
Q17	27	79.000	0.820
Q18	26	71.000	0.527
Q19	26	59.000	0.212
Q20	26	103.000	0.347
Q21	26	71.000	0.527
Q22	26	71.000	0.527
Q28	21	71.500	0.251
Q29	25	57.000	0.270

For all scaled items, no significant difference was found between the groups of faculty members who had taken the ADA Online Accessibility course, and those faculty members who did not participate.

A Chi-Square test was performed to analyze differences between responses for the two faculty groups for dichotomous items. Table Eight below shows the response frequencies for each question.

Table 8

Response Frequencies for Dichotomous Items

Item	Y/N	Participated		Did not Participate		Total	
		N	%	N	%	N	%
Q23	No	0	0.0%	2	14.3%	2	7.7%
	Yes	12	100%	12	85.7%	24	92.3%
Q24	No	0	0.00%	1	7.7%	1	4.0%
	Yes	12	100.0%	12	92.3%	24	96.0%
Q25	No	8	66.7%	7	58.3%	15	62.5%
	Yes	4	33.3%	5	41.7%	9	37.5%
Q26	No	1	8.3%	0	0.0%	1	3.7%
	Yes	11	91.7%	15	100.0%	26	96.3%
Q27.1	No	4	36.4%	1	7.7%	5	20.8%
	Yes	7	63.6%	12	92.3%	19	79.2%
Q27.2	No	9	81.8%	3	30.0%	12	57.1%
	Yes	2	18.2%	7	70.0%	9	42.9%
Q27.3	No	7	63.6%	0	0.0%	7	33.3%
	Yes	4	36.4%	10	100.0%	14	66.7%
Q27.4	No	4	36.4%	6	60.0%	10	47.6%
	Yes	7	63.6%	4	40.0%	11	52.4%
Q27.5	No	9	81.8%	3	30.0%	12	57.1%
	Yes	2	18.2%	7	70.0%	9	42.9%
Q30.1	No	7	58.3%	1	7.7%	8	32.0%
	Yes	5	41.7%	12	92.3%	17	68.0%
Q30.2	No	7	58.3%	7	58.3%	14	58.3%
	Yes	5	41.7%	5	41.7%	10	41.7%
Q30.3	No	7	58.3%	5	41.7%	12	50.0%
	Yes	5	41.7%	7	58.3%	12	50.0%
Q30.4	No	11	91.7%	8	66.7%	19	79.2%
	Yes	1	8.3%	4	33.3%	5	20.8%
Q30.5	No	12	100.0%	8	66.7%	20	83.3%
	Yes	0	0.0%	4	33.3%	4	16.7%
Q30.6	No	12	100.0%	10	83.3%	22	91.7%
	Yes	0	0.0%	2	16.7%	2	8.3%
Q30.7	No	3	25.0%	6	50.0%	9	37.5%
	Yes	9	75.0%	6	50.0%	15	62.5%
Q30.8	No	11	91.7%	10	83.3%	21	87.5%
	Yes	1	8.3%	2	16.7%	3	12.5%
Q30.9	No	9	75.0%	7	58.3%	16	66.7%
	Yes	3	25.0%	5	41.7%	8	33.3%
Q30.10	No	7	58.3%	7	58.3%	14	58.3%
	Yes	5	41.7%	5	41.7%	10	41.7%
Q30.11	No	12	100.0%	9	75.0%	21	87.5%
	Yes	0	0.0%	3	25.0%	3	12.5%

Item	Y/N	Participated		Did not Participate		Total	
		N	%	N	%	N	%
Q31	Yes	7	58.3%	6	50.0%	13	54.2%
	No	5	41.7%	6	50.0%	11	45.8%
Q32	Yes	11	91.7%	7	58.3%	18	75.0%
	No	1	8.3%	5	41.7%	6	25.0%
Q33	Yes	6	50.0%	9	75.0%	15	62.5%
	No	6	50.0%	3	25.0%	9	37.5%
Q34	Yes	11	91.7%	14	100.0%	25	96.2%
	No	1	8.3%	0	0.0%	1	3.8%
Q35.1	No	0	0.0%	2	14.3%	2	8.0%
	Yes	11	100.0%	12	85.7%	23	92.0%
Q35.2	No	7	63.6%	10	71.4%	17	68.0%
	Yes	4	36.4%	4	28.6%	8	32.0%
Q35.3	No	9	81.8%	8	57.1%	17	68.0%
	Yes	2	18.2%	6	42.9%	8	32.0%
Q35.4	No	10	90.9%	10	71.4%	20	80.0%
	Yes	1	9.1%	4	28.6%	5	20.0%
Q35.5	No	11	100.0%	11	78.6%	22	88.0%
	Yes	0	0.0%	3	21.4%	3	12.0%
Q35.6	No	11	100.0%	10	71.4%	21	84.0%
	Yes	0	0.0%	4	28.6%	4	16.0%
Q36.1	No	11	100.0%	11	78.6%	22	88.0%
	Yes	0	0.0%	3	21.4%	3	12.0%
Q36.2	No	3	27.3%	2	14.3%	5	20.0%
	Yes	8	72.7%	12	85.7%	20	80.0%
Q36.3	No	5	45.5%	8	57.1%	13	52.0%
	Yes	6	54.5%	6	42.9%	12	48.0%
Q36.4	No	7	63.6%	4	28.6%	11	44.0%
	Yes	4	36.4%	10	71.4%	14	56.0%
Q36.5	No	4	36.4%	4	28.6%	8	32.0%
	Yes	7	63.6%	10	71.4%	17	68.0%

Table Nine below shows the Chi-Square values calculated for each dichotomous item and the level of significance for each item. Items of significance ($p < 0.05$) included Questions 27.2, 27.3, 27.5, 30.1, and 30.5. The other items did not show a significant difference between the control group and faculty members who took the ADA Online Training Course. However, items 30.11, 32, and 35.6 show significant values that were slightly above the $p < 0.05$ cutoff for significance.

Table 9

Chi-Square Values and Significance Levels

Item	Value	Df	Asymptotic Significance (2-sided)
Q23	1.857	1	0.173
Q24	0.962	1	0.327
Q25	0.178	1	0.673
Q26	1.298	1	0.255
Q27.1	2.970	1	0.085
Q27.2	5.743	1	0.017
Q27.3	9.545	1	0.002
Q27.4	1.173	1	0.279
Q27.5	5.743	1	0.017
Q30.1	7.354	1	0.007
Q30.2	0.000	1	1.000
Q30.3	0.667	1	0.414
Q30.4	2.274	1	0.132
Q30.5	4.800	1	0.028
Q30.6	2.182	1	0.140
Q30.7	1.600	1	0.206
Q30.8	0.381	1	0.537
Q30.9	0.750	1	0.386
Q30.10	0.000	1	1.000
Q30.11	3.429	1	0.064
Q31	0.168	1	0.682
Q32	3.556	1	0.059
Q33	1.600	1	0.206
Q34	1.213	1	0.271
Q35.1	1.708	1	0.191
Q35.2	0.172	1	0.678
Q35.3	1.724	1	0.189
Q35.4	1.461	1	0.227
Q35.5	2.679	1	0.102
Q35.6	3.741	1	0.053
Q36.1	2.679	1	0.102
Q36.2	0.649	1	0.420

Item	Value	Df	Asymptotic Significance (2-sided)
Q36.3	0.337	1	0.561
Q36.4	3.074	1	0.080
Q36.5	0.172	1	0.678

Research Question Two: Accessibility Skills

Participants were asked to identify their skill levels for implementing twelve accessibility skills. They were also asked about their use of these skills, and their implementation of captioned media within their courses. This section consisted of two multiple response items and a series of scaled response items.

Table 10 below shows the descriptive statistics for the scaled response items for Part Three of the questionnaire.

Table 10

Descriptive Statistics for Scaled Response Items

Item	Y/N	N	Mean	Std. Deviation	Std. Error	Confidence Interval		Minimum	Maximum
Q37	Yes	12	3.33	1.23	0.36	2.55	4.12	2	5
	No	13	2.54	1.39	0.39	1.70	3.38	1	5
	Total	25	2.92	1.35	0.27	2.36	3.48	1	5
Q38	Yes	12	2.50	1.45	0.42	1.58	3.42	1	5
	No	13	3.23	1.48	0.41	2.34	4.13	1	5
	Total	25	2.88	1.48	0.30	2.27	3.49	1	5
Q41_1	Yes	12	2.33	0.89	0.26	1.77	2.90	1	3
	No	10	1.90	0.74	0.23	1.37	2.43	1	3
	Total	22	2.14	0.83	0.18	1.77	2.51	1	3
Q41_2	Yes	12	1.83	0.83	0.24	1.30	2.36	1	3
	No	10	2.00	0.82	0.26	1.42	2.58	1	3
	Total	22	1.91	0.81	0.17	1.55	2.27	1	3
Q41_3	Yes	12	1.75	0.75	0.22	1.27	2.23	1	3
	No	10	1.80	0.63	0.20	1.35	2.25	1	3
	Total	22	1.77	0.69	0.15	1.47	2.08	1	3
Q41_4	Yes	12	2.00	0.85	0.25	1.46	2.54	1	3
	No	11	2.45	0.52	0.16	2.10	2.81	2	3
	Total	23	2.22	0.74	0.15	1.90	2.54	1	3

Item	Y/N	N	Mean	Std. Deviation	Std. Error	Confidence Interval		Minimum	Maximum
Q41_5	Yes	12	1.58	0.90	0.26	1.01	2.16	1	3
	No	10	2.20	0.63	0.20	1.75	2.65	1	3
	Total	22	1.86	0.83	0.18	1.49	2.23	1	3
Q41_6	Yes	11	1.45	0.52	0.16	1.10	1.81	1	2
	No	9	2.11	0.93	0.31	1.40	2.82	1	3
	Total	20	1.75	0.79	0.18	1.38	2.12	1	3
Q41_7	Yes	12	1.42	0.51	0.15	1.09	1.74	1	2
	No	11	1.82	0.87	0.26	1.23	2.41	1	3
	Total	23	1.61	0.72	0.15	1.30	1.92	1	3
Q41_8	Yes	12	1.75	0.62	0.18	1.36	2.14	1	3
	No	10	2.10	0.57	0.18	1.69	2.51	1	3
	Total	22	1.91	0.61	0.13	1.64	2.18	1	3
Q41_9	Yes	12	2.58	0.67	0.19	2.16	3.01	1	3
	No	11	2.73	0.47	0.14	2.41	3.04	2	3
	Total	23	2.65	0.57	0.12	2.40	2.90	1	3
Q41_10	Yes	12	2.50	0.90	0.26	1.93	3.07	1	3
	No	10	2.60	0.70	0.22	2.10	3.10	1	3
	Total	22	2.55	0.80	0.17	2.19	2.90	1	3
Q41_11	Yes	10	1.70	0.82	0.26	1.11	2.29	1	3
	No	10	2.20	0.79	0.25	1.64	2.76	1	3
	Total	20	1.95	0.83	0.18	1.56	2.34	1	3
Q41_12	Yes	11	2.00	0.77	0.23	1.48	2.52	1	3
	No	10	2.10	0.74	0.23	1.57	2.63	1	3
	Total	21	2.05	0.74	0.16	1.71	2.38	1	3
Q42_1	Yes	11	2.27	0.90	0.27	1.67	2.88	1	3
	No	9	1.89	0.78	0.26	1.29	2.49	1	3
	Total	20	2.10	0.85	0.19	1.70	2.50	1	3
Q42_2	Yes	11	2.00	0.89	0.27	1.40	2.60	1	3
	No	10	2.00	0.82	0.26	1.42	2.58	1	3
	Total	21	2.00	0.84	0.18	1.62	2.38	1	3
Q42_3	Yes	11	1.73	0.79	0.24	1.20	2.26	1	3
	No	11	1.55	0.69	0.21	1.08	2.01	1	3
	Total	22	1.64	0.73	0.15	1.31	1.96	1	3
Q42_4	Yes	11	1.82	0.75	0.23	1.31	2.32	1	3
	No	11	2.36	0.67	0.20	1.91	2.82	1	3
	Total	22	2.09	0.75	0.16	1.76	2.42	1	3
Q42_5	Yes	12	1.50	0.80	0.23	0.99	2.01	1	3
	No	10	2.50	0.53	0.17	2.12	2.88	2	3
	Total	22	1.95	0.84	0.18	1.58	2.33	1	3
Q42_6	Yes	12	1.50	0.67	0.19	1.07	1.93	1	3
	No	10	2.00	0.67	0.21	1.52	2.48	1	3
	Total	22	1.73	0.70	0.15	1.42	2.04	1	3

Item	Y/N	N	Mean	Std. Deviation	Std. Error	Confidence Interval		Minimum	Maximum
Q42_7	Yes	11	1.45	0.69	0.21	0.99	1.92	1	3
	No	10	1.60	0.70	0.22	1.10	2.10	1	3
	Total	21	1.52	0.68	0.15	1.21	1.83	1	3
Q42_8	Yes	11	1.91	0.70	0.21	1.44	2.38	1	3
	No	10	2.10	0.57	0.18	1.69	2.51	1	3
	Total	21	2.00	0.63	0.14	1.71	2.29	1	3
Q42_9	Yes	11	2.55	0.82	0.25	1.99	3.10	1	3
	No	11	2.36	0.67	0.20	1.91	2.82	1	3
	Total	22	2.45	0.74	0.16	2.13	2.78	1	3
Q42_10	Yes	11	2.45	0.93	0.28	1.83	3.08	1	3
	No	9	2.11	0.78	0.26	1.51	2.71	1	3
	Total	20	2.30	0.86	0.19	1.90	2.70	1	3
Q42_11	Yes	11	1.55	0.69	0.21	1.08	2.01	1	3
	No	10	1.90	0.74	0.23	1.37	2.43	1	3
	Total	21	1.71	0.72	0.16	1.39	2.04	1	3
Q42_12	Yes	10	2.20	0.92	0.29	1.54	2.86	1	3
	No	10	1.70	0.67	0.21	1.22	2.18	1	3
	Total	20	1.95	0.83	0.18	1.56	2.34	1	3
Q43_1	Yes	11	2.36	0.92	0.28	1.74	2.98	1	3
	No	11	1.82	0.87	0.26	1.23	2.41	1	3
	Total	22	2.09	0.92	0.20	1.68	2.50	1	3
Q43_2	Yes	11	2.27	0.90	0.27	1.67	2.88	1	3
	No	11	1.91	0.94	0.28	1.27	2.54	1	3
	Total	22	2.09	0.92	0.20	1.68	2.50	1	3
Q43_3	Yes	12	2.00	0.85	0.25	1.46	2.54	1	3
	No	11	1.73	0.90	0.27	1.12	2.33	1	3
	Total	23	1.87	0.87	0.18	1.49	2.25	1	3
Q43_4	Yes	11	2.18	0.87	0.26	1.59	2.77	1	3
	No	11	2.27	0.90	0.27	1.67	2.88	1	3
	Total	22	2.23	0.87	0.19	1.84	2.61	1	3
Q43_5	Yes	12	1.83	0.83	0.24	1.30	2.36	1	3
	No	11	1.91	0.70	0.21	1.44	2.38	1	3
	Total	23	1.87	0.76	0.16	1.54	2.20	1	3
Q43_6	Yes	11	1.91	0.94	0.28	1.27	2.54	1	3
	No	11	2.00	0.77	0.23	1.48	2.52	1	3
	Total	22	1.95	0.84	0.18	1.58	2.33	1	3
Q43_7	Yes	11	2.18	0.87	0.26	1.59	2.77	1	3
	No	11	1.82	0.87	0.26	1.23	2.41	1	3
	Total	22	2.00	0.87	0.19	1.61	2.39	1	3
Q43_8	Yes	11	2.09	0.70	0.21	1.62	2.56	1	3
	No	11	2.00	0.63	0.19	1.58	2.42	1	3
	Total	22	2.05	0.65	0.14	1.76	2.33	1	3

Item	Y/N	N	Mean	Std. Deviation	Std. Error	Confidence Interval		Minimum	Maximum
Q43_9	Yes	11	2.64	0.67	0.20	2.18	3.09	1	3
	No	11	2.36	0.92	0.28	1.74	2.98	1	3
	Total	22	2.50	0.80	0.17	2.14	2.86	1	3
Q43_10	Yes	11	2.45	0.82	0.25	1.90	3.01	1	3
	No	11	2.18	0.87	0.26	1.59	2.77	1	3
	Total	22	2.32	0.84	0.18	1.95	2.69	1	3
Q43_11	Yes	11	1.82	0.75	0.23	1.31	2.32	1	3
	No	11	2.00	0.77	0.23	1.48	2.52	1	3
	Total	22	1.91	0.75	0.16	1.58	2.24	1	3
Q43_12	Yes	12	2.33	0.78	0.22	1.84	2.83	1	3
	No	11	2.09	0.83	0.25	1.53	2.65	1	3
	Total	23	2.22	0.80	0.17	1.87	2.56	1	3

Table 11 below shows frequency counts and percentages for each selected option for dichotomous response items.

Table 11

Frequencies for Dichotomous Response Items

		Participated		Did not participate		Total	
		N	%	N	%	N	%
Q39.1	No	8	66.7%	5	83.3%	13	72.2%
	Yes	4	33.3%	1	16.7%	5	27.8%
Total		12	100.0%	6	100.0%	18	100.0%
Q39.2	No	6	50.0%	2	33.3%	8	44.4%
	Yes	6	50.0%	4	66.7%	10	55.6%
Total		12	100.0%	6	100.0%	18	100.0%
Q39.3	No	10	83.3%	4	66.7%	14	77.8%
	Yes	2	16.7%	2	33.3%	4	22.2%
Total		12	100.0%	6	100.0%	18	100.0%
Q39.4	No	11	91.7%	3	50.0%	14	77.8%
	Yes	1	8.3%	3	50.0%	4	22.2%
Total		12	100.0%	6	100.0%	18	100.0%
Q39.5	No	5	41.7%	3	50.0%	8	44.4%
	Yes	7	58.3%	3	50.0%	10	55.6%
Total		12	100.0%	6	100.0%	18	100.0%
Q39.6	No	6	50.0%	4	66.7%	10	55.6%
	Yes	6	50.0%	2	33.3%	8	44.4%
Total		12	100.0%	6	100.0%	18	100.0%

		Participated		Did not participate		Total	
		N	%	N	%	N	%
Q39.7	No	7	58.3%	2	33.3%	9	50.0%
	Yes	5	41.7%	4	66.7%	9	50.0%
Total		12	100.0%	6	100.0%	18	100.0%
Q39.8	No	10	83.3%	4	66.7%	14	77.8%
	Yes	2	16.7%	2	33.3%	4	22.2%
Total		12	100.0%	6	100.0%	18	100.0%
Q39.9	No	10	83.3%	5	83.3%	15	83.3%
	Yes	2	16.7%	1	16.7%	3	16.7%
Total		12	100.0%	6	100.0%	18	100.0%
Q40.1	No	1	9.1%	2	22.2%	3	15.0%
	Yes	10	90.9%	7	77.8%	17	85.0%
Total		11	100.0%	9	100.0%	20	100.0%
Q40.2	No	0	0.0%	4	44.4%	4	20.0%
	Yes	11	100.0%	5	55.6%	16	80.0%
Total		11	100.0%	9	100.0%	20	100.0%
Q40.3	No	1	9.1%	4	44.4%	5	25.0%
	Yes	10	90.9%	5	55.6%	15	75.0%
Total		11	100.0%	9	100.0%	20	100.0%
Q40.4	No	2	18.2%	3	33.3%	5	25.0%
	Yes	9	81.8%	6	66.7%	15	75.0%
Total		11	100.0%	9	100.0%	20	100.0%
Q40.5	No	2	18.2%	2	22.2%	4	20.0%
	Yes	9	81.8%	7	77.8%	16	80.0%
Total		11	100.0%	9	100.0%	20	100.0%
Q40.6	No	4	36.4%	8	88.9%	12	60.0%
	Yes	7	63.6%	1	11.1%	8	40.0%
Total		11	100.0%	9	100.0%	20	100.0%
Q40.7	No	5	45.5%	4	44.4%	9	45.0%
	Yes	6	54.5%	5	55.6%	11	55.0%
Total		11	100.0%	9	100.0%	20	100.0%
Q40.8	No	5	45.5%	7	77.8%	12	60.0%
	Yes	6	54.5%	2	22.2%	8	40.0%
Total		11	100.0%	9	100.0%	20	100.0%
Q40.9	No	5	45.5%	3	33.3%	8	40.0%
	Yes	6	54.5%	6	66.7%	12	60.0%
Total		11	100.0%	9	100.0%	20	100.0%

		Participated		Did not participate		Total	
		N	%	N	%	N	%
Q40.10	No	4	36.4%	3	33.3%	7	35.0%
	Yes	7	63.6%	6	66.7%	13	65.0%
Total		11	100.0%	9	100.0%	20	100.0%
Q40.11	No	5	45.5%	5	55.6%	10	50.0%
	Yes	6	54.5%	4	44.4%	10	50.0%
Total		11	100.0%	9	100.0%	20	100.0%
Q40.12	No	3	27.3%	6	66.7%	9	45.0%
	Yes	8	72.7%	3	33.3%	11	55.0%
Total		11	100.0%	9	100.0%	20	100.0%

Table 12 below shows the Chi-Square tests performed for these items. Items with significant differences between the two groups include Q39.5, Q40.2, Q40.3, and Q40.6. ($p < 0.05$).

Table 12

Chi-Square Statistical Tests

Item	Value	Df	Asymptotic Significance (2-sided)
Q39.1	.554[a]	1	0.457
Q39.2	.450[a]	1	0.502
Q39.3	.643[a]	1	0.423
Q39.4	4.018[a]	1	0.045
Q39.5	.112[a]	1	0.737
Q39.6	.450[a]	1	0.502
Q39.7	1.000[a]	1	0.317
Q39.8	.643[a]	1	0.423
Q39.9	.000[a]	1	1.000
Q40.1	.669[a]	1	0.413
Q40.2	6.111[a]	1	0.013
Q40.3	3.300[a]	1	0.069
Q40.4	.606[a]	1	0.436
Q40.5	.051[a]	1	0.822
Q40.6	5.690[a]	1	0.017
Q40.7	.002[a]	1	0.964

Item	Value	Df	Asymptotic Significance (2-sided)
Q40.8	2.155[a]	1	0.142
Q40.9	.303[a]	1	0.582
Q40.10	.020[a]	1	0.888
Q40.11	.202[a]	1	0.653
Q40.12	3.104[a]	1	0.078

Table 13 below shows the Mann-Whitney U scores and significance values for scaled items. There were no findings of significance for these items.

Table 13

Mann-Whitney U Scores for Ordinal Items

Item	N	Mann-Whitney U Score	Significance
Q37	25	51.500	0.152
Q38	25	99.000	0.270
Q41.1	20	41.500	0.228
Q41.2	22	67.000	0.674
Q41.3	22	63.500	0.821
Q41.4	23	86.000	0.235
Q41.5	22	86.500	0.080
Q41.6	20	70.000	0.131
Q41.7	23	82.000	0.347
Q41.8	22	77.500	0.254
Q41.9	23	71.500	0.740
Q41.10	22	60.000	1.000
Q41.11	20	67.000	0.218
Q41.12	21	59.000	0.809
Q42.1	20	36.500	0.331
Q42.2	21	55.000	1.000
Q42.3	22	53.000	0.809
Q42.4	22	84.500	0.116
Q42.5	20	55.000	0.656
Q42.6	22	84.000	0.123
Q42.7	21	62.000	0.654
Q42.8	21	63.500	0.557
Q42.9	22	48.500	0.438
Q42.10	20	36.000	0.331
Q42.11	21	70.000	0.314
Q42.12	20	33.500	0.218

Item	N	Mann-Whitney U Score	Significance
Q43.1	22	40.500	0.218
Q43.2	22	47.500	0.401
Q43.3	23	54.000	0.487
Q43.4	22	64.500	0.797
Q43.5	23	70.500	0.786
Q43.6	22	46.500	0.365
Q43.7	22	56.000	0.365
Q43.8	23	56.000	0.797
Q43.9	22	52.500	0.606
Q43.10	22	49.500	0.478
Q43.11	22	68.500	0.606
Q43.12	23	55.000	0.525

Research Question Three: Course Accessibility Evaluation

Research participants were asked if they consented to the use of Blackboard Ally scores for the courses they had taught. Courses included were recent courses, having been taught from the Spring 2020 term up through Spring 2022 term. Courses without any content taught by the selected instructors were excluded from this analysis. Of the 34 faculty participants, two faculty members elected not to release data from Blackboard, three faculty members did not respond to the question about consent, and two other faculty members did not have any courses that were taught during the period listed (or courses taught did not have any content evaluated by Blackboard Ally).

Table 14 below shows the average Blackboard Ally accessibility scores for courses taught from the Spring 2020 term through the Spring 2022 term.

Table 14

Faculty Members' Average Blackboard Ally Accessibility Scores

Faculty	Ally Score Average	ADA Course Completed
Faculty 1	72.27	No
Faculty 2	57.00	No
Faculty 3	77.14	No
Faculty 4	74.40	No
Faculty 5	74.13	No
Faculty 6	89.00	Yes
Faculty 7	67.20	Yes
Faculty 8	33.82	No
Faculty 9	81.10	No
Faculty 10	54.60	No
Faculty 11	82.6	Yes
Faculty 12	91.5	Yes
Faculty 13	87.00	Yes
Faculty 14	81.18	No
Faculty 15	74.12	No
Faculty 16	81.89	No
Faculty 17	59.92	Yes
Faculty 18	72.75	Yes
Faculty 19	91.73	Yes
Faculty 20	73.00	Yes
Faculty 21	75.75	Yes
Faculty 22	83.30	Yes
Faculty 23	92.00	Yes
Faculty 24	77.54	No
Faculty 25	66.42	No
Faculty 26	87.82	Yes
Faculty 27	73.00	No

14 faculty members had not completed the ADA Compliance and Online Courses professional development course, while 13 faculty members had completed the course. Table 15 below shows the central tendencies of both faculty groups. Group One were faculty members who had completed the ADA Compliance and Online Courses professional development course, while Group Two represented the control group (those who had not completed the online course).

Table 15

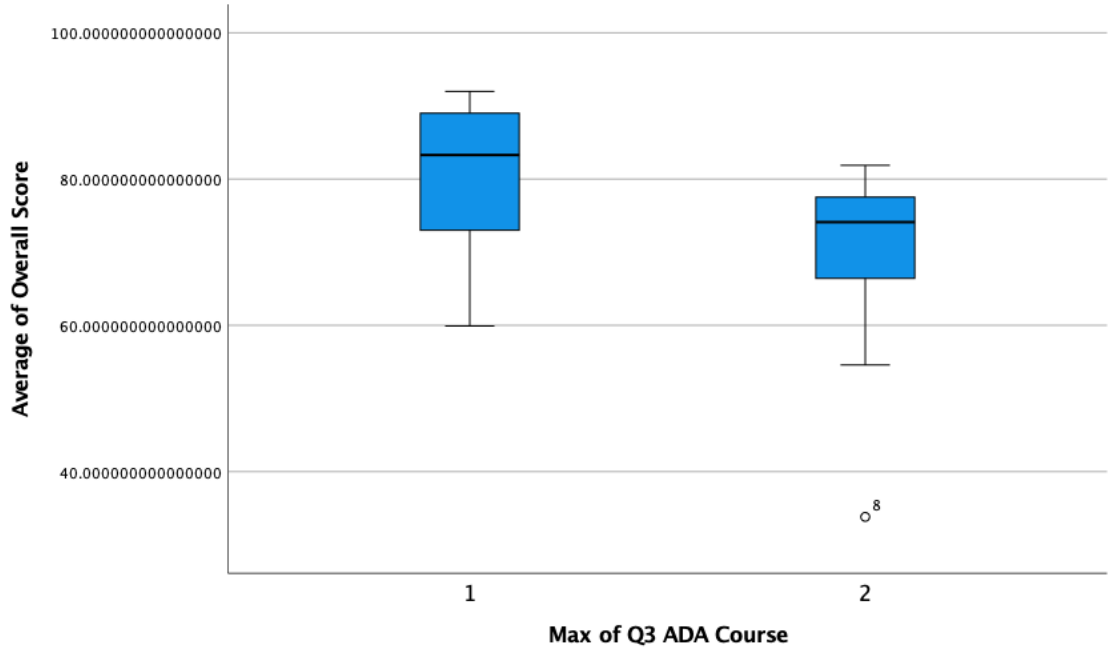
Measures of Central Tendency for Accessibility Scores

Group		N	Mean	Std. Dev.	Std. Error	95% CI		Mi.	Max.	Var.
1		13	81.04	10.39	2.88	74.77	87.32	59.92	92.00	
2		14	69.90	13.28	3.55	62.23	77.57	33.82	81.89	
Total		27	75.27	13.05	2.51	70.10	80.43	33.82	92.00	
Model	Fixed Effects			11.98	2.31	70.52	80.01			
	Random Effects				5.57	4.44	146.09			51.43

The mean accessibility score for faculty who had completed ADA Compliance and Online Courses professional development was 81.04 points out of 100 points, while the mean accessibility score for faculty who had not completed training was 69.09. A standard deviation of 10.39 points was calculated for the treatment group, while a standard deviation of 13.28 points was calculated for the control group. Figure 1 below shows the score distribution of faculty members as a box plot, showing quartile scores and outlier data. Those who took the ADA online professional development course had a larger spread of scores, while the highest score achieved by faculty who have not completed the training was less than the mean score of those who had completed the online training. In addition, there was one outlier amongst the group of faculty members who had not completed the ADA online professional development.

Figure 1

Blackboard Ally Scores Boxplot



Note. Horizontal Axis Labels:
1: Completed ADA course
2: Did not complete ADA course
This figure shows boxplots for average course accessibility scores for faculty who had completed the ADA Compliance and Online Courses professional development compared to those faculty members who had not completed the online training.

An Analysis of Variance (ANOVA) test was performed to identify whether the relationship between the control and treatment groups were significant. The ANOVA test performed indicated a significant relationship between course completion status and content accessibility. This test was performed with a 95% level of confidence. Table 16 below shows the results of the ANOVA statistical test.

Table 16
ANOVA Statistical Test Results

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	836.893	1	836.893	5.831	0.023
Within Groups	3588.125	25	143.525		
Total	4425.018	26			

Note. This table shows the sum of squares, df, mean square, F statistic, and significance of between group and within group variance.

Research Question Four: UDL Awareness

For this research question, participants were asked whether they were familiar with Universal Design for Learning (UDL). Participants were also asked for consent to obtain Blackboard Ally accessibility scores for the courses they had taught from Spring Semester 2020 through Spring Semester 2022. The scores for their courses were recorded and an average score for each instructor was computed. Of the 27 instructors who had met the inclusion criteria, 20 instructors reported that they were familiar with the principles of UDL, while seven participants had responded that they were not familiar with the concepts related to UDL.

The table below shows the average course accessibility score for each faculty member, along with their response to whether each faculty member was familiar with the concepts of UDL.

Table 17
Faculty Members' Average Course Accessibility Score and UDL Familiarity

Faculty	Ally Score Average	UDL Familiarity
Faculty 1	72.27	Yes
Faculty 2	57.00	Yes
Faculty 3	77.14	Yes
Faculty 4	74.40	Yes
Faculty 5	74.13	Yes
Faculty 6	89.00	Yes
Faculty 7	67.20	Yes

Faculty	Ally Score Average	UDL Familiarity
Faculty 8	33.82	Yes
Faculty 9	81.10	No
Faculty 10	54.60	No
Faculty 11	82.6	No
Faculty 12	91.5	Yes
Faculty 13	87.00	Yes
Faculty 14	81.18	Yes
Faculty 15	74.12	No
Faculty 16	81.89	No
Faculty 17	59.92	Yes
Faculty 18	72.75	Yes
Faculty 19	91.73	Yes
Faculty 20	73.00	Yes
Faculty 21	75.75	Yes
Faculty 22	83.30	Yes
Faculty 23	92.00	Yes
Faculty 24	77.54	No
Faculty 25	66.42	Yes
Faculty 26	87.82	Yes
Faculty 27	73.00	No

The mean Ally accessibility score for faculty members who selected they were familiar with UDL concepts was 75.37 points, with a standard deviation of 14.24 points. For faculty members who indicated that they were not familiar with UDL, the mean accessibility score was 74.98 points, with a standard deviation of 9.75. The overall mean accessibility score was 75.27 points with a standard deviation of 13.30. The range of scores for faculty members who expressed familiarity with UDL is broader than the range of scores for faculty members who did not express familiarity with UDL. There was one outlier for faculty members who expressed familiarity with UDL, and one outlier for faculty members who did not express familiarity with UDL.

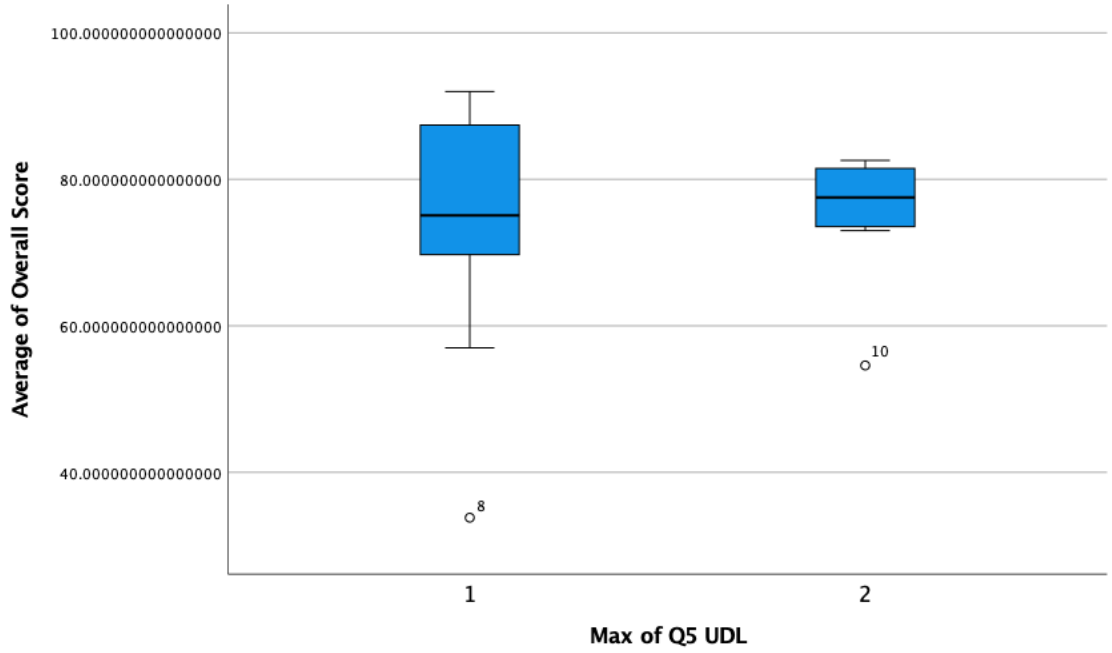
Table 18

Descriptive Statistics for Accessibility Scores Based on UDL Familiarity

		N	Mean	Std. Dev.	Std. Err.	95% CI		Min	Max	Var.
1		20	75.37	14.24	3.18	68.70	82.03	33.82	92.00	
2		7	74.98	9.75	3.68	65.97	83.99	54.60	82.60	
Total		27	75.27	13.05	2.51	70.10	80.43	33.82	92.00	
Model	Fixed Effects			13.30	2.56	69.99	80.54			
	Random Effects				2.56	42.73	107.79			-16.99

Figure 2

Boxplot for Ally Accessibility Scores Based on UDL Familiarity



Note. Horizontal Axis Labels:
1: Indicated familiarity with UDL
2: Did not indicate familiarity with UDL

An ANOVA test was performed to determine if there was any significant variance between each group. The ANOVA test performed did not identify a significant difference between the two groups of faculty members. The test was conducted with a 95% confidence interval. Table 19 below shows the ANOVA score calculations.

Table 19

ANOVA Test for Research Question 4

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	0.783	1	0.783	0.004	0.948
Within Groups	4424.235	25	176.969		
Total	4425.018	26			

Note. This table shows the ANOVA test results for this research question, with sum of squares, df, mean square, F statistic, and significance ($p < 0.05$).

Chapter Five

Discussion and Conclusion

Overview

Designing online learning environments to be accessible to all learners is an emerging challenge for faculty members, content creators, instructional designers, university administrators, and educational institutions. If Web Accessibility is not considered during the design process, then learners are at risk of not being able to interact with course materials. Institutions can open themselves up to financial liability.

Therefore, it is important for institutions to adopt an intuitional culture that puts accessibility at the forefront by promoting inclusive design and Universal Design for Learning. UDL serves as a framework for the development of courses and curricula that are accessible to diverse learners. Institutions should also offer professional development for faculty members on how to create accessible content. Institutions should also promote tools such as Blackboard Ally for creating accessible materials, and to serve as a tool for evaluation and continuous improvement in creating accessible course materials.

Assessment programs should ensure that professional development for creating accessible course materials is effective for promoting Web Accessibility. Faculty members should be provided with the skills, tools, and resources necessary to create accessible content. It is also important for the development of a culture of accessibility for faculty members to hold beliefs that facilitate building such a culture.

To determine the effectiveness of professional development on promoting Web Accessibility, this study explored the following research questions:

- Is there a difference amongst faculty attitudes towards accessible content for those who have completed professional development in Web Accessibility in contrast to those who have not?
- Is there a difference amongst faculty skills in creating accessible content amongst faculty who have completed professional development in Web Accessibility in contrast to those who have not?
- Is there a difference in the level of web accessibility of courses taught by faculty who have completed professional development in Web Accessibility in contrast to those who have not?
- Does faculty awareness of Universal Design for Learning (UDL) have an impact on the level of web accessibility of courses taught by faculty?

Discussion of Research Questions and Results

This study utilized a 43-item questionnaire, as well as course-level data from Blackboard Ally for courses taught between Spring 2020 and Spring 2022. The questionnaire was sent to 290 individual faculty members, and 31 faculty members responded to the survey, for a response rate of 10.6%. The study population included faculty members at a Midwestern regional research university.

Research Question One. Research Question One was: "Is there a difference amongst faculty attitudes towards accessible content for those who have completed web accessibility training in contrast to those who have not?" This research question explored various attitudes related to developing accessible web-based learning environments, as well as the identification of institutional policies and practices related to web accessibility. Themes related to this research question were explored in part one of the

questionnaire, which was based on research conducted by Vollenyder, et al. (2017). The research included the following beliefs related to the consideration of Web Accessibility: Personal effort, social responsibility, product quality, user advocacy, legal obligations, self-perception as specialist, awareness and priorities, requirement conflicts, technical compatibility, resources, and knowledge and skills (p. 354).

From the participants' responses, there were no findings of significance related to these identified beliefs. Most research participants indicated that they had a positive view towards creating accessible content. Participants also showed a willingness to consider the incorporation of accessible web content for future courses they plan to teach. This willingness stems from users anticipating students and peers would view accessible web course resources positively. Additionally, most faculty members agreed that the consideration of Web Accessibility (WA) was an institutional priority.

While there were no significant differences between groups of faculty members based on their participation in the ADA Compliance and Online Courses professional development course, there was a variation in responses across all participating instructors related to the following items:

- For question one, which explored whether implementing WA resulted in more complex work for faculty members, eight faculty members disagreed slightly, while 19 faculty members indicated they either somewhat agreed or strongly agreed that the consideration of WA made their work more difficult.
- For question five, which explored whether legal obligations factored into decisions about the implementation of WA, nine faculty members indicated they disagreed with this obligation, while 17 members indicated they agreed.

- For question six, which covered technical constraints, 15 instructors indicated they felt technical constraints did not make the consideration of WA to be difficult, while ten instructors agreed with the consideration of WA.
- For question seven, eight faculty members disagreed with the assertion that WA made their work more difficult. Faculty members, while 19 faculty either agreed or strongly agreed with the proposition that WA made their work more difficult.
- For question eight, 15 instructors reported they considered a lack of knowledge and skill to be a factor in being able to apply principles of web accessibility.
- For question 16, 16 faculty members reported they considered a lack of time to be a factor in their ability to implement WA.
- For question 17, 10 faculty members reported a lack of knowledge and skills related to creating accessible course content affected their decision to implement accessible course content.

Instructors from both groups expressed a desire for inclusivity, and a desire to meet the needs of students and to comply with legal and institutional requirements. This outcome falls in line with user advocacy, which was one of the salient beliefs explored in Vollenwyder, et al. (2019). According to Vollenwyder, et al. (2019), "User advocacy emerged as the most important salient belief, influencing the formation of attitude as well as subjective norm regarding the consideration of Web Accessibility" (p. 356).

However, some faculty members indicated that a lack of technical skills or access to time and resources necessary to consider WA in course development. For users who completed the professional development, this finding indicates a gap between skills taught in the professional development course and what participants had reported in the

questionnaire. A further needs analysis related to desired professional development and other necessary resources should be performed to determine additional resources that may be helpful to faculty in helping them to overcome limitations with a perceived lack of resources and skills for developing accessible course materials.

Professional development related to creating accessible course environments should focus on developing faculty skills for designing accessible Web environments. Professional development should then be focused on lowering the learning curve necessary for creating accessible content. Regarding professional development, Vollenwyder, et al. (2019) discusses, “Web practitioners' knowledge and skill of how to effectively work on Web Accessibility should be continuously supported, because it benefits their self-perception as specialists” (p. 358). Therefore, it is important for educational institutions to support the professional development of faculty members by providing resources, tools, and instruction in developing accessible course materials.

Part Two of the questionnaire explored institutional policies and practices related to the creation of accessible course materials. This section of the questionnaire included binary response items, scaled response items, and multiple response items. Participants agreed the university had stated accessibility policies, and resources were made available for helping students with obtaining academic support. Respondents felt developing accessible course materials was an important goal of the institution. Respondents also indicated that opportunities for professional development were available and were targeted to different audiences at the institution.

Of the items in Part Two of the questionnaire, items 27.2, 27.3, 27.5, 30.1, and 30.5 showed a significant ($p < 0.05$) difference for participants who had completed the

ADA Compliance and Online Courses professional development course compared to those who had not completed the course.

Question 27 asked participants to identify which units were responsible for enforcing accessibility issues online. Users could select multiple responses for this item, and the options were 1) Disability Services, 2) Center for teaching and learning, 3) Distance Learning office, 4) individual colleges or departments, and 5) Office of diversity and inclusion. There was a difference in responses for whether the center for teaching and learning, distance learning, or the office of disability and inclusion were responsible for enforcing accessibility requirements. The responses to this item represent an opportunity for improving institutional policies to clarify how specific organizational units are responsible for developing and enforcing accessibility of online educational resources.

Question 30 asked users who is responsible for reviewing online courses for digital accessibility. The choices were 1) Faculty, 2) Faculty developer, 3) Instructional designer, 4) Instructional technologist, 5) Administrator, 6) Production team, 7) Quality Matters Reviewers, 8) Quality Assurance Specialist, 9) Disability Services Specialist, 10) Digital Accessibility Specialist/Coordinator, and 11) Web developers. Of these choices, a difference in response pattern was identified for 1) Faculty, and 5) administrators. Additionally, item 11) Web developers, was slightly above the cutoff value for significance ($p < 0.05$), so it is likely this item could show a significant difference in a larger study.

Item 32, which asked if accessibility statements were provided, and item 35.6, which asked if web developers were a targeted audience for disability training, were

slightly above the cutoff of p. < 0.05 for significance. These items could become significant in a future survey with a greater level of user participation.

Even though other items did not show a significant difference in the response patterns per group, there were variations in overall responses for the following items:

- Item 25 asked if compliance with digital accessibility policies was evaluated. Of the faculty members who responded to this question, nine respondents responded with yes, while 15 responded that compliance was not evaluated. This item indicates that faculty may not be aware of how policies are evaluated. A recommendation would be to incorporate a detailed compliance plan at the institutional level and explain the compliance plan in professional development related to accessible course materials and compliance with accessibility policy.
- Item 28 asked how frequently courses were evaluated for compliance with accessibility requirements. Of the faculty who responded, nine respondents indicated that courses were never evaluated, while ten respondents indicated that courses were evaluated on an annual basis. Recommendations for this item would include specifying the frequency of evaluation and review of courses as part of policies related to accessibility.
- Item 31 asked if there were budgets for developing accessible courses. 13 faculty members indicated that there was such a budget, while 11 indicated there was no budget.
- Item 33 asked if courses were reviewed for mobile accessibility. 15 respondents indicated that courses were reviewed for mobile accessibility, while nine respondents indicated that courses were not reviewed. As such, implementation of

policies related to mobile accessibility and processes for reviewing course content should be put in place and communicated to instructors.

While the research study did not show a significant difference between those who took the ADA Compliance and Online Courses professional development course for most items, the study did point to some deficiencies in policy awareness that could be addressed through improvements in communication and professional development. The study indicated that the participants in the sample likely had awareness of accessibility requirements. Participants also expressed a desire to make course materials accessible, but some participants acknowledged a deficit of skills for making accessible content, as well as feeling they lacked the necessary resources for creating accessible content.

Research Question Two. Research Question Two explored whether participation in professional development resulted in users being more proficient with a selection of skills related to the creation of accessible content. The items in Part 3 of the questionnaire were used to explore topics related to transcription and captioning of audiovisual media, usage of selected accessible contents, and skills related to creating such content.

User performance on these items is noted as follows:

- Question 37 asked faculty members how frequently audiovisual items were accompanied with transcripts. Based on the data collected, and the statistical tests performed, no significant difference between the two groups of faculty members was identified. However, faculty reported a variety of frequencies for providing transcripts for media.
- Question 38 asked faculty members how frequently closed captions were provided for audiovisual items. No significant difference was identified between

the two groups studied. Of the faculty members who responded, 13 (or 52%) faculty members indicated that course audiovisual materials were captioned "always" or "often," while 12 faculty members reported that audiovisual materials were captioned "sometimes," "rarely," or "never." This value falls below the percentage of respondents who reported that captions were provided "always" or "often" of 61% on the study by Mancilla and Frey (2021).

- Question 39 asked faculty members who was responsible for creating captions and transcripts. The options were: 1) By faculty developer, 2) By instructional designer, 3) By student worker, 4) By third party, fee-based service, 5) Auto-generated by software, 6) By faculty member, 7) By disability services office, 8) By multimedia specialist, and 9). Courses used are already closed captioned. Of these items, the was a significant difference between the two study groups based on 5) Auto-generated by software. In addition, option 6, By faculty member fell slightly above the cutoff point for significance, and this item could be significant in a study with larger numbers of participants.
- Question 40 asked faculty members which accessibility practices they utilized in the courses they taught. These items were: 1) Descriptive hyperlinks, 2) Alternative text, 3) Alternative formats (ex: audio, video, text, images), 4) Headings, 5) Readable PDFs, 6) Table design, 7) Captioning/transcripts, 8) Document design, 9) Font colors and contrasts, 10) Plain language (ex: familiar language, active voice, concise sentences), 11) Keyboard accessibility, and 12) Consistent navigation menus. The two groups of faculty members differed significantly with their use of 2) alternative text, and 6) table design, with faculty

members who completed professional development making greater use of these technologies. The use of descriptive hyperlinks and alternative text were the two most-utilized skills, while accessible document design and accessible table design were the least utilized.

- Question 41 asked faculty members which of the items in Question 40 resulted in the highest level of difficulty for faculty members to implement. There was no significant difference between the two groups. Table 20 below shows the breakdown of response counts for this item.

Table 20
Response Counts for Level of Effort to Implement Accessible Technologies

Level of Effort	High	Medium	Low
Descriptive hyperlinks	6	7	9
Alternative text	8	8	6
Alternative formats (ex: audio, video, text, images)	8	11	3
Headings	4	10	9
Readable PDFs	9	7	6
Table design	9	7	4
Captioning/transcripts	12	8	3
Document design	5	14	3
Font colors and contrasts	1	6	16
Plain language (ex: familiar language, active voice, concise sentences)	4	2	16
Keyboard accessibility	7	7	6
Consistent navigation menus	5	10	6

According to the table above, implementing captioning and transcripts represented the item that required the highest level of effort, while accessible font colors and contrasts, as well as plain language represented the items that most faculty members identified as having the lowest level of effort to implement.

Meanwhile, headings, accessible document design, alternative formats, and consistent navigation represented a medium level of effort to implement.

- Question 42 asked faculty members which of the items from Question 40 posed the greatest challenge. There was no significance between the two groups. Table 21 below shows the response counts based on how faculty members ranked each skill as their greatest challenge.

Table 21
Response Counts for Challenging Skills

Greatest Challenge	High	Medium	Low
Descriptive hyperlinks	6	6	8
Alternative text	7	7	7
Alternative formats (ex: audio, video, text, images)	11	8	3
Headings	5	10	7
Readable PDFs	8	7	7
Table design	9	10	3
Captioning/transcripts	12	7	2
Document design	4	13	4
Font colors and contrasts	3	6	13
Plain language (ex: familiar language, active voice, concise sentences)	5	4	11
Keyboard accessibility	9	9	3
Consistent navigation menus	7	7	6

The table above shows which items represent items for which faculty had indicated posed the greatest challenge for them. These items included implementing alternative formats and captioning. Faculty members indicated that document design, headings, and table design posed a medium challenge, while plain language and font colors and contrasts represent the items that posed the lowest challenge.

- Question 43 asked faculty members which of the items from Question 40 they felt they needed additional trainings for. There was no significance between the two groups. Table 22 below shows how faculty members ranked their needs for training on these items:

Table 22
Rank of Accessibility Skills Based on Faculty Members' Need for Training

Need for Training	High	Medium	Low
Descriptive hyperlinks	8	4	10
Alternative text	8	4	10
Alternative formats (ex: audio, video, text, images)	10	6	7
Headings	6	5	11
Readable PDFs	8	10	5
Table design	8	7	7
Captioning/transcripts	8	6	8
Document design	4	13	5
Font colors and contrasts	4	3	15
Plain language (ex: familiar language, active voice, concise sentences)	5	5	12
Keyboard accessibility	7	10	5
Consistent navigation menus	5	8	10

The table above shows which items faculty members reported the greatest need for training. Based on the table, the participating faculty members reported that alternative formats represented the area they felt needed more training in. Meanwhile, faculty members identified a medium need for training in creating readable PDFs, accessible document design, and keyboard accessibility.

Items 41-43 evaluated the effort required to create accessible course elements as well as areas that instructors felt they needed additional training for. Of these items, alternative formats and creation of captions and transcripts for multimedia objects represented the items instructors felt were the most difficult to implement, as well as the

areas that faculty members felt they needed additional training for. The creation of alternative formats and captioning of audiovisual materials represented the accessible design elements for which participants of Mancilla and Frey (2021) had indicated were the most difficult to implement.

Research Question Three. Research Question Three was: Is there a difference between the level of accessibility of courses taught by faculty who completed the ADA Compliance and Online Courses professional development course compared to those who did not. Course accessibility was measured using overall Blackboard Ally accessibility scores, and a mean score was calculated for each participant. Overall, a significant difference was identified between mean accessibility scores for the two groups of faculty members. Faculty members who had completed training had higher mean accessibility scores. The value for significance was $p = 0.023$ ($p < 0.05$). Faculty members who have completed professional development related to creating accessible course materials were more likely to have higher levels of accessibility in their courses.

Considering the importance of developing accessible course materials from both a legal and a usability standpoint, professional development related to creating accessible course materials should be offered to faculty on a broad basis. As more faculty members take part in professional development related to creating accessible online courses, the overall accessibility of online courses can be improved on an institutional level.

The literature review showed that the availability of accessibility evaluation tools such as WebAIM or Blackboard Ally has led to more faculty and instructional developers using these tools to improve the accessibility of online learning environments. Professional development should be provided to faculty members on effective use of

accessibility evaluation tools and the process of accessible content creation in software programs that are frequently used by faculty members. (Mancilla & Frey, 2020). While tools such as Ally can help to improve Web Accessibility, there is concern that such tools can create a misleading picture of course accessibility (Lieberman, 2018).

Research Question Four. Research Question Four asked if "Awareness of UDL principles contributed to higher levels of course accessibility compared to faculty members who did not express awareness of UDL". In the questionnaire, faculty members were asked to self-report if they were familiar with the principles of UDL. Of the faculty members who participated in the questionnaire, 20 faculty members reported they were familiar with UDL principles, while six faculty members did not. There was no significant difference in accessibility scores for these two groups of faculty members.

It is likely that the faculty surveyed had a high understanding of UDL concepts, even if they did not partake in professional development related to accessibility. Ultimately, a thorough understanding and familiarity of UDL principles among faculty at the institutional level can help to advocate for improved accessibility of online courses, and to promote more equitable learning experiences for students.

Existing studies may indicate that faculty members at different institutions may have familiarity with at least one principle related to UDL. In turn, faculty members who do express familiarity are often willing to apply principles of UDL within the courses they teach (Westline, et al., 2019; Scott, Temple & Marshall, 2015).

Conclusions

The growth of the Internet as a medium for instruction over the past few decades, in the form of online learning, web-assisted courses, and blended learning has created

many opportunities and challenges for expanding educational access to diverse learners. This trend, as well as the switch to remote learning options during the global COVID-19 pandemic, also shows that accessibility of web-based instructional content is an important consideration for instructional best practices and legal compliance.

This research study explored faculty attitudes and beliefs related to the creation of accessible content and the implementation of best practices for Web Accessibility. Faculty members understood the legal concepts related to accessibility and disability law. Participants also expressed positive desires for creating accessible content as well as a willingness to meet student expectations of accessible content.

Faculty members expressed that they did not always have the appropriate knowledge and skills or the resources to make content accessible in their courses. This belief was expressed consistently among faculty who completed professional development, as well as those who did not. Therefore, additional focus should be placed on developing faculty skills and confidence with developing accessible course materials.

The research study showed faculty users who received professional development in understanding accessible course design were able to apply that knowledge to improve accessibility in their courses. Tools such as Blackboard Ally allowed faculty members to supplement professional development by providing feedback for how instructors can improve their course materials, as well as providing students with alternative formats that can benefit student learning.

The use of Blackboard Ally helps to realize the potential for UDL in online course design by helping to adapt the learning experience for students with different learning needs. Scott, et al., (2015) mentions, “UDL as a framework for online coursework and

preparation might ensure a quality learning experience for students. It may also help teacher preparation programs seeking to design and deliver quality instructional experiences for students, and help college programs maintain a level of quality that will improve online teacher preparation" (p. 100).

It is important for institutions to support accessibility and inclusion at the institutional level. Mancilla and Frey (2021) demonstrated the importance of institutional support for promoting course accessibility. "It is critical for campus *administrators* to establish a culture of inclusivity that undergirds all online course development efforts and prioritizes the digital accessibility of instructional materials" (p. 11). Therefore, institutions should encourage the creation of accessible online course materials by investing in resources to facilitate the creation of accessible online course materials, as well as providing professional development and support to course instructors, instructional designers, and others involved in the content creation process.

Recommendations for Further Research

This study explored the effectiveness of the ADA Compliance and Online Courses professional development course and its effects on faculty member's attitudes, beliefs, practices, and skills. The study evaluated the level of accessibility of courses taught by faculty based on their completion of the ADA Compliance and Online Courses professional development and if familiarity with UDL affected the level of accessibility of courses taught by faculty. This study serves as foundational research that further research can expand on the areas of accessibility and universal design.

1. Overall, low participation rates for this study may limit the applicability of the sample members to the study population. Therefore, future survey research in this area

should use larger samples to provide a more inclusive view of faculty attitudes as well as faculty technical skills for creating accessible course materials. Even with a small sample, the internal consistency scores obtained using the Rasch model indicate the instrument used would be more effective for identifying performance differences in a larger sample (Lord, F. M., 1980).

2. The literature review showed how educational institutions and political jurisdictions have adopted programs for implementing UDL principles in learning environments. UDL principles have been cited in federal educational legislation (CAST, 2022). As a result, institutions should consider pilot programs for designing learning environments according to the principles of UDL. Online learning environments designed according to the principles of UDL would be evaluated to determine if integrating UDL into the design process for learning environments results in greater compliance for accessibility principles, and results in courses that are more accessible in contrast to courses designed outside the UDL model.

3. This research study explored the accessibility levels of courses taught within the institutional LMS, with a focus on overall accessibility scores. A case study analysis of specific courses could explore the accessibility level of individual course components. This type of study would take a deeper look at individual courses to determine areas of strength as well as areas of improvement.

4. Quality Matters requires courses to meet specific qualifications for a course to be certified by Quality Matters. QM Standard 8 is focused on accessibility of the course site, and QM encourages instructors to utilize UDL principles when designing courses for certification. Additional research can focus on whether courses designed to meet QM

standards exhibit higher accessibility scores than for courses designed without accordance with QM Standard 8.

5. This research study explored faculty attitudes, beliefs, and skills related to creating accessible course materials. However, the foundational aspects of UDL relate to student learning by enabling multiple means of engagement, representation, and action and expression (Meyer, et al, 2014, p. 89). The goal of legislation such as the Rehabilitation Act and the Americans with Disabilities Act is to ensure equal access to educational opportunities without regard to disability status, a research study that explores student experiences with course accessibility should be considered. For example, studies could focus on barriers to accessibility encountered in courses, as well as student use of Blackboard Ally tools to generate alternative formats and their interaction with the content.

6. A qualitative study could examine faculty experiences with creating accessible content. The study would focus on areas of strength as well as areas of weakness in terms of implementing accessible course designs. Additional areas of interest could include use of tools such as Blackboard Ally to assist with measuring course accessibility, as well as the conceptual framework of UDL.

7. This study used a cross-sectional design in which course accessibility scores were obtained for courses taught between Spring 2020 and Spring 2022. A cohort study of participants enrolled in a single session of the ADA Compliance and Online Courses professional development program would compare accessibility scores of courses taught by participants prior to course completion with courses taught after course completion.

This study would give a before and after look into the impact of professional development on the accessibility of courses taught by participants.

8. The outcomes of the research study identified a deficiency between reported skill levels for creating accessible content and the overall accessibility scores of courses taught by faculty.

Summary

The findings of this research study indicate, that amongst the faculty members surveyed, a desire to create accessible web content for the purposes of ensuring legal compliance as well as satisfying the need to accommodate students with different learning styles and abilities. While there was not a significant difference between faculty members who participated in training in contrast to those who did not participate in training, this study indicates that there is value in developing positive faculty attitudes towards accessibility.

While the study did not find a significant difference in skill level amongst faculty members who participated in professional development, versus those who did not, there was a significant difference between the level of accessibility of course content. Finally, the principles of UDL were broadly understood by the surveyed faculty, understanding of UDL did not have a significant effect on the level of accessibility of course content. However, UDL is a key component of creating accessible and engaging online learning experiences for students.

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Appendix A

Accessibility Questionnaire

Demographic Information

1. Please describe your faculty status: (Full time instructor, Part-time instructor/adjunct instructor, Graduate teaching assistant)
2. How many semesters have you taught online?
3. Have you completed the ADA Online Accessibility Certificate Course? (Yes/No)
4. I have used Blackboard Ally to improve the accessibility of my course site. (Yes/No)
5. I am familiar with Universal Design for Learning principles (Yes/No)

Part 1: Beliefs and Attitudes
Please indicate your level of agreement with the following items: (1 = Strongly disagree, 2 = Disagree, 3 = Agree, 4 = Strongly agree)

1. The consideration of Web Accessibility in my next course makes my work more complex
2. With the consideration of WA in my next course, I can support other students
3. Students expect that I consider WA in my next course
4. Legal obligations require that I consider WA in my next course.
5. I feel that the institution prioritizes WA
6. Technical constraints make it difficult for me to consider WA
7. Lack of knowledge and skill make it difficult to consider WA
8. Complex tasks are unpleasant for me
9. Supporting other people is pleasant for me
10. Regarding Web Accessibility, I want to do what users expect form me.
11. Regarding Web Accessibility, I want to be compliant with legal obligations
12. It is likely that my institution will have a high awareness and priority for Web Accessibility
13. It is likely that the requirements of my institution will make it difficult to consider Web Accessibility in my next project.
14. It is likely that technical constraints will make it difficult for me to consider Web Accessibility in my next project.
15. It is likely that I will not have the time and money necessary to consider Web Accessibility in my next project.
16. It is likely that I will not have the knowledge and skill necessary to consider Web Accessibility in my next project
17. The consideration of Web Accessibility in my next project would be pleasant for me
18. The consideration of Web Accessibility in my next project would be desirable for me
19. Most people who are important to me approve of my consideration of Web Accessibility in my next project

20. The consideration of Web Accessibility in my next project is up to me
21. In am confident that I can consider Web Accessibility in my next project
22. I intend to consider Web Accessibility in my next project

Part 2: Institutional Policies and Practices (Mancilla & Frey, 2021)

23. Does your institution have a formal policy that addresses digital accessibility? Note: "Digital accessibility" is the ability of electronic materials (ex.; audio, video, documents, images) to be easily navigated and understood by all students, including those with disabilities. This definition will apply throughout the survey.
    Yes
    No
24. Has a digital accessibility policy or similar guidelines been drafted at your institution?
    Yes
    No
25. Is compliance with the digital accessibility policy evaluated?
    Yes
    No
26. Are online students made aware of disability services or resources (in an orientation, course syllabus, etc.)?
    Yes
    No
27. Which office/s are responsible for enforcing digital accessibility issues in online courses? [select all that apply]
    Disability Services
    Teaching and Learning Center
    Distance Education Center
    Individual academic departments, schools or colleges
    Office of Diversity and Inclusion
    None

28. for digital accessibility?
    Never
    Every year
    Every 2-3 years
    Every 4-5 years
    Every 6+ years
29. What is your institution's level of priority for making courses digitally accessible for students with disabilities?
    High
    Medium
    Low
    Nonexistent

30. Who is responsible for reviewing online courses for digital accessibility [select all that apply]? Faculty
    Faculty developer
    Instructional designer
    Instructional technologist
    Administrator
    Production team
    Quality Matters Reviewers
    Quality Assurance Specialist
    Disability Services Specialist
    Digital Accessibility Specialist/Coordinator
    Web developers
31. Does your institution have a budget for creating digitally accessible course materials?
    Yes
    No
32. Are accessibility statements provided for vendor or third-party technologies?
    Yes
    No
33. Are online course materials reviewed for mobile accessibility?
    Yes
    No
34. Does your institution offer training on how to develop accessible online courses?
    Yes
    No
35. If your institution offers accessibility training, who is the target audience? Select all that apply.
    Faculty
    Faculty developers
    Instructional designers
    Instructional technologists
    Administrators
    Web developers
36. If accessibility training is offered, what types are available? Select all that apply.
    Mentoring program
    Internal course or workshop
    External course or workshop (OLC, QM, WebAim) Online resources
    Webinars
    Other, please specify_____

Part 3: instructional skills and practices

37. How frequently are online audio or video components accompanied by transcripts the courses I teach?
    Always
    Often
    Sometimes

Rarely
Never

38. How frequently is online video closed captioned in the courses I teach?
    Always
    Often
    Sometimes
    Rarely
    Never

39. How is closed captioning created at your institution? Select all that apply.
    By faculty developer
    By instructional designer
    By student worker
    By third party, fee-based service
    Auto-generated by software
    By faculty member
    By disability services office
    By multimedia specialist
    Courses used are already closed captioned

40. Which of the following digital accessibility practices are incorporated into the instructional design process for online courses? [select all that apply]
    Descriptive hyperlinks
    Alternative text
    Alternative formats (ex: audio, video, text, images)
    Headings
    Readable PDFs
    Table design
    Captioning/transcripts
    Document design
    Font colors and contrasts
    Plain language (ex: familiar language, active voice, concise sentences)
    Keyboard accessibility
    Consistent navigation menus

41. Rate the level of effort required for each of the following practices.
    Please use the following scale to rank each item: (High, Medium, Low)
    Descriptive hyperlinks
    Alternative text
    Alternative formats (ex: audio, video, text, images)
    Headings
    Readable PDFs
    Table design
    Captioning/transcripts
    Document design

Font colors and contrasts
Plain language (ex: familiar language, active voice, concise sentences)
Keyboard accessibility
Consistent navigation menus

42. What are your greatest challenges in creating digitally accessible course materials?
    Please use the following scale to rank each item: (High, Medium, Low)
    Descriptive hyperlinks
    Alternative text
    Alternative formats (ex: audio, video, text, images)
    Headings
    Readable PDFs
    Table design
    Captioning/transcripts
    Document design
    Font colors and contrasts
    Plain language (ex: familiar language, active voice, concise sentences)
    Keyboard accessibility
    Consistent navigation menus

43. Rank your need for training in the following digital accessibility practices.
    Please use the following scale to rank each item: (High, Medium, Low)
    Descriptive hyperlinks
    Alternative text
    Alternative formats (ex: audio, video, text, images)
    Headings
    Readable PDFs
    Table design
    Captioning/transcripts
    Document design
    Font colors and contrasts
    Plain language (ex: familiar language, active voice, concise sentences)
    Keyboard accessibility
    Consistent navigation menus

Appendix B

Requests for Permission for Questionnaire Instruments

Dear Tony,

thank you for your message.

And thank you for asking: You are welcome to use and adapt the items for your research. If you plan to apply a similar approach with the Theory of Planned Behavior as we did, I can also recommend you have a look at the materials provided by Fishbein and Ajzen. In the appendix of their book "Predicting and Changing Behavior: the reasoned action approach", they included a quite useful summary how to prepare a standard questionnaire based on their theory. There is also a short paper available online covering this issue in a similar manner: https://people.umass.edu/aizen/pdf/tpb.measurement.pdf

You will notice that we did not fully follow the guide and preferred a consistent 7-point Likert scale for all answers to add more clarity for the participants.

Good luck and I am looking forward to your research. Please do not hesitate to contact me if you have any other questions.

Best regards,
Beat

Am 05.02.2020 um 21:45 schrieb Walters, Anthony P <Anthony.Walters@utoledo.edu>:

Dear Beat,

I am a doctoral candidate in the Educational Technology program from the University of Toledo, in Toledo, Ohio, United States, and I am creating a doctoral dissertation proposal regarding faculty attitudes, beliefs, and skills related to creating accessible course materials. I have reviewed the research study that you had contributed to "Salient beliefs influencing the intention to consider Web accessibility", and I would like to request permission to utilize and adapt the questionnaire for use in my dissertation research.

Thank you,

Tony Walters
(He/Him/His)
Educational Technologist
Doctoral Candidate, Educational Technology Program

UToledo Online

Rocket Hall 1610A, Mail Stop 345

2801 W. Bancroft St.
Toledo, Ohio 43606-3390
419.530.2328

Tony,

Best of luck on your dissertation. Thank you for reaching out. As Barbara mentioned, we are happy to share with credit attributed.

Rae

Rae Mancilla, Ed.D.
Assistant Director of Online Learning |Office of Online Learning
University of Pittsburgh | School of Health and Rehabilitation Sciences
6071 Forbes Tower, Pittsburgh, PA 15260
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From: Barbara Frey <barbarafrey622@gmail.com>
Date: Monday, February 22, 2021 at 7:49 AM
To: "Walters, Anthony P" <Anthony.Walters@utoledo.edu>
Cc: "Mancilla, Rae" <ram199@pitt.edu>
Subject: Re: Request for permission

Tony,
We're so glad our white paper was interesting and helpful to you. Yes, please use the survey for your dissertation research. Rae and I only ask that you give us credit for our work.
Best wishes,
Barbara Frey

Sent from my iPhone

On Feb 21, 2021, at 9:21 PM, Walters, Anthony P Anthony.Walters@utoledo.edu wrote:

Dear Barbara and Rae,

My name is Tony Walters and I am a doctoral candidate at The University of Toledo. I was reading the whitepaper on Course Design for Digital Accessibility: Best Practices and Tools and I feel the included questionnaire would be suitable for my

dissertation research of evaluating the efficacy of online professional development and training for developing accessible online courses. I would like to seek permission to use the evaluation to distribute to faculty in order to evaluate their awareness of best practices and skills.

Thank you,

Tony Walters
(He/Him/His)
Educational Technologist

UToledo Online

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Appendix C

Informed Consent Document

ADULT RESEARCH SUBJECT - INFORMED CONSENT FORM

Principal Investigator *Berhane Teclehaimanot, Professor, 419-530-7979*

Other Investigators *Anthony Walters, Ed Technologist/PhD Candidate, 419-530-2328*

Purpose: You are invited to participate in the research project entitled *Evaluating the Effectiveness of Online Faculty Development in Creating Accessible Content* which is being conducted at the University of Toledo under the direction of Berhane Teclehaimanot and Anthony Walters. The purpose of this study is to evaluate the effectiveness of online professional development in online accessibility requirements and the development of accessible online content.

Description of Procedures: This research study will take place in Toledo, OH. Participants will complete an online questionnaire containing topics related towards attitudes and beliefs, policies, and technology skills related to creating accessible online course content. The questionnaire is estimated to take 30-60 minutes to complete. The research staff will also utilize aggregate accessibility scores from courses taught by the instructor.

Potential Risks: Risks related to participating in this study are anticipated to be minimal. Some potential risks may include loss of anonymity or access to sensitive data. Recognizing this, the research team will take the following steps to minimize risks, including using a questionnaire hosted on an encrypted web platform, and storing data on encrypted and password protected computer systems.

Potential Benefits: A direct benefit to you if you participate in this research may be that you will learn about accessibility policies and develop an understanding of your skill level with creating accessible online content. The field of educational technology may benefit from this research by identifying faculty attitudes towards developing accessible online content and assessing faculty skills with creating online educational content. Others may benefit by learning about the results of this research.

Confidentiality: The questionnaire will be hosted on a secure, encrypted survey hosting site, and data will be stored as encrypted files on a password-protected computer system. Personally identifiable information will be anonymized using a coding system, with participants assigned a random numerical identifier. Data collected from the study will be published in an aggregate fashion.

Voluntary Participation: The information collected from you may be de-identified and used for future research purposes. As a reminder, your participation in this research is voluntary. Your refusal to participate in this study will involve no penalty or loss of benefits to which you are otherwise entitled and will not affect your relationship with The University of Toledo or any of your classes. You may skip any questions that you may be

uncomfortable answering. In addition, you may discontinue participation at any time without any penalty or loss of benefits.

Contact Information: If you have any questions at any time before, during or after your participation you should contact a member of the research team (Berhane Teclehaimanot (419-530-7979) or Anthony Walters (419-530-2328).
If you have questions beyond those answered by the research team or your rights as a research subject or research-related injuries, the Chairperson of the SBE Institutional Review Board may be contacted through the Human Research Protection Program on the main campus at (419) 530-6167.

CONSENT SECTION – Please read carefully

You are making a decision whether or not to participate in this research study. By answering Yes to the first question of the survey, you indicate that you have read the information provided above, you have had all your questions answered, and you have decided to take part in this research. You may take as much time as necessary to think it over.

By participating in this research, you confirm that you are at least 18 years old.

Appendix D

Invitation Letter to Faculty Members

Dear Faculty Member,

As a member of the University of Toledo faculty community, you have been selected by the research team to participate in a research study entitled Evaluating the Effectiveness of Online Faculty Development in Creating Accessible Content. The purpose of this study is to evaluate the effectiveness of online professional development in online accessibility requirements and the development of accessible online content.

This research survey will cover faculty attitudes and behaviors, policy familiarity, and skill levels for designing accessible course content. The study will evaluate the following research questions:

- Is there a difference amongst faculty attitudes towards accessible content for those who have completed web accessibility training in contrast to those who have not?
- Is there a difference amongst faculty skills in creating accessible content amongst faculty who have completed web accessibility training in contrast to those who have not?
- Is there a difference in the level of web accessibility of courses taught by faculty who have completed accessibility training in contrast to those who have not?
- Does faculty awareness of Universal Design for Learning (UDL) have an impact on the level of web accessibility of courses taught by faculty?

If you are interested in participating, please use the link below to access the survey and view the Informed Consent Form. If you have any questions related to this study, please contact the Primary Investigator, Dr. Berhane Teclehaimanot (419-530-7979) or Anthony Walters (419-530-2328), Co-Investigator.

Thank you for your time,
Anthony Walters

Doctoral Candidate
Study Number: 301033-UT Exemption Granted: 05/22/2021