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Expert Consensus On Barriers to College and University Online Education for Students with Blindness and Low Vision

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EXPERT CONSENSUS ON BARRIERS TO COLLEGE AND UNIVERSITY ONLINE EDUCATION FOR STUDENTS WITH BLINDNESS AND LOW VISION

by

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ABSTRACT

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Online education courses have increased exponentially over the last twenty years. These courses provide opportunities for education to students that may find attending in a regular classroom difficult, if not impossible. The number of students with disabilities enrolling in online education courses is also increasing. However, because of the mode of delivery (via computer/internet), blind and low vision college and university students can find it difficult to participate fully in an online course if it is not designed with accessibility in mind. The purpose of this study was to identify the barriers that blind and low vision college and university students face when accessing online education courses. A framework for the present study was developed using five factors that influence accessibility for blind and low-vision students: (1) inconsistent policies, (2) lack of accessibility and universal design, (3) lack of instructor training, (4) lack of monitoring and accountability, (5) inequities in access to bandwidth infrastructure and devices. A three-round Delphi survey was developed to gather expert opinions regarding the effect

these factors have on accessibility to online education for blind and low-vision students. Participants for the study were blind and low vision college and university students who had previously taken an online course and had used any assistive technology devices to access the computer. The first round of the Delphi consisted of seven open-ended questions. Responses from the first round were analyzed and 25 survey items were generated for Round Two. Study participants rated each item on a 7-point Likert scale. In the third and final round study participants were sent the same 25 survey items along with the mean and standard deviation (*SD*) for each and given the opportunity to reconsider their answers based on the group's responses. Round Three mean and standard deviations scores were analyzed and survey items were ranked in importance for participants from lowest *SD* scores to highest. *SD* scores above 1.00 were not ranked in importance for participants. Results were discussed in context to the established framework. Additionally, implications, limitations, and recommendations for future research were also discussed.

(148 pages)

PUBLIC ABSTRACT

Expert Consensus On Barriers to College and University Online Education for Students with Blindness and Low Vision

Sachin D. Pavithran

The availability of online college and university courses have continued to grow, offering opportunities for education to students that may find attending in a regular classroom difficult, if not impossible. The number of students with disabilities enrolling in online courses is also growing. However, because of the mode of delivery (via computer/internet), blind and low vision college and university students can find it difficult to participate fully in an online course if it is not designed with accessibility in mind. Education is directly related to blind and low vision individuals becoming fully employed and independent. Blind and low vision college and university students who have previously taken an online course and used assistive technology devices to access the computer are aware of the issues of accessibility to online courses. The current study began by asking a group of blind and low-vision students to answer seven open-ended questions regarding their experiences accessing online courses at their college or university. The group responses generated 25 survey items and participants were asked to rate each item. Survey items were evaluated and participants were given the opportunity to re-rate their answers based on the group's responses. The final results were evaluated and ranked in importance according to participant responses. Results were discussed along with the implications, limitations, and recommendations for future research.

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CHAPTER I

INTRODUCTION

Background

Since the advent and advancement of digital technology, education for many students**,** with or without disabilities, in the U.S. and throughout the world has been transformed. Although the brick-and-mortar school still exists, education now extends far beyond the walls of the school. Gates (1999) anticipated that with new technologies and greatly increased bandwidth on the horizon, the power of information would be accessible to "anyone, anytime, anywhere." With the predicted explosion in technology, online education courses via the Internet have increased exponentially.

Online education has become a well-accepted medium of learning. With 198 accredited online education programs in the U.S. (Guide to Online Schools, 2015), online education has become a suitable option for many students and offers numerous advantages. In fact, students are expected to use electronic platforms including college websites, email, and instructional software (Oertle & Bragg, 2014). With access to the internet, students are able to attend class anytime, anywhere and are able to retrieve course materials 24 hours a day, 7 days a week. Students are able to take classes from instructors across the nation and around the world, which also allows them to network with classmates from a wide range of backgrounds and locations. Students can access instructors through chat, discussion threads, or email, without having to wait for office hours. Online courses offer flexibility, allowing students to work at their own pace, which

is extremely helpful for students balancing education with work and family life (Franklin University, 2015).

The National Center for Education Statistics (2014) reported that for 2012 Fall Semester, there were approximately 21,147,055 students enrolled in either undergraduate or graduate courses at colleges and universities in the U.S. Of these students, approximately 5,452,100 were participating in online education, meaning that more than 25% of all students in higher education chose exclusively, or in part, to pursue their education goals via the Internet. Online courses provide opportunities for education to students that may find attending a regular classroom difficult, if not impossible (Richardson, 2009). They benefit from the availability of online notes, the ability to work at their own pace, access to online course materials, and the ability to maintain anonymity (Fitchen et al., 2009).

One group who could benefit from this explosion of online learning is blind students,[1] although it appears that these students may be benefitting less from the new technologies. It is unknown exactly how many blind students participate in online education but according to Guercio, Stirbens, Williams, & Haiber (2011), the number of blind students involved in online education is large and is projected to increase. Oertle and Bragg (2014), speaking of students with all types of disabilities in all types of postsecondary institutions of learning, helped to quantify this increase.

> In fact, Newman, Wagner, Knokey, and Shaver (2010) documented that, between 1990 and 2005, the postsecondary enrollment of students with disabilities

[1] People first language will not be used in this paper when referring to blind and low vision individuals, considering it implies that the person's condition caused him or her to be disabled and, therefore, places responsibility on the blind individual to overcome the boundaries erected by society and society's reluctance to provide equal access (Richardson, 2009).

> increased from 26% to 46%. Undergraduates who identify as having a disability are now 11% of the student population. (Synder & Dillow, 2012, p. 59)

Jacko (2011) asserted that online learning could be a significant advantage for blind and low-vision students because of the absence of physical barriers, such are found in campus facilities, including buildings and other lack of accommodations. However, the developers and publishers of course management software and the colleges and universities that purchase their products often overlook the needs of blind and low-vision students. Oertle and Bragg (2014) reported findings of an investigation that examined the accessibility at community colleges. Of the 30 community college websites tested for accessibility, none were found to be completely accessible although web accessibility policies were in place and IT professionals reported they had been informed about web accessibility. According to Putnam, Spiegel, and Bruininks (1995), societal values and philosophies regarding people with disabilities influence inclusion in education.

A review of the literature has shown that little is known of the first-hand experiences of blind and low-vision students when accessing online education courses using assistive technology (AT) devices, or how students feel when confronting inaccessibility. The literature has indicated that little thought has been given to ask blind and low-vision students about their experiences in accessing online education. According to Horton and Sloan (2014), user perspective is an effective and proven tool for focusing attention on otherwise discounted issues with a web design or implementation. It is hoped that the results of this study will accomplish the following: (1) add to the body of literature showing the gap that currently exists; (2) create opportunities for future research that will be better able to address inaccessibility to online education at colleges

and universities; (3) aided colleges and universities in crafting effective accessibility policies by addressing the barriers to equal access to online education; and (4) help faculty and curriculum developers by making resources available to them in creating accessible online education courses.

A review of the literature of empirical studies on the experiences and barriers to online education for students who are blind identified a total of 13 articles. Some of these studies included students with other types of disabilities, in addition to blindness and low vision. Thus, there are few empirical studies on blind and low-vision students and their first-hand experiences of online education. A greater number of position papers were located, mainly calling for the accessibility of college and university online education courses for blind and low-vision students. Moreover, a review of the literature has suggested that there are barriers to online education accessibility for blind and low-vision students. The literature also included an extensive discussion of the laws that apply to accessibility and points out the ambiguity as to what extent online education courses are covered under the law. The literature also indicated that accessibility policies for online learning programs tend to be inadequate but does provide both positive and negative examples of accessibility to online education courses at colleges and universities. However, the literature does not clearly state if there is a general awareness of inaccessibility to online education courses among colleges and universities.

Through careful review, a framework for the present study was developed using five factors that influence accessibility for blind and low-vision students (Deshler, East, Rose, & Greer, 2012). They include (1) inconsistent policies, (2) lack of accessibility and

universal design, (3) lack of instructor training, (4) lack of monitoring and accountability, (5) inequities in access to bandwidth infrastructure and devices. A three-round Delphi survey will be developed to gather expert opinions regarding the effect these factors have on accessibility and barriers to online education for blind and low-vision students. The results of the Delphi survey will add to the body of the literature on accessibility, create opportunities for future research, aid colleges and universities in crafting effective accessibility policies, and provide resources for faculty and curriculum developers in creating accessible online education courses.

Importance of the Problem

Classroom education for blind and low-vision students has a short history. Indeed, the first known school for the blind, The Royal Institute for Blind Youth, opened in Paris, France in 1784 by Valentin Haüy (Omvig, 2014). Teaching at the Royal Institute was primarily through oral instruction and repetition (Louis Braille School, n.d.). Haüy, while director of the Institute, pioneered AT by developing a method to print books with raised letters to teach children at the Institute to read with their fingers. Louis Braille, a student at the school, was influenced by Haüy's work and developed his own system of raised dots to represent the alphabet (Louis Braille School, n.d.). Soon, other schools for the blind opened throughout Europe and the U.S., and the Braille system became the standard for reading and writing for blind individuals throughout the world. Accommodations made at colleges and universities today still include materials in alternative formats, such as Braille and audio recordings.

AT devices have been developed to increase access to the World Wide Web for people with disabilities. AT devices developed for people with blindness and low vision include screen readers (Bradbard, Peters, & Caneva, 2010; Burgstahler, 2002; Burgstahler, Corrigan, & McCarter, 2004; Carnevale, 1999; Fitchen et al., 2009; Guercio et al., 2011; Jacko, 2011; Kip-Rupnow, Dowrick, & Burke, 2001; Opitz, 2002; Roberts, Crittenden, & Crittenden, 2011; Tandy & Meacham, 2009; Wall & Sarver, 2003; Weir, 2005), screen magnifiers (Bradbard et al., 2010; Burgstahler, 2002), speech recognition software (Bradbard et al., 2010; Fitchen et al., 2009; Wald, Draffan, & Seale, 2009; Weir, 2005), speech synthesizers (Bradbard et al., 2010; Burgstahler, 2002; Tandy & Meacham, 2009), large word and talking word processors (Bradbard et al., 2010), and refreshable Braille displays and Braille embossers (Bradbard et al., 2010). However, in spite of these advancements, the small body of literature indicates that blind and low-vision students experience barriers and accessibility challenges to online education.

According to Burgstahler (2006), the planning stage is the essential part in providing accessibility for blind and low-vision students. Those who use AT devices to access online courses benefit when universal design principles are incorporated during the planning stage of online course development. Universal design refers to the design of products and environments that are usable by all individuals to the greatest extent possible, with no need for adaptation or specialized design, thus, allowing unassisted access or indirect access for people using AT and, therefore, removing any need for accommodations (Burgstahler, 2002).

This involves making decisions that assure accessibility to a wide range of

individuals regardless of abilities, disabilities, learning styles or any other characteristics, therefore eliminating the need for accommodations (Burgstahler, 2006). Universal design can include making documents available in multiple formats (Lorenzetti, 2004; Optiz 2002), creating websites with consistent and predictable navigation patterns (Burgstahler, 2002; Keeler & Horney, 2007), organizing similar content on a web page, using clear and simple language (Burgstahler, 2002), limiting colors and multiple fonts (Opitz, 2002; Wall & Sarver, 2003), using large letters and bullet points to separate information (Keeler & Horney, 2007; Opitz, 2002), limiting graphics (Edmonds, Allen, Todd, & Kaplan, 2005), and providing alternative text tags when graphics are used (Carnevale, 1999). Although knowledge of universal design principles is well established, Wattenberg (2004) contended that the promise that technology would eliminate barriers has not been realized and instead, the digital divide has increased between those who are able to access technology and those who are not.

In September 2012, the principal investigators of the Center for Online Learning and Students with Disabilities, a research and development organization at the University of Kansas, Lawrence, issued an open letter addressing concerns that had emerged during a preliminary investigation of online learning accessibility (Deshler, 2012). Significant issues were discovered including problems with inconsistent policies, accessibility and universal design, lack of instructor training for online courses, lack of monitoring and accountability, and inequities in access to bandwidth infrastructure and devices. No further details or information concerning this project are available.

Delphi Method

A Delphi survey is a systematic consensus-building method for gathering and organizing expert opinions about a complex topic (Clayton, 1997; Hsu & Sandford, 2007; Vázquez-Ramos, Leahy, & Hernández, 2007). It is a particularly valuable method when the specific aim of a study is to enhance understanding of problems, examine possible solution, or develop projections (Skulmoski, Hartman, & Krahn, 2007). Clayton explained, "The Delphi is a technique for collecting judgments that attempt to overcome the weaknesses implicit in relying on a single expert, a one-shot group average, or round-table discussion" (pp. 374-375). It gives an opportunity for researchers to capitalize on the knowledge and experience of a group of experts who may not be able to come together physically (Briendenhann & Wickens, 2002), and come from differing backgrounds, attitudes, and philosophies (Fleming, Boeltzig-Brown, & Foley, 2015).

Four key aspects characterize the classic Delphi method.

1 Anonymity of Delphi participants allows for the free expression of opinions without pressure from others in the group to conform to any particular idea (Andranovich, 1995; Clayton, 1997; Fleming et al., 2015; Hsu & Sandford, 2007; Lang, 1995; Putnam et al., 1995; Skulmoski et al., 2007; Turoff & Hiltz, 1996; Wouldenberg, 1991).

2. Iteration allows the participants to re-evaluate their views as the group progresses to each round (Andranovich, 1995; Clayton, 1997; Lang, 1995; Putnam et al., 1995; Skulmoski et al., 2007, Wouldenberg, 1991).

3. Controlled feedback informs participants of the perspectives of others in the group and allows participants to clarify or reconsider their views (Andranovich, 1995; Clayton, 1997; Hsu & Sandford, 2007; Lang, 1995; Skulmoski et al., 2007; Wouldenberg, 1991).

4. Statistical accumulation of group responses allows for quantitative analysis and interpretation of data (Hsu & Sandford, 2007; Skulmoski et al., 2007).

Vázquez-Ramos et al. (2007) and Skulmoski et al. (2007) have suggested that before researchers decide to use the Delphi method they should: (1) Determine the best mode of group communication to use for the study; (2) Identify and locate the expert panel; (3) Study other research techniques; and (4) Consider how other research techniques apply to the research problem. Failure to initially address these considerations may result in a failed use of the Delphi method. Once the Delphi is deemed the most suitable research method for the study, expert panel selection is considered the most important step in the process (Clayton, 2007; Hsu & Sandford, 2007; Lang, 1995).

The quality of study results is dependent on proper panel selection (Hsu & Sandford, 2007; Lang 1995; Skulmoski et al. 2007) and according to Clayton (1997) "serves to authorize the Delphi's superiority and validity over other less painstaking and rigorous survey procedures" (p. 378). Therefore, participants should have expert knowledge on the subject matter (Andranovich, 1995; Briendenhann & Wickens, 2002; Clayton, 1997; Helmer & Rescher, 1959; Hsu & Sandford, 2007; Lang, 1995; Skulmoski et al., 2007), be willing to commit to the process over a substantial period of time (Briendenhann & Wickens, 2002; Clayton, 1997; Skulmoski et al., 2007), be able to participate fully (Clayton, 1997), and give thoughtful feedback (Hsu & Sandford, 2007). Moreover, Lang suggested that participants should have a stake in and be directly affected by the outcome of the study. Panel size is dependent on the purpose and complexity of the study and the necessary expertise of participants. However, it is generally accepted that for a homogeneous group, a panel size may consist of 10 to 15 individuals (Briendenhann & Wickens, 2002; Clayton, 1997; Skulmoski et al., 2007).

According to Hsu and Sandford (2007), a Delphi process can incorporate as many rounds as needed to achieve consensus among participants. However, a three round Delphi is usually considered sufficient. In the first round of the Delphi study, the purposefully selected panel is sent a letter of introductions with instructions for completing the survey, along with an open-ended questionnaire (Briendenhann & Wickens, 2002; Clayton, 1997; Hsu & Sandford, 2007; Vázquez-Ramos et al., 2007). Responses from the first round are analyzed and from the data, a Likert-type scale ranking survey is developed and distributed to the panel (Clayton, 1997). In the second round, participants have an opportunity to reconsider their statements from round one based on the group's responses. The responses from round two are analyzed and another Likert-type scale ranking survey is developed and distributed to the panel. Participants again have another opportunity to revise previous statements (Vázquez-Ramos et al., 2007). From the results of the third round, there is a final analysis and interpretation of data (Skulmoski et al., 2007).

The term "Delphi" refers to the 'Delphic Oracle' in Greek mythology. It was believed that a "chosen one" on the island of Delphi could predict the future with absolute certainty. Thus, the original Delphi was developed to predict future technological outcomes (Clayton, 1997). Norman Dalkey of the RAND Corporation developed the original Delphi method in the 1950s while working on a U.S.-sponsored military project (Hsu & Sandford, 2007; Skulmoski et al., 2007). At the time Dalkey needed expert opinions from different sources to estimate the number of A-bombs required to reduce the munitions output by a fixed amount. Therefore, the Delphi is

particularly appropriate when there is incomplete knowledge about a problem or phenomena (Skulmoski et al., 2007). It is especially useful when the problem would be better analyzed from the subjective viewpoints of individuals who have expert and/or first-hand knowledge about the problem. “Common surveys try to identify ‘what is’; whereas, the Delphi technique attempts to address ‘what could/should be’” (Hsu & Sandford, 2007).

Although the classic Delphi technique follows specific steps, it has proven to be a flexible and adaptable research methodology that has been effectively used for rehabilitation counseling research (Vázquez-Ramos et al., 2007) education policy development (Clayton, 1997), selecting effective state VR practices (Fleming et al., 2015), instructional technology (IT; Skulmoski et al., 2007), environmental impact assessment (Green, Hunter & Moore, 1989), political policy development (Andranovich, 1995) tourism development and management (Briedenhann & Wickens, 2005) and education policy for students with disabilities (Putnam et al., 1995) including other types of program planning, needs assessment, and policy development (Hsu & Sandford, 2007). The Delphi has been modified to incorporate or combine with other quantitative and qualitative research methods such as web conferencing with panelists (Fleming et al., 2015), and developing semistructured interviews from data gathered from the Delphi (Briendenhann & Wickens, 2005).

However, there are limitations to a Delphi study. According to Clayton (1997), the background and experiences of panel members can influence responses on a Delphi survey. It has been assumed that participants are equal in knowledge and experience,

however, that's not always the case (Hsu & Sandford, 2007). Therefore, the outcomes of a Delphi survey can be the result of identifying general statements rather than an in-depth examination of the subject matter. Also, responses can be influenced by the amount of time each participant has to dedicate to the process. The multiple feedback process, which is foundational to the Delphi, can influence low response rates and can affect the quality of results (Hsu & Sandford, 2007). Furthermore, participants may also be influenced by the responses from others during the proceeding rounds. They may change their own responses to better conform to the group. Fleming et al. (2015) and Vázquez et al. (2007) referred to this as "regression to the mean."

Fleming et al. (2015) stated that "The Delphi method is most appropriate when precise information and knowledge under study is not available" (p. 391). The Delphi is an appropriate method for this investigation considering there is little documented in the literature on the first-hand experiences of blind and low-vision students when accessing online education courses. Clayton (1997) considered the use of the Delphi especially appropriate to use when considering the possible results if changes were not made or the wrong changes were implemented: "The effects of critical decisions may linger and when a mistake is made, the damage may be irreparable and extremely costly" (p. 374). Failure to provide higher education opportunities to any segment of the population is costly to both these individuals and to society at large. Additionally, rather than leaving decision-making to administrators or other policy makers, it makes sense to ask the individuals with the greatest expertise, knowledge, and experience and those who to stand to gain from the eventual resolution of the question or issue. Stated differently, a Delphi panel is

best comprised of individuals who “are invested in the problem” and, in this case, these individuals are blind students. Biedenhann and Wickens (2002) described this as “Equally significant is the degree to which participants are themselves interested in the problem under investigation” (p. 14). These authors consider the Delphi Technique to be based upon “the ethos of empowerment.”

Empowerment of people with disabilities is one of the guiding principles of both research and practice in rehabilitation counseling. Directly soliciting input from people with disabilities and utilizing this input has been increasingly emphasized. This principle may account for the wider use of the Delphi technique in rehabilitation.

> Bellini and Rumrill (1999) noted that as rehabilitation research focuses on more complex themes, research methods become more complex as well. One research method that has captured the attention of rehabilitation researchers in the past years is the Delphi method. (Vázquez-Ramos et al., 2007, p. 111)

However, the rehabilitation literature that has utilized the Delphi method has not addressed the issues of accessibility to online education at colleges and universities for blind and low-vision students. The current Delphi study will add to the rehabilitation literature by considering the first-hand experiences and recommendations for accessibility of blind and low-vision students who have a stake in and may be affected by the outcomes of the study. The National Federation of the Blind (NFB) will serve as a resource to recruit the expert panel for this Delphi study.

The National Federation of the Blind

According to the NFB (2014), their organization has the largest membership of any other organization of the blind in the world. Its objective is complete integration into

society and equality for the blind. To understand the significant value of establishing a partnership with NABS for this three-round Delphi survey, it is essential to first examine the history and philosophy of its parent organization, the NFB. The NFB was founded in 1940 when sixteen individuals from seven U.S. states met together in Wilkes-Barr, Pennsylvania in order to establish a constitution and organize under a single federation for the purpose of collective action that would improve the lives of blind people (NFB, 1940). The original constitution of the NFB stated that its purpose in organizing on a national level was to promote the economic and social welfare of the blind. It organized on the premise that individually, they were "scattered, ineffective and inarticulate, subject to the oppression of the social worker and the arrogance of the governmental administrator" (NFB, 1940). Collectively, though, they were masters of their futures and guardians of their common interest. After the NFB's founding convention, other state organizations of the blind expressed an interest in joining. The NFB membership has grown to the tens of thousands and there is an affiliate in every state in the union, including the District of Columbia and Puerto Rico (NFB, 2014).

The history of the NFB began long before the 1940 Pennsylvania convention. It began in California in 1881 when an eight-year-old farm boy named Newel Perry living near Redding, California lost his sight after coming in contact with poison oak (tenBroek, 1961; Wittenstein, 2014). Perry's life had been much like that of other boys his age living in the country at that time. He worked on his family's farm, played and ran outdoors, and was educated in a one-room schoolhouse. Perry stated that after he lost his sight, it was assumed that he would be completely helpless (Baum, 2012). He said that when he had

recovered sufficiently to get out of bed, some neighbors came to see if he could dress and marveled at how he was able to manage, especially that he could still put on his own shoes. When he was well enough to go outside, his concerned father tried to keep him from straying off. However, Perry quickly developed the ability to navigate his surroundings and soon was able to do most things he had done before losing his sight. Nevertheless, he did not return to the one room schoolhouse (Baum, 2012).

Perry was orphaned at the age ten and was then sent to the California School for the Deaf and Blind (tenBroek, 1961). While at the school, Perry and two friends would talk about their aspirations for adulthood and how they would support themselves. Perry stated that none of them had ever heard of a blind man working and supporting himself (Baum, 2012). The three would talk about going to college and wonder if college was possible for a blind person. They sought advice on the subject by writing to all head administrator of schools for the blind in other states. Half the superintendents replied although, none were encouraging. These administrators reasoned that even if the boys were able to undertake college and graduate, they would live a life of discontent since these college graduates would be relegated to jobs that society considered the blind capable of doing (Baum, 2012).

In contrast, according to tenBroek (1961), the principal of the California School for the Blind, Warring Wilkinson, was a forward-thinking pathfinder who took great interest in the welfare and future of his students. Wilkinson saw potential in Perry and advocated for him to attend Berkeley High School and after that, the University of California at Berkeley. TenBroek also stated that it was Wilkinson who instilled in Perry

the belief that education is the key to independence for the blind. This concept would be the foundation of Perry's future work and influence.

In 1898, under Perry's leadership, the alumni from the California School for the Blind organized the Alumni Association of Self-Supporting Blind (Baum, 2012). From the beginning, the association advocated for improving the economic circumstances of the blind through higher education and remunerated employment. At that time**,** according to Perry (Baum, 2012), any education for the blind beyond that which was provided at the state school was considered either impractical or impossible or both. Perry understood that these objectives would require legislation and he and the members of the newly formed organization crafted a bill to be presented by a member of the California legislature.

Two years after forming the Alumni Association for Self-Supporting Blind, Perry left California and went to Europe where he earned a Ph.D. in Mathematics, graduating with honors from the University of Munich in Germany (Baum, 2012; tenBroek, 1961). Then, in 1902, he went to New York City with plans to teach mathematics at a college or university. However, the paternalistic attitudes that had dogged him since losing his sight were now his hurdle to realizing his teaching aspirations. During his 10 years in New York, he wrote to hundreds of colleges and universities and distributed his dissertation and the scholarly article he had written and had published while still in Europe. He employed networking strategies such as attending meetings of mathematicians, enlisting help from his teachers and reaching out to anyone and everyone who might have some connection that would help him. The responses to his inquiries varied. According to

tenBroek, some were astonished at Perry's accomplishments; many showed indifference or blatantly stated they did not consider a blind man capable of teaching college-level mathematics. Others said they thought he could be a successful teacher but not at their college. None said "yes."

While in New York, Perry's help was sought to promote assistance to the blind through welfare and sheltered workshops. According to Perry (Baum 2012), the concepts of welfare and sheltered workshops were counter-intuitive to empowering the blind to be independent and lead productive lives. Instead, Perry wrote the New York Reader Bill for Blind College Students, which would make state funds available for the blind to enter college and pay for readers. Although the bill had both support and opposition, it passed both houses unanimously and was signed into law. That fall eleven blind people in New York were able to enter college (Baum 2012).

Perry returned to the California School for the Blind in 1912, this time as a teacher. Soon after he introduced his reader bill to the California legislature, which proved successful. Now any of his students if they chose could go to college. From the California School for the Blind Perry organized and led a social movement, having first secured the opportunity for his students to attend college then preparing and encouraging them to do so. In 1934, Perry organized the California Council of the Blind; an outgrowth of the original alumni group he had started years earlier. According to tenBoek (1961), Perry continued to fight against low standards, low expectations, and sheltered workshops, while advocating for higher education and employment for the blind. The concepts Perry taught became the foundational principles of the NFB. His student, Jacob

tenBroek (1961) said of him:

> There were three habits of life one might almost say three elements of personality which I formed out of his teaching and example when I was an adolescent in his charge. First: an attitude towards my blindness, a conception that it is basically unimportant in the important affairs of life. A physical nuisance, yes! A topic of unembarrassed conversation, a subject of loud questions by small children in the street as you pass, certainly. But not something which shapes one's nature, which determines his career, which affects his usefulness or happiness. Second: a basic assumption that sighted people generally have boundless good will towards the blind and an utterly false conception of the consequences of blindness. It is their misconception about its nature that creates the social and economic handicap of blindness. Third: public activity as a rule of life, a sense of responsibility to exert personal effort to improve the lot of others.

tenBroek had come to the California School for the Blind in 1922. With Perry's help, tenBroek went on to attend the University of California, Berkeley, graduating with honors (Stein, 2015). After, tenBroek earned a Doctor of Science of Jurisprudence degree from UC Berkeley, Boalt Hall and later the Doctor of Jurisprudence Science from Harvard Law School. tenBroek became a well-known and respected constitutional law scholar, authoring more than 30 articles published in professional and law review journals. He became an active and influential member of the California Council of the Blind and in 1940 was elected as the founding president of the newly formed the NFB.

The National Association of Blind Students

At the NFB 1967 yearly convention, a group of students organized the first of the NFB's national divisions, the National Federation of the Blind Student Division, later known as the National Association of Blind Students (NABS, 2012a). According to NABS, its two founding purposes are to recruit blind students to its parent organization and to provide students with leadership opportunities and experience. Moreover, its

principal activities have been to promote equal access to educational and life opportunities for blind and low-vision students. The organization works to provide blind students with up-to-date and relevant information on topics that affect them and serves as a forum for networking and information sharing among its members. Externally, NABS engages in education and advocacy work to raise awareness among the general public of the capabilities of the blind and ensure that blind students are able to compete on an equal footing with their sighted peers in educational and life opportunities (NABS, 2012a).

For the Delphi survey to demonstrate validity, Hsu and Sandford (2007) asserted that, "investigators need to closely examine and seriously consider the qualifications of the Delphi subjects" (p. 3). NABS members that will be participating in the Delphi survey are blind or low-vision college and university students who have a working knowledge of screen reading access software, magnification software or they may use the contrast settings on their computer. Therefore, they will have first-hand experience, knowledge, and understanding of how inaccessibility affects them (NFB, 2014). Therefore, NABS is a most appropriate choice for the proposed Delphi survey.

Disability Law and Policy

According to Best (1919), there were few laws for the blind before Perry and tenBroek. Legislation for the blind had primarily been of two types: (1) funding for state schools for blind children for the purpose of teaching them the "blind trades" such as chair caning, basket weaving, and broom making; and (2) welfare (Best, 1919; Omvig, 2014). Best observed;

In ascertaining the general status of the blind in the United States, our first

> attention should perhaps be directed to the position to which they have been assigned by the state. The attitude of the state towards the various elements that compose its population is represented primarily in the law; and in the special treatment accorded by it to the blind, we may determine the regard in which they are publicly held. (p. 23)

Perry contended that policies had in effect amounted to the blind being forced to manage for themselves the best they could after leaving school with little or no help from the state (Baum, 2012). Furthermore, he observed that most state laws at that time kept the blind relegated to a life of poverty. Missouri and Georgia judged the blind as not capable of working. New York and Wisconsin required families to support their blind family members, although, New York granted that the blind could receive a license free of charge to sell papers and other goods, such as pencils, or play music on the streets. Many New England states made allowances for the blind to ask for alms without being labeled a tramp (Best, 1919).

Moreover, according to Best (1919), the courts questioned the ability of a blind person to travel unaccompanied using a public carrier, such a train and if refusing access could be justified. It was reasoned that a blind person traveling alone created safety hazards, especially if it involved changing cars during the trip. It was argued that an unaccompanied blind person should be required to produce evidence that they were capable of traveling alone.

The idea of civil rights for the blind was unheard of until 1949 when Tussman and tenBroek argued that equal protection of the laws, found in the 14th amendment of the U.S. Constitution had largely been understood that all persons would be fairly and equally judged of the law regardless of wealth, class, rank, or privilege. However, it did

more than require administrative justice. It demanded that the law itself be equal, a requirement of protection of equal laws. This interpretation defined how the state could impermissibly exclude individuals from the benefits and rights afforded to everyone and proved an important step in the development of the Civil Rights Movement and foundational in disability rights (NationsBlind, 2008).

According to Francis (NationsBlind, 2008), TenBroek's 1966 article, "The Right to Live in the World: The Disabled in the Law of Torts" laid the groundwork for the social model of disability and established that issues of disability are Civil Rights issues (NationsBind, 2008). tenBroek (1966) argued that people with disabilities, specifically, the blind are not inherently restricted in their ability to move about and interact in society. Instead, it is the barriers created by a society that is limiting to them. Moreover, tenBroek continued, it is their civil right to live, to participate, and contribute to their communities and have access to public accommodations, education, travel and remunerative employment. From "The Right to Live in the World," tenBroek wrote the Model White Cane Law that has become known as the civil rights law for the blind and others with physical disabilities, requiring that they have equal inclusion in the activities of the state (NationsBlind, 2008). That document became incorporated into the Rehabilitation Act of 1973 as its civil rights provisions. It also influenced the Americans with Disabilities Act (ADA) of 1990 and its later amendments.

Today, accessibility advocates reference Section 504 of Rehabilitation Act of 1973, the ADA of 1990, and Section 508 of the Rehabilitation Act Amendments of 1998 as the basis for requiring colleges and universities to provide online accessibility for

students with disabilities (Wall & Sarver, 2003). The Rehabilitation Act of 1973 was one of the first acts of legislation to tackle the problem of discrimination against people with disabilities (Wall & Sarver, 2003). Section 504 was enacted long before the wide use of the internet (Edmonds, 2004b) and although doesn't specifically address access to online education (Burgstahler, 2002), according to Wattenberg (2004), it is foundational in its intent to prevent discrimination in employment and education for people with disabilities in any facility receiving federal funding. It states that covered entities cannot exclude or otherwise discriminate against students with disabilities, who would otherwise be qualified for educational programs and services (Burgstahler, 2002; Burgstahler et al., 2004; Edmonds, 2004b; Paist, 1995; Tandy & Meacham, 2009; Wall & Sarver, 2003).

The ADA reinforces and extends Section 504 by requiring institutions of higher education, both public and private, to make available educational programs and services to students with disabilities and prohibits discrimination and exclusion (Burgstahler, 2002; Edmonds, 2004b; Paist, 1995; Tandy & Meacham, 2009). Although its purpose is to remove barriers that prevent people with disabilities from accessing opportunities that are available to people without disabilities (Opitz, 2002), there are no specific regulations regarding access to IT. However, Titles II and III of the ADA stipulate that communications provided by covered entities will be just as effective for people with disabilities as any other individual, meaning that information will be posted in accessible formats (Edmonds, 2004b; Opitz, 2002; Wall & Sarver, 2003). In 1996 the U.S. Department of Justice made clear that the communications mandate in the ADA includes covered entities that use the Internet for communication purposes, not excluding online

courses, which are to be made accessible to qualified students with disabilities (Burgstahler et al., 2004).

More recently, in 2010 the U.S. Departments of Justice and Education jointly issued a Dear Colleague letter to college and university presidents addressing the use of electronic book readers that lack an accessible text-to-speech function, making them inaccessible to blind and low-vision students (Perez & Ali, 2010). The letter spells out the scope and reach of Titles II and III of the ADA and Section 504 of the Rehabilitation Act concerning the required use of technology in the classroom. It makes clear that when those technologies are inaccessible to an entire population, meaning blind and low-vision students, it constitutes discrimination, which is expressly prohibited under the ADA. Moreover, the Department of Justice has authority to enforce and implement Title III of the ADA, which covers private colleges and universities and both Departments of Justice and Education have enforcement authority under Title II of the ADA, which covers public universities (Perez & Ali, 2010).

In addition to Section 504 and the ADA, Section 508 is intended to prevent discrimination of people with disabilities in the workplace and in education (Wattenberg, 2004). The technology boom of the 1990s promised universal communication and opportunities to the masses, however, lawmakers observed that people with disabilities were experiencing barriers to IT (Edmonds, 2004b). The 1998 amendments to Section 508 expands the previous legislation to cover electronic and information technologies (Wattenberg, 2004), and requires that all technology products sold to federal agencies and federally funded institutions, including colleges and universities, be accessible to all

people, including those with disabilities. In 1999, the Department of Education issued a letter stating that the amendments to Section 508 also apply to state government entities that receive federal funding, which would include some colleges and universities (Edmonds, 2004b).

Section 508 amendments detail specific standards for accessible websites that are founded on a subsection of the Web Accessibility Guidelines created by the World Wide Web Consortium, and adopted by the U.S. Access Board (Edmonds, 2004b). The legislation also directs any institution receiving federal funding to develop and enact policies and guidelines that promote the use of IT for people with disabilities (Wattenberg, 2004).

Statement of the Problem

Jacko (2011) argued that because of the lack of physical barriers, online education should be a benefit for blind and low-vision students. American laws and policies require post-secondary online courses to be accessible (Wattenberg, 2004) and universal design principles and guidelines are well known (Burgstahler et al., 2004). Nevertheless, Jacko stated that incompatibility of popular online course delivery systems with the AT used by blind and low-vision students persists, creating barriers that keep these students from full participation; a violation of their civil rights.

It is unknown how many blind students are affected by inaccessibility given the absence of data on blind and low-vision students participating in post-secondary online courses. There are, however, 3,521,686 people in the U.S. with some type of visual

disability (National Research & Training Center on Blindness & Low Vision, 2015a) and according to National Research & Training Center on Blindness & Low Vision (2015b),

> A lack of employment opportunities continues to prevent large numbers of individuals who are blind or severely visually impaired from becoming self-supporting and from fully participating in society. Nationally representative data from 2014 document that employment rates among individuals aged 16 to 64 who are blind or visually impaired are around 30%, as compared with 72% employment among people without disabilities. Specific subgroups of individuals with visual impairment show even lower employment rates. Specific research is needed to evaluate the effectiveness of existing practices and new interventions that can improve workforce participation by individuals who are blind or visually impaired. (para. 1)

According to Wattenberg (2004), education is directly related to blind and low vision individuals becoming fully employed and independent. Inaccessibility to online courses is a significant problem that is perpetuated by the lack of awareness and care given by courseware developers, course designers, instructors, and college and university administrators.

Guarding Against Researcher Bias

In any study, regardless of methodology, there is the possibility of researcher bias and the subsequent reduction of objectivity. In all phases of research, including designing, implementing, and interpreting, the researcher monitors, controls, and addresses the presence of bias and subjectivity. However, when the researcher has experienced many of the problems that are the basis of his study and when the researcher is an active professional advocate for a group of individuals, much like the participants selected for the study, the potential for researcher bias is greatly increased. Stated differently, when does interest in and proximity to the research question result in

researcher bias? For the present study, the following methods were implemented in order to reduce bias: (1) leading questions were avoided, (2) results were recorded accurately, and (3) round two had a comment box for participants to state if any of their comments in round one had been omitted from round two.

Purpose Statement and Research Questions

The purpose of this study is to investigate the accessibility of online education courses at colleges and universities for blind and low-vision students. This purpose will be achieved by answering the following research questions.

> RQ1: Given the Delphi methodology, what are the barriers to accessible online education courses at colleges and universities for blind and low-vision students?
>
> RQ2: Given the Delphi methodology, what are the solutions to removing barriers to accessible online education courses at colleges and universities for blind and low-vision students?

Definition of Key Terms

Accessibility: Refers to how easily a student with or without disabilities is able to approach, operate, participate in and/or use safely, with dignity a site, facility, work environment, service, program or technology (Job Accommodations Network, n.d.; University of Wisconsin-Madison, 2015). For this study, accessibility will refer to the ability of a blind or low-vision student to access an online education program with their AT such as a screen reader, magnification software, or manipulating the contrast settings on a computer, and perform at the same level as their peers in obtaining information and

participating in a class without any special accommodations.

Accommodations: Adjustments to the classroom, curriculum, or institution policies and procedures to address inaccessibility posed by disability limitations at colleges and universities (Shaw & Dukes, 2005). For example, an accommodation for a blind or low vision student can be a reader that will read assigned course materials to the student because the materials are not accessible to the student via their AT.

Assistive technology: Any item, piece of equipment or product system that is used to increase, maintain or improve accessibility to the Internet and online education for blind and low-vision students (Center for Persons with Disabilities, n.d.). For this study, assistive technology will refer to screen reading software, magnification software, and manipulation of the contrast setting on a computer that is used by blind and low-vision students in order to access information that is displayed on a computer screen and converted to information from text to speech.

Delphi Survey: A systematic consensus-gaining process used to survey and collect the opinions of experts on a particular subject (Yousuf, 2007). For purposes of this study, a three-round Delphi survey will be used to determine the first-hand experiences of blind and low-vision students when accessing online education. Data gathered from the survey will be used to develop a final research instrument.

Distance education: Distance education refers the geographic separation between students and the instructor. Distance education can be accomplished by different modes. However, for this study distance education will refer to online education where blind and low-vision students use AT to access the online classroom (IGI Global, 2017).

Low vision: For this study, the following criteria will be used for individuals with low vision. Visual acuity of less than 6/18 (0.3) but equal to or better than 3/60 in the better eye with best correction (Mississippi State University, The National Technical Assistance Center on Blindness & Low Vision, 2012)

National Association of Blind Students (NABS): NABS is a division of the NFB and works to promote equal access to educational and life opportunities for blind and low-vision students (NABS, 2012a). For this study, a partnership will be sought with NABS and a panel to participate in the Delphi survey will be selected from NABS members.

Online education: Online education falls under the umbrella of distance education and refers to the mode of delivery in which a course is being made available to students, which is via the Internet (Sener, 2015). For this study, online education will be courses that blind and low-vision students access via the Internet using their AT with personal computers.

Total blindness: For this study, the following criteria will be used for individuals with total blindness: The inability of a person to see anything with either eye (American Foundation for the Blind, 2008).

U.S. Architectural and Transportation Barriers Compliance Board (Access Board): An independent federal agency created in 1973 to ensure access to federally funded facilities. The Board develops and maintains design criteria, is a resource for information on accessible design, provides technical assistance and training, and has enforcement authority of accessibility standards for federally funded facilities. (Access

Board, n.d.).

Universal design: A concept of designing products including online technology, and the built environment to be appealing and usable to the greatest number of individuals possible, regardless of age, ability, or status in life (Burgstahler et al, 2004). For this study, when universal design principles are implemented into online education courses for blind and low-vision students the need for accommodations is eliminated.

Visual impairment: For this study, the following criteria will be used for individuals with visual impairment: Visual acuity of 20/70 or worse in the better eye with correction, or a total field loss of 140 degrees. Other factors that influence visual impairment can be light sensitivity, light/dark adaption, contrast sensitivity and glare sensitivity (American Federation for the Blind, 2008).

World Wide Web Consortium (W3C): An international community of member organizations, Consortium staff, and the public. The community was founded by the inventor of the World Wide Web, Tim Berners-Lee and is dedicated to universal web accessibility. W3C created the Web Accessibility Initiative (WAI), which establishes standards and guidelines and serves as a resource of information on how to create accessible websites (World Wide Web Consortium, 2015).

Summary

This chapter presents a brief explanation of the problem and the theoretical framework of this study. This chapter also outlines the purpose and presents research questions that will guide the study, and key terms are defined. Chapter II is a review of

the relevant literature relating to the problem and the factors that impact blind and low-vision students in college and university online education course accessibility. Chapter III describes the methodology that will be used for this study, which is a three-round Delphi survey with an expert panel of blind and low-vision students recruited through NABS.

CHAPTER II

REVIEW OF THE LITERATURE

The purpose of this chapter is to review the current literature concerning the accessibility of online education courses at universities for blind and low-vision students. The objectives of this review were as follows.

1. To determine if accessibility to college and university online education courses is currently considered an issue for students with disabilities at colleges and universities, and, if so, what factors contribute to inaccessibility.

2. To discuss the limitations and strengths in the literature.

Locating the Articles

The 33 articles for this review were located by searching in Google Scholar and the *Educational Resource Information Center* (ERIC) via EBSCO Host database. The "search all databases" function was used when searching ERIC. Descriptors used to locate the articles were: "online," "learning," "distance," "education," "disab*," blind*, low vision, and "access*," then narrowed by the subject of college and university education and limited to articles from the year 2000 to the present. Two more articles were selected when changing the range of dates to 1995 to present. A number of articles were located using descendant search in Google Scholar. Articles were included for the review if they met the following criteria.

1. The article was available either in full text online or from the Utah State University inter-library loan.

2. The article addressed accessibility to online education courses for students with disabilities at institutions of higher education either in the U.S. or abroad.

3. The article was published either in a scholarly journal or another reputable online publication.

The selected articles selected exhibit a variety of aspects associated with online education course accessibility for blind and low-vision students at colleges and universities. There is a lack of literature focusing solely on the experiences of blind and low-vision students when accessing online education courses. Therefore, articles that looked at different types of disabilities, including blindness and low vision were included. Preference was given to articles regarding colleges and universities in the U.S. However, because of the lack of literature on the subject, it was necessary to look at other nations. Hence, articles regarding accessibility to online education in Canada, United Kingdom (UK), and India were also included. All articles pointed out potential barriers to accessibility and some make recommendations as to how to create more accessible online courses for students with disabilities.

Study Characteristics

Thirteen of the articles selected for this review were empirical studies. Seven of the studies used qualitative research methods with small population groups and employed research instruments to gather comprehensive and in-depth data. One qualitative study used an instrument developed for the Students with Disabilities Online Learning (SDOL) survey (Roberts et al., 2011). Three qualitative studies developed questionnaires, surveys, and interviews specific for their study (Kharade & Peese, 2012; Muwanguzi & Lin, 2012; Wald et al., 2009). One qualitative study developed a list of accessibility indicators then collected examples from participating distance learning programs of how these programs

apply these indicators to the online learning education courses being offered (Bergstahler, 2006). Similarly, another study identified design elements for online accessibility and then observed how often those design elements were found in online courses of the participating colleges and universities (Keeler & Horney, 2007). Another study required participants to try newly developed screen reading software and answer questions about their experience (Guercio et al., 2011). Qualitative methods allow researchers to gather a wealth of data, gain a deeper understanding of the subject matter, and identify new concepts. However, qualitative methods are limited by small participant size and study outcomes cannot claim to be representative of the general population (Rhodes, 2013).

Six of the studies reviewed use quantitative research methods by analyzing data from large subject samples. Two of the quantitative studies used available instruments such as the *Attitudes Toward Requesting Accommodations (ATRA*; Barnard-Brak & Sulak, 2010), the *Course Experience Questionnaire (CEQ)*, and the *Personal and Educational Development Inventory (PEDI*; Richardson, 2009). One study used the software tool, Bobby 3.2, to analyze science web pages for accessibility (Veal, Bray, & Flowers, 2005). Another developed an online survey specific to the study (Fitchen et al., 2009). One quantitative study in the review was a content analysis of the accessibility policies of land grant universities in the U.S. (Bradbard et al., 2010).

Quantitative research methods gather data from a large number of subjects. These methods can allow for comparison among groups and the data gathered can be generalized over a broader population (Rhodes, 2013). However, the information gathered tends to be less detailed and does not allow for deeper explanations of

phenomena.

The dependent variable(s) in most of the studies was a measurement of different factors that affect the accessibility of online learning education courses for students with disabilities, including those with blindness and low vision. Although there is some discussion about particular college and university online education programs, the articles did not clearly state if there is a general awareness of accessibility problems at most colleges and universities. Consequently, there is little discussion of any procedures to follow when schools are made aware of an accessibility problem.

There is a lack of empirical research in the literature regarding online education course accessibility that specifically addresses the objectives of this review. Therefore, included in this review are eighteen position/discussion/informational articles and (Burgstahler, 2002; Burgstahler et al., 2004; Carnevale, 1999; Edmonds, 2004a, 2004b; Edmonds et al., 2005; Foley & Ferri, 2012; Jacko, 2011; Lorenzetti, 2004; Opitz, 2002; Paist, 1995; Parry, 2010; Santovec, 2005; Schettler, 2002; Tandy & Meacham, 2009; Wall & Sarver, 2003; Wattenberg, 2004; Weir, 2005), one “Dear Colleague” letter issued from the U.S. Departments of Education and Justice (Perez & Ali, 2010) and one literature review (Kim-Rupnow, Dowrick & Burke, 2001). These articles are helpful in presenting ideas, suggestions, and concerns regarding accessible online education courses. However, none can be considered general statements for all online college and university programs nor considered to be the position of all students or faculty engaged in online education.

Five Perceived Barriers That May Influence College and University Online Education Accessibility

In September 2012, the Center on Online Learning and Students with Disabilities issued an open letter from the principal investigators of a study aimed at discovering "how online learning environments can be optimally designed and implemented to be accessible, engaging, and effective for all students, including those with disabilities" (Deshler et al., 2012). This study involved students with disabilities who participated in online learning environments in colleges and universities. In their initial investigation, Deshler et al. found barriers to online accessibility and nine broad areas were identified as being of significant concern. The study involved students with disabilities participating in online learning environments in secondary education settings. Five of those areas of concern were applicable to online education programs of higher education and therefore, have been adapted and used as a theoretical framework for the current study. The five areas of investigation are (a) inconsistent policies, (b) lack of accessibility and universal design, (c) lack of instructor training, (d) lack of monitoring and accountability, and (e) inequities in access to bandwidth infrastructure and devices.

Inconsistent Policies and Guidelines

Deschler et al. (2012) provided many recommendations found in the literature of the methods and procedures colleges and universities can implement when developing an accessibility policy that is both clear and standardized. A strong accessibility policy begins with top-level leadership who values online education (Santovec, 2005) and is

committed to accessibility as a priority (Fitchen et al., 2009; Lorenzetti, 2004; Paist, 1995). Bradbard et al. (2010) advised that a designated person from a college or university's top administration be assigned specifically to advocate and develop an effective accessibility policy. This commitment to accessibility based on a clearly stated vision (Kim-Rupnow et al., 2001) and philosophy (Paist, 1995) sets the tone and commits the institution to ensure their online offerings are universally accessible (Bradbard et al., 2010; Lorenzetti, 2004).

Just as important, colleges and universities understand the legal requirements relating to online accessibility and remain up-to-date on all associated legislation and standards (Lorenzetti, 2004). Bradbard et al. (2010) recommended that colleges and universities consult with legal experts to assure that their accessibility policy complies with enacted legislation. This is advisable considering there is no one single or explicit federal law or court decision that requires institutions to make their online education offerings accessible but, instead, there is a combination of laws that govern online education accessibility for people with disabilities (Edmonds, 2004b; Tandy & Meacham, 2009). Accessibility advocates reference Section 504 of Rehabilitation Act of 1973, the Americans with Disabilities Act (ADA) of 1990, and Section 508 of the Rehabilitation Act Amendments of 1998 as the basis for requiring colleges and universities to provide online accessibility for students with disabilities (Wall & Sarver, 2003).

The Rehabilitation Act of 1973 was one of the first acts of legislation to tackle the problem of discrimination against people with disabilities (Wall & Sarver, 2003). Section 504 was enacted long before the wide use of the internet (Edmonds, 2004b) and although

it does not specifically address access to online education (Burgstahler, 2002), it is foundational in its intent to prevent discrimination in employment and education for people with disabilities in any facility receiving federal funding (Wattenberg, 2004). It states that covered entities cannot exclude or otherwise discriminate against students with disabilities, who would otherwise be qualified for educational programs and services (Burgstahler, 2002; Burgstahler et al., 2004; Edmonds, 2004b; Paist, 1995; Tandy & Meacham, 2009; Wall & Sarver, 2003).

The ADA reinforces and extends Section 504 by requiring institutions of higher education, both public and private, to make available educational programs and services to students with disabilities and prohibits discrimination and exclusion (Burgstahler, 2002; Edmonds, 2004b; Paist, 1995; Tandy & Meacham, 2009). There are no specific regulations regarding access to IT in the ADA, although, the stated purpose of the ADA is to mandate the removal barriers that prevent people with disabilities from accessing opportunities that are available to people without disabilities (Opitz, 2002), However, Titles II and III of the ADA stipulate that communications provided by covered entities will be just as effective for people with disabilities as any other individual, meaning that information must be posted in accessible formats (Edmonds, 2004b; Opitz, 2002; Wall & Sarver, 2003). In 1996 the U.S. Department of Justice clarified that the communications mandate in the ADA includes covered entities that use the Internet for communication purposes, not excluding online courses, which are to be made accessible to qualified students with disabilities (Burgstahler, et al., 2004).

More recently, in 2010 the U.S. Departments of Justice and Education jointly

issued a “Dear Colleague” letter to college and university presidents addressing the use of electronic book readers that lack an accessible text-to-speech function, thus rendering these textbooks inaccessible to blind and low-vision students (Perez & Ali, 2010). The letter detailed the scope and reach of Titles II and III of the ADA and Section 504 of the Rehabilitation Act concerning the required use of technology in the classroom. Further, the Dear Colleague letter elucidated that these technologies are inaccessible to an entire population, such as blind and low-vision students, this inaccessibility constitutes discrimination, which is expressly prohibited under the ADA. Moreover, the Department of Justice has authority to enforce and implement Title III of the ADA, which covers private colleges and universities and both Departments of Justice and Education have enforcement authority under Title II of the ADA, which covers public universities (Perez & Ali, 2010).

In addition to Section 504 and the ADA, Section 508 is intended to prevent discrimination against people with disabilities in the workplace and in education (Wattenberg, 2004). The technology boom of the 1990s promised universal communication and opportunity for the masses, however, lawmakers observed that people with disabilities were experiencing barriers to IT (Edmonds, 2004b). The 1998 amendments to Section 508 expands the previous legislation to cover electronic and information technologies (Wattenberg, 2004), and requires all technology products sold to federal agencies and federally funded institutions, including colleges and universities, be accessible to all people, including those with disabilities. In 1999, the Department of Education issued a letter stating that the amendments to Section 508 also apply to state

government entities that receive federal funding, which would include many colleges and universities (Edmonds, 2004b).

Section 508 amendments detail specific standards for accessible websites that are founded on a subsection of the Web Accessibility Guidelines created by the World Wide Web Consortium, and adopted by the U.S. Access Board (Edmonds, 2004b). The legislation also directs any institution receiving federal funding to develop and enact policies and guidelines that promote the use of IT for people with disabilities (Wattenberg, 2004). Accordingly, colleges and universities that adopt Section 508 as the foundation for their accessibility policy are likely able to show that they are in compliance with the ADA (Edmonds, 2004b).

The literature also recommends that policies carefully describe potential barriers that students with disabilities may face when accessing online education. This can be accomplished when colleges and universities consult with students and instructors with disabilities and include them in the discussions while policies are being developed. Moreover, an accessibility policy needs to consider previously developed online courses and set dates for when those courses will be brought into compliance with current policy standards and guidelines (Burstahler, 2002).

Most colleges and universities have some type of web accessibility policy in place; however, many have been found deficient in a number of key areas and not compliant with legal mandates (Bradbard et al., 2010). Legal and technical requirements for accessibility are complex (Burgstahler, 2006; Edmonds, 2004b). Broad and general language in the legislation has led to confusion and varied interpretations of the way in

which these laws apply to online accessibility (Carnevale, 1999). This, in turn, has led to unanswered questions college and university administrators need to know when developing an accessibility policy (Wattenberg, 2004). When Bradbard et al. analyzed the web accessibility policies at land-grant universities in the U.S., they discovered that policies varied in their scope and application between the different institutions. More than half the policies failed to clearly define who was accountable for policy compliance; such as course designers, individual instructors or departments, and which web pages were under policy jurisdiction. Also, policies lacked clear guidance on what constitutes an accessible website, leaving course designers and instructors unsure of expectations. Further adding to the ambiguity, policies often did not provide information on training, or establish a time frame for implementation, or discuss approval mechanisms for accessibility, or establish enforcement criteria and consequences for noncompliance.

When colleges and universities lack a clear, mandatory, and functioning accessibility policy, faculty may create and maintain their own online education course websites with limited instruction, guidance, and support from their institution (Bradbard et al., 2010). Consequently, online courses may be built with limited web design skills or knowledge of universal design principles. Without a viable accessibility policy in place, accommodations in online education courses may be made on an “ad hoc” basis at the discretion of the instructor or department (Barnard-Brak & Sylak, 2010). This could lead to barriers for students with disabilities and place the institution at risk of noncompliance with legal statutes. Strong accessibility policies prevent discrimination and stigma and allow students with disabilities to disclose their disabilities to instructors (Richardson,

2009). Moreover, accessibility policies influence market pressures, which are more likely to bring course management software into compliance with Section 508 guidelines (Schettler, 2002).

Lack of Accessibility and Universal Design

Online education courses have become an integral part of the educational opportunities at most institutions of higher education. Many colleges and universities have expanded their online offerings and made significant investments in their online course management software in order to stay up-to-date and competitive (Muwanguzi & Lin, 2010; Parry, 2010). It is reasonable to conclude that with the increase of students participating in online education courses, the number of students with disabilities participating has also increased (Fitchen et al., 2009; Guercio et al., 2011; Roberts et al., 2011). These courses have the potential to open a world of opportunities to many students, including those with disabilities (Santovec, 2005) and can be particularly beneficial to blind and low-vision students considering the absence of physical barriers (Jacko, 2011). However, Deshler et al. (2012) in their initial investigation found that the widely used online education environments were largely inadequate in terms of basic accessibility and universal design.

Tim Berners-Lee declared, “The power of the Web is in its universality. Access by everyone regardless of disability is an essential aspect” (Web Accessibility Initiative, 2014). The process of assessing an online education course for accessibility during development and making decisions that assure accessibility to a wide range of individuals regardless of abilities, disabilities, learning styles or any other characteristic, is referred to

as universal design and is recommended throughout the literature (Barnard-Brak & Sulak, 2010; Burgstahler 2002, 2006; Burgstahler et al., 2004; Edmonds, 2004a; Edmonds et al., 2005; Keeler & Horney, 2007; Lorenzetti, 2004; Opitz, 2002; Tandy & Meacham, 2009; Wall & Sarver, 2003; Wattenburg, 2004; Weir, 2005).

Planning for accessibility while an online education course is being developed is far simpler and incurs less expense than scrambling to make accommodations after the course has begun and a student discloses a disability (Burgstahler, 2002, 2006; Burgstahler et al., 2004; Santovec, 2005). In the initial planning stages, it is recommended that instructors take an inventory of course materials and content to determine how these might pose potential barriers to students with disabilities (Edmonds, 2004a). It is also advised that instructors consult with students with disabilities to discover how their AT devices would access an online education course (Edmonds, 2004a; Weir, 2005). By observing and conversing with students, instructors and course designers can gain knowledge and understanding of how to design a course from a student's perspective. Edmonds (2004a) stressed that designing and building an accessible online education course requires a significant amount of time; therefore, instructors and course designers need to budget their time accordingly.

Universal design principles specific to blind and low-vision students recommended in the literature included providing documents in multiple formats such as HTML, word-processed documents and PDFs (Lorenzetti, 2004; Optiz 2002), thus allowing students to choose the format most accessible for them. Also, websites must incorporate consistent and predictable navigation patterns (Burgstahler, 2002; Keeler &

Horney, 2007), be organized according to similar content, use clear and simple language (Burgstahler, 2002), limit colors and multiple fonts (Opitz, 2002; Wall & Sarver, 2003), display simplistic and uncluttered content by implementing the maximum use of white space, and use large letters and bullet points to separate information (Keeler & Horney, 2007; Opitz, 2002). Other recommendations include using limited graphics (Edmonds et al., 2005), and providing alternative text tags when graphics are used (Carnevale, 1999). Similarly, videotapes, video clips, and televised presentations need to incorporate oral descriptions of all content (Lorenzetti, 2004). Likewise, presenters at video conferences must fully describe all visual materials (Burgstahler, 2002). Furthermore, communication between instructors and students is essential in an online education course. It is recommended that email is used instead of synchronic messaging (Burgstahler, 2002; Burstahler et al., 2004; Lorenzetti, 2004). After an online course is developed, testing the web pages with different monitors, computer platforms, and web browsers is recommended to ensure the site is accessible and relevant to the content and delivery mode (Burgstahler, 2002; Optiz, 2002).

Seemingly, the expertise and the technology required to develop universally accessible online education courses are available (Carnevale, 1999). In spite of the availability of both expertise and technology, many publications relating to online education course design do not address the issue of accessibility (Burghstahler, 2006). Moreover, web design practices have become more complex and course management software more sophisticated with options to easily add images and video clips to enhance the online learning and promote visual appeal (Bradbard et al., 2010; Burstahler, 2002,

2006; Lorenzetti, 2004; Veal et al., 2005).

There is a mistaken belief that assistive technologies remove all barriers to online education (Burgstahler, 2006; Edmonds, 2004a; Foley & Ferri, 2012; Keeler & Horney). However, AT devices used by blind and low-vision students are often incompatible with online course management software (Burgstahler, 2006; Foley & Ferri, 2012) and barriers are created when universal design principles are not incorporated. For example, text-to-speech software can relay text on a computer screen but is unable to interpret images, graphics, and frames (Burgstahler et al., 2004, Tandy & Meacham, 2009). If alternative text tags for graphics and oral descriptions for video presentations are not provided, blind and low-vision students will be unable to access that part of the course (Bradbard et al., 2010; Burgstahler, 2002, 2006; Burgstahler et al., 2004; Carnevale, 1999; Jacko, 2011; Kharade & Peese, 2012; Muwanguzi & Lin, 2010). Similarly, image-based PDFs and PowerPoint slides can also prove difficult since they are graphics and cannot be read by screen readers (Fitchen et al., 2009; Jacko, 2011; Tandy & Meacham, 2009; Wald et al., 2009).

Guercio et al. (2011) explains that web pages are designed to be mouse controlled and the two-dimensional page layout and the use of frames can confuse screen readers and therefore, the content is rendered meaningless to blind students. Also, it is confusing and difficult to follow pop-up windows that redirect pages (Bradbard et al., 2010; Guercio et al., 2011), along with moving content on the computer screen, and inconsistent and unpredictable web page content (Keeler & Horney, 2007). As discussed previously, real-time chat tools are not always compatible with diction software (Fitchen

et al., 2009); screen readers have a tendency to garble the continuously changing text (Burgstahler, 2006; Bursgstahler et al., 2004; Jacko, 2011). Furthermore, compounding these difficulties, low-vision students who use screen enlargers view only a small portion of a web page at a time. If web pages are cluttered or inconsistent, navigation and understanding of the content can be difficult (Wald et al., 2009). Also, barriers can be erected for colorblind students when a course requires discernment of colors such as distinguishing between pertinent data on a computer screen (Burgstahler, 2002; Guercio et al., 2011).

When online education courses pose barriers to blind and low-vision students, negative educational outcomes are created. For example, Kharade and Peese (2012) conducted an exploratory case study in India to examine the relationship between barriers encountered by blind and low-vision students when accessing online courses and the students' perceived educational experience. All participants used some type of assistive device and reported that it was difficult or impossible to access any graphics. Participants also found it difficult to access assignments, real-time chat, discussion boards, emails, and videos. Students using screen magnifiers reported similar problems. Participants reported that because of the difficulty of participating in online chat they rarely participated in discussions or debates and felt anxious and self-conscious of how they would be perceived by others in the class. As a result, these students did not fully participate or benefit from the discussions or the course in general.

Fitchen et al. (2009) found in their study the most commonly reported problem by blind and low-vision students in online education courses was inaccessible websites and

course management systems. When queried about how the problem was resolved, the students' most common response was that the problem went unresolved. Similarly, Muwanguzi and Lin (2010) examined the accessibility challenges and emotional responses of blind students when accessing educational materials using the Course Management System (CMS), Blackboard and how online accessibility affects students' educational goals. The students reported emotional setbacks and frustration because of the loss of time and lag in academic progress due to inaccessibility and they felt marginalized by the university administration and technology designers.

Online learning objects are powerful tools (Edmonds et al., 2005). However, poorly conceived design creates needless barriers (Carnevale, 1999) leading to "limited mastery of curricular material, inability to participate with peers, frustration with completing lessons, low grades or inability to complete the lesson or course" (Keeler & Horney, 2007 p. 69). Some students may abandon their education pursuits (Kharade & Peese, 2012). Moreover, making "ad hoc" accommodations can present a significant strain on university resources leaving students with disabilities less likely to have their needs met (Parry, 2010; Roberts et al., 2011; Wald et al., 2009).

Lack of Instructor Training for Online Courses

There is agreement in the literature that training faculty and course designers on accessibility is foundational in eliminating barriers to online education courses (Barnard-Brak & Sulak, 2010; Burghstahler, 2002; Burghstahler et al., 2004; Edmonds, 2004a; Fitchen, 2009; Kharade & Peese, 2012; Lorenzetti, 2004; Paist, 1995; Veal et al., 2005).

Institutions of higher education must clarify and emphasize to faculty and staff the college or university's accessibility policies and standards in addition to state and federal laws regulating accessibility (Edmonds, 2004a; Lorenzetti, 2004). Training instructors and course designers about their roles and responsibilities regarding accessibility (Richardson, 2009) increases awareness of accessibility issues and is associated with positive perceptions of students with disabilities (Barnard-Brak & Sulak, 2010; Paist, 1995). Institutions can conduct workshops (Paist, 1995) or develop training modules on methods to develop universally accessible online courses (Fitchen et al., 2009), and ways in which to assist students with online education challenges (Kharade & Peese, 2012). To ensure accessibility for students, training for instructors and course designers must be both ongoing and consistent (Burgstahler, 2002; Burgstahler et al., 2004).

Many colleges and universities offer professional development workshops for their faculty and staff (Weir, 2005). However, Deshler et al. (2012) found in their initial investigation that few instructors are trained in creating online education courses. Moreover, training for instructors to be aware of barriers (Tandy & Meacham, 2009) and how to develop accessible online courses is often nonexistent. This leaves instructors and course designer lacking in the web design skills needed to create accessible online courses or the adequate knowledge necessary to purchase accessible online technology (Barnard-Brak & Sulak, 2010; Fitchen et al., 2009; Jacko, 2011; Tandy & Meacham, 2009; Wattenburg, 2004).

When students with disabilities at a small rural college were surveyed about their experiences with online course accessibility all students indicated that the number one

barrier to their full classroom participation and success was a lack of faculty training in online accessibility (Stoneham, 2005). The survey also found that prior to training, faculty tended to believe that making courses accessible compromised the integrity of the coursework. Yet, following training, instructors had an increased awareness of accessibility issues and were more open to developing accessible online courses.

Lack of Monitoring and Accountability

There is little discussion in the literature regarding the monitoring and accountability for accessibility to online education courses at colleges and universities. Nonetheless, there is agreement in the available literature that after accessibility policies, procedures and guidelines are in place, colleges and universities have an obligation to consistently monitor and evaluate progress toward full accessibility (Burgstahler, 2002; Burgstahler et al., 2004; Muwanguzi & Lin, 2010). Although colleges and universities are moving toward policies that include Section 508 and W3C standards, many still lack an accountability and monitoring requirement (Edmonds, 2004b). Tabs, Waits, and Lewis (2003) observed from their study that of the colleges and universities they surveyed, 18% reported that they followed established accessibility guidelines to a major extent, 28% followed guidelines to a moderate extent, 18% followed guidelines to a minor extent, and 3% admitting they did not follow guidelines at all. Moreover, 33% did not know if their online offerings were compliant with established policies. Monitoring and accountability can be overlooked when colleges and universities allocate limited attention to the accessibility of their online offerings (Burgstahler, 2002; Jacko, 2011), leading to inaccessible online education courses (Burgstahler, 2006).

Inequities in Access to Bandwidth Infrastructure and Devices

Access to a computer and the Internet has been linked to educational success, increased income, access to healthcare, and other community services and benefits (Wattenberg, 2004). For people with disabilities, the Internet has the power to provide greater independence with greater access to education and employment (Opitz, 2002). Yet, there is a digital divide between those who have access to information technology and those who do not (Deshler et al., 2012). Similar to socioeconomic divides, individuals with low incomes, those living in rural areas, members of a minority or ethnic group and/or people with disabilities are more likely to be affected (Burgstahler, 2002). However, there is a second digital divide comprised of people with disabilities who can be further segregated when they are not able to access information technology, with or without their assistive devices. Wattenberg found that less than 3% of people with high school diplomas use computers and the Internet compared to 63% of college graduates, and within those populations, people with disabilities are half as likely to own a computer or be able to access the Internet.

The lack of accessibility to information technology as a violation of civil and human rights for people with disabilities is briefly discussed in the literature (Deshler et al., 2012; Jacko, 2011; Muwanguzi & Lin, 2010; Parry, 2010; Wall & Sarver, 2003). Muwanguzi and Lin conceded that much has been done to improve universal access to technology, yet blind and low-vision students continue to struggle with poorly designed interfaces that do not allow them to access large portions of information on academic websites with their assistive devices, thus denying students basic human rights to

education (Parry, 2010). The U.S. Office of Civil Rights has indicated that colleges and universities are to be proactive in providing access to students with disabilities and that simply responding to accommodation requests on an ad hoc basis is not acceptable (Wall & Sarver, 2003). Jacko noted that it was perplexing that colleges and universities spend a significant amount of money on diversity initiatives, yet fail to consider curriculum access for blind and low-vision students, especially when the technology to do so is both available and required by federal regulations.

Use of the Delphi Technique in Rehabilitation

The Delphi technique utilizes the available expertise of various well-defined groups, resulting in a greater quantity of and better quality information, allowing changes and improvements in decision-making and eventually leading to changes in practice. The use of an anonymous, iterative process to collect expert judgments, interspersed with feedback, results in a better understanding of a problem. According to Fleming et al. (2015), this research technique is suited to rehabilitation practice, research, and education due to three conditions: the relative youth of the profession and discipline of rehabilitation, limited funding, and the rapid changing of the field, a result of advances in medicine, federal law, and advocate efforts of people with disabilities. This combination of a relatively new field and rapid changes point make the Delphi technique an appropriate method since other types of research often require a great deal of time to complete. Fleming et al. pointed to a shortcoming of using the Delphi technique in rehabilitation practice. “One challenge has to do with small expert community in the

public VR program" (p. 403).

Chronologically, the first published Delphi study in rehabilitation asked consumers with disabilities about their values, needs, and requirements of AT (Batavia & Hammer, 1990). This Delphi resulted in a survey. The second published Delphi study in rehabilitation explored social policy in vocational rehabilitation and appeared in the policy journal, *Policy Studies* (Buck, Gross, Hakim, & Weinblett, 1993). These researchers found experts in the state/federal rehabilitation agency and asked them about ways in which their agencies had implemented laws and policies. The third published Delphi study in rehabilitation appeared in 1998 (Rubin, McMahon, Chan, & Kamnetz, 2006) with the purpose of establishing priorities for research in rehabilitation. Two published Delphi studies in rehabilitation appeared in 2001 and both sought to determine important content areas in rehabilitation education. The focus of the first was single area of rehabilitation education, disability management (Currier, Chan, Berven, Habeck, & Taylor, 2001). During this time, coursework on Disability Management was introduced, but there was little concrete agreement concerning course content or even what Disability Management included. The second 2001 study dealt with the knowledge and skills for effective clinical supervision (Thielsen & Leahy, 2001).

In 2006, a Delphi study asked leaders in the discipline of rehabilitation about their perceptions of the issues facing counseling in rehabilitation (Shaw, Leahy, Chan, & Catalano, 2006). Finally, in 2014, a Delphi study elicited information about an important issue in state/agency vocational rehabilitation, the implementation of a recent federal mandate to give priority for service to individual with the most significant disabilities.

(Fleming, Boeltzig-Brown, Foley, Halliday, & Burns 2014).

This chronology of the use of Delphi studies in rehabilitation show that the first published study, more than 25 years ago, considered individuals with disabilities to be the experts. To our knowledge, until this present study, for 25 years, no other Delphi study in rehabilitation considered people with disabilities as experts. The use of the Delphi technique in rehabilitation has continued to disregard people with disabilities as experts and this body of research might be considered to have perpetuated a status quo in which professionals speak for people with disabilities (Smart, 2017, p. 64).

Summary

The literature reviewed in this chapter addresses factors relating to the accessibility of online learning courses and demonstrates that accessibility to online education is a significant obstacle for blind and low-vision students. The following framework is proposed for the present study: (a) inconsistent policies; (b) lack of accessibility and universal design; (c) lack of instructor training; (d) lack of monitoring and accountability; and (e) inequities in access to bandwidth infrastructure and devices. The literature includes both an extensive discussion of the laws that apply to accessibility and the ambiguity about the extent online learning and distant education courses are covered under the law. The literature also indicates that accessibility policies for online learning programs tend to be inadequate. The literature provides both positive and negative examples of creating accessibility for online education courses at colleges and universities. The literature points to an overall lack awareness among instructors, course

designers, software developers, and administration regarding accessibility issues, in addition to the digital divide affecting blind and low-vision students. There are also civil and human rights concerns when students with disabilities are denied access to education due to inaccessibility. The literature does not address the first-hand experiences of blind and low-vision students when accessing online education courses using AT devices, or how students feel when facing inaccessibility. Consequently, little thought has been given to ask blind and low-vision students of their experiences in accessing online education and what they believe are possible solutions to the problem.

CHAPTER III

METHODOLOGY

A review of the literature has suggested that barriers exist to online education accessibility for blind and low vision college and university students. The literature also included an extensive discussion of the laws that apply to accessibility and the ambiguity as to what extent online education courses are covered under the law. Moreover, the literature revealed that accessibility policies for online learning programs tend to be inadequate, but does provide both positive and negative examples of accessibility to online education courses at colleges and universities. However, the literature does not clearly state if there is a general awareness of inaccessibility to online education courses. Thus, there is little discussion about what is done when colleges and universities are notified of inaccessibility or attitudes toward creating accessibility for blind and low-vision students. Furthermore, little is known about the first-hand experiences of blind and low-vision students when accessing online education courses using AT devices, or how students feel when facing inaccessibility. Therefore, little thought has been given to ask blind and low-vision students of their experiences when accessing online education and what they believe may be possible solutions to the problem.

Research Questions and Design

The purpose of this study was to investigate the barriers to accessible online education courses for blind and low vision college and university students and to explore the solutions to these identified barriers. To address this purpose, the following research

questions were used as a guide.

RQ1: Given the Delphi methodology, what are the barriers to accessible online learning courses at colleges and universities for blind and low-vision students?

RQ2: Given the Delphi methodology, what are the solutions to removing the barriers to accessible online learning courses at colleges and universities for blind and low-vision students?

To identify and summarize these barriers and solutions, a framework for the present study was developed. Deshler et al. (2012), in their initial investigation, found barriers to online accessibility and nine broad areas were identified as being of significant concern. Five of those areas of concern are applicable to online education programs at colleges and universities, and therefore, have been adapted and used as a theoretical framework for the current study. They include (1) inconsistent policies and guidelines, (2) lack of accessibility and universal design, (3) lack of teacher training for online courses, (4) lack of monitoring and accountability, and (5) inequities in access to bandwidth infrastructure and devices. The term “theoretical framework” will be used throughout this dissertation.

A three-round Delphi survey was conducted to gather expert opinions regarding the effect these factors have on accessibility and barriers to online education for blind and low vision college and university students. Approval was sought from the Utah State University Institutional Review Board/Human Subjects Committee prior to recruiting the study participants. After approval, the Listserv of the NFB, National Association of Blind Students was used to invite 650 individuals to participate in the study. NABS’ (2012a) principal activities have been to promote equal access to educational and life

opportunities for blind and low-vision students. The organization works to provide blind students with up-to-date and relevant information on topics that affect them and serves as a forum for networking and information sharing among its members. Externally, NABS engages in education and advocacy work to raise awareness among the general public of the capabilities of the blind and ensure that blind students are able to compete on an equal footing with their sighted peers in educational and life opportunities (NABS, 2012a).

Fifty-two individuals responded, expressing an interest to participate. All were emailed a link to the survey. Of those, 43 agreed to participate in the first round of the Delphi. Participants were asked six demographic questions before beginning the open-ended survey questions. Forty-one participants responded to the demographic questions.

Participants

The quality of results from a Delphi study is dependent on proper panel selection (Hsu & Sandford, 2007, Lang, 1995; Skulmoski et al., 2007). Therefore, participants should have expert knowledge on the subject matter (Andranovich, 1995; Briendenhann & Wickens, 2002; Clayton, 1997; Helmer & Rescher, 1959; Hsu & Sandford, 2007; Lang, 1995; Skulmoski et al., 2007), be willing to commit to the process over a substantial period of time (Briendenhann & Wickens, 2002; Clayton, 1997; Skulmoski et al., 2007), be able to participate fully (Clayton, 1997), and give thoughtful feedback (Hsu & Sandford, 2007). It is generally accepted that for a homogeneous group, a panel may consist of 10 to 15 individuals (Briendenhann & Wickens, 2002; Clayton, 1997; Skulmoski et al., 2007).

Participants for this Delphi survey were blind and low vision college and university students. The following inclusion criteria were used: (a) be blind or have low vision; (b) be enrolled in a 2-year college or 4-year university; (c) have at any time been enrolled in an online course at a college or university: and (d) have used AT devices to access the computer. Because the validity of a three-round Delphi survey is based on the direct knowledge and experience of the participants related to the topic at hand (Clayton, 1997), participants for this study were not randomly selected. Moreover, participants should be agreeable to revising initial statements to reach consensus (Hsu & Sandford, 2007).

Sampling techniques and the calculation of attrition rates are not used in Delphi studies because this technique does not test hypotheses and does not seek to generalize to other groups, using probability statements. The purpose of the Delphi is study to improve understanding of a problem, when the information is incomplete. Skulmoski et al. (2007) summarized, “Potential sample size is positively related to the number of experts” (p. 11).

Hsu and Sandford, in an article entitled, “The Delphi Technique: Making Sense of Consensus” (2007) stated,

> “Regarding the selection of subjects for a Delphi study, choosing the appropriate subjects is the most important step in the entire process because it directly relates to the results generated (Judd, 1972; Taylor & Judd, 1989, Jacobs, 1996). Since the Delphi technique focuses on eliciting expert opinions over a short period of time, the selection of Delphi subjects is generally dependent upon the disciplinary areas of expertise required by the specific issue. (p. 3).

To cite a single example, Fleming, Boeltzig-Brown, and Foley (2015) used the Delphi method for selecting effective practices in rehabilitation,

> “by first soliciting nominations from all of the Vocational Rehabilitation

> agencies, the entire membership of Council of State Administrators (CSAVR), members of the Rehabilitation Services Administration (RSA), the State Rehabilitation Councils (SRCs), the regional Technical Assistance and Continuing Education Centers, (TACEs), the National Institute on Disability and Rehabilitation Research (NIDRR), rehabilitation professional membership organizations, and other entities" (p. 395).

Of these hundreds of potential panelists, Fleming et al. (2015) reported that a total of 12 panelists participated. At the conclusion, these researchers made the following point: "One challenge had to do with the small expert community in the public VR program" (p. 403).

For this study, the 650 members of National Association of Blind Students were sent preliminary information, asking each member if he or she would be interested in participation. Fifty-two individuals responded to this preliminary request and 33 completed all three rounds. Participation as a panelist included both meeting the criteria for "expert" and committing to a survey process of three iterations.

Instrumentation

Delphi Survey

A Delphi survey is a systematic consensus-building method for gathering and organizing expert opinions about a complex topic (Clayton, 1997; Hsu & Sandford, 2007; Vázquez-Ramos et al., 2007). It is a particularly valuable method when the specific aim of a study is to enhance understanding of problems, examine possible solution, or develop projections (Skulmoski et al., 2007). Four key aspects characterize the classic Delphi method.

1. Anonymity of Delphi participants allows for the free expression of opinions

without pressure from others in the group to conform to any particular idea (Andranovich, 1995; Clayton, 1997; Fleming et al., 2015; Hsu & Sandford, 2007; Lang, 1995; Putnam et al., 1995; Skulmoski et al., 2007; Turoff & Hiltz, 1996; Wouldenberg, 1991).

2. Iteration allows the participants to re-evaluate their views as the group progresses to each round (Andranovich, 1995; Clayton, 1997; Lang, 1995; Putnam et al., 1995; Skulmoski et al., 2007, Wouldenberg, 1991).

3. Controlled feedback informs participants of the perspectives of others in the group and allows participants to clarify or reconsider their views (Andranovich, 1995; Clayton, 1997; Hsu & Sandford, 2007; Lang, 1995; Skulmoski et al., 2007; Wouldenberg, 1991).

4. Statistical accumulation of group responses allows for quantitative analysis and interpretation of data (Hsu & Sandford, 2007; Skulmoski et al., 2007).

For this study, the Delphi method was chosen as an appropriate research tool to gather expert opinions regarding the accessibility of online education for blind and low vision college and university students. Fleming et al. (2015) stated that "The Delphi method is most appropriate when precise information and knowledge under study is not available" (p. 391). The Delphi is an appropriate method for this investigation considering there is little documented in the literature on the first-hand experiences of blind and low-vision students when accessing online education courses. Rather than leaving decision-making to administrators or other policy-makers, it makes sense to ask the individuals with the greatest expertise, knowledge, and experience and those who stand to gain from the eventual resolution of the question or issue. A Delphi panel is best comprised of individuals who "are invested in the problem" and, in this case, these individuals are blind students.

According to Hsu and Sandford (2007), a Delphi process can incorporate as many rounds as needed to achieve consensus among participants. Although the classic Delphi

technique follows specific steps (see Table 1), it has proven to be a flexible and adaptable research methodology that has been effectively used for rehabilitation counseling research (Vázquez-Ramos et al., 2007) education policy development (Clayton, 1997), selecting effective state VR practices (Fleming et al., 2015), IT (Skulmoski et al., 2007), environmental impact assessment (Green et al., 1989), political policy development (Andranovich, 1995) tourism development and management (Briedenhann & Wickens, 2005) and education policy for students with disabilities (Putnam et al., 1995) including

Table 1

Summary Table of the Steps, Phases, and Activities Involved in the Execution of a Three-Round Delphi Survey

Steps	Phases	Activities
1	Selection	a. Identification of potential experts b. Invitation to participate c. Recruitment of panelists d. Constitution of the panel of experts
2	Exploration (Round 1)	a. Distribution of Delphi Round 1 (survey with open-ended questions) b. Follow-up of Delphi Round 1 c. Collect Delphi Round 1 d. Collation and categorization of results (content analysis) e. Construction of Delphi Round 2 (first generation of potential items)
3	Evaluation (Round 2)	a. Distribution of Delphi Round 2 b. Follow-up of Delphi Round 2 c. Collect Delphi Round 2 d. Collation and categorization of results (provided in terms of central tendency and measures of dispersion of participants' responses). e. Construction of Delphi Round 3
4	Reevaluation (Round 3)	a. Distribution of Delphi Round 3 (participants are provided with summary statistics from the previous round and are encouraged to reevaluate their answers based on their individual and group responses). b. Follow-up of Delphi Round 3 c. Collect Delphi Round 3 d. Re-collation and categorization of results (provided in terms of central tendency and measures of dispersion of participants' responses.) e. Calculation of summary statistics
5	Final consensus	a. Identification of items of which consensus was obtained.

other types of program planning, needs assessment, and policy development (Hsu & Sandford, 2007). The Delphi has been modified to incorporate or combine with other quantitative and qualitative research methods (Fleming et al., 2015; Briendenhann & Wickens, 2002).

Participants for this Delphi study were asked to respond to a series of three electronic surveys (also called rounds). Participants were given 10 days to complete each round using the survey software, Qualtrics Suite. Qualtrics (2016) is a web-based survey research tool. The survey software is simple, flexible, easy to use, and allows for quick responses and real-time analysis. It is also accessible to screen reader users, which makes it ideal for the population that was targeted for the study.

The first round included a letter of information that described the purpose, procedures, instructions, risks, benefits, confidentiality, and an Institutional Review Board approval statement (see Appendix A). Participants completed a series of demographic questions relating to the inclusion criteria, such as current academic year, highest obtained professional degree, field of study/major, if they have been able to finish an online education course, and where they reside in the U.S. (see Table 2).

The Delphi process typically begins with an open-ended questionnaire. Open-ended questions serve as the cornerstone for soliciting specific information about a content area from the study participants (Hsu & Sandford, 2007). For this Delphi study, the first round was made up of seven open-ended questions (see Table 3 in Chapter IV).

These questions were based on the theoretical framework developed for this study and were designed to bring out the perceived barriers to accessibility in online education

Table 2

Demographic Data of the Sample

Variable	*N*	%
Academic year		
Freshman	4	10
Sophomore	8	20
Junior	7	17
Senior	5	12
Other	17	41
Highest obtained professional degree		
GED/high school diploma	16	39
Associate's degree (A.A., A.A.S., etc.)	6	15
Bachelor's degree (B.A., B.S., etc.)	10	24
Master's degree (M.A., M.S., MSW, M.Ed., etc.)	7	17
Doctoral students (Ph.D., Ed.D., J.D., etc.)	2	5
Professional degree area of study		
Rehabilitation counseling	1	2
Counseling	2	5
Special education	6	15
Disability studies	0	0
Psychology	6	15
Social work	2	5
High education administration	0	0
Other	24	58
Geographic region		
Region 1: New England	2	5
Region 2: Mid-Atlantic	3	7
Region 3: East North Central	3	7
Region 4: West North Central	5	12
Region 5: South Atlantic	11	27
Region 6: East South Central	2	5
Region 7: West South Central	9	22
Region 8: Mountain	2	5
Region 9: Pacific	4	10

courses for blind and low vision college and university students and the possible solutions to these perceived barriers. The data derived from this round were qualitative in nature; therefore, a content analysis and coding process was conducted to identify themes

and patterns in the data.

Adu (2015) explained the purpose of coding is to reduce the data without losing the meaning. The open-ended questions of the first round of the Delphi survey are designed to elicit large amounts of data. However, without reducing the data through coding, researchers would not only get lost in the data but presenting the data would be cumbersome, confusing, and boring for the reader.

The Round One survey results were exported from Qualtrics and printed. The In Vivo coding process was used to analyze the actual words of the participants. Saldaña (2009) explained, “In Vivo Coding is appropriate for qualitative studies, but particularly for beginning qualitative researchers learning to code data, and for studies that prioritize and honor the participant’s voice” (p. 74). The focus for this study was to discover the first hand experiences and perspectives of participants when accessing online education courses. Therefore, In Vivo was judged to be an appropriate coding process.

All responses from participants were read and analyzed. Codes using actual words of participants were assigned that represented the data and addressed research questions. Codes were then organized according to the established theoretical framework. Twenty-five statements were created from coded words and phrases. A 7-point Likert-type scale ranking survey was developed for participants to rate each statement as follows:

1. Strongly disagree
2. Disagree
3. Somewhat disagree
4. Neither agree nor disagree
5. Somewhat agree
6. Agree
7. Strongly agree

To guard against research bias, the following two statements were added to the survey along with a text box under each statement that allowed participants the opportunity to state if any of their responses from Round One were omitted from Round Two.

1. If any barrier to online courses were not raised in the above Likert-type scale ranking questions please include them below.
2. If any solutions to online courses were not raised in the above Likert-type scale ranking questions please include them below.

The Round Two Delphi Survey was sent to participants and they were given 10 days to complete it. After responses were gathered, mean and standard deviation of the score were obtained from Qualtrics.

The objective of the third and final Delphi round was to reach participant consensus. Therefore, participants were provided with the mean and standard deviation of the score from Round Two with suggestions for how to interpret the statistics. Participants then rerated all survey items. Responses from Round Three were analyzed and ranked according to the Round Three standard deviation of the score. Responses with a standard deviation of the score above 1.00 were not ranked as a priority for participants.

Ethical Considerations

Observer bias or confirmation bias is a concern of any research study because observer bias can invalidate the results. The basic underlying assumption of this study was to elicit the voice of a group, which is rarely heard, individuals who are blind. In the past, researchers, physicians, and service providers have often “spoken” for people with

all types of disabilities, never taking into consideration that need to hear individuals with disabilities. The ethos of the Delphi technique is based on empowerment.

The methodology of a Delphi study provides three safeguards against this type of bias. First, the use of broad, open-ended questions in the first round ensured that the participants' voices were heard without any undue influence. Second, the computerized program Qualtrics solicited the responses and then the word-for-word responses were coded manually using the In Vivo coding method. Therefore, it was not possible for the experimenter to subtly communicate his expectations to the participants.

The stated methodology, of which all participants were aware, did anticipate that participants might alter their responses when presented with the mean and standard deviation of the score of each question from Round two but not individual responses. Therefore, any change in responses must be considered a result participants coming closer to consensus rather than researcher input.

Summary

This chapter discussed the methodology employed for three-round Delphi survey according the established research questions and the established theoretical framework. An explanation of the In Vivo coding process was given with the ranking process from the Round Three results. Chapter IV will present the findings of all three rounds of the Delphi.

CHAPTER IV

RESULTS

It has been established that education is directly related to blind and low vision individuals becoming fully employed and independent (Wattenberg, 2004). Inaccessibility to online courses is a significant problem thought to be perpetuated by the lack of awareness and skill of courseware developers, course designers, instructors, and college and university administrators. Therefore, the purpose of this study was to investigate the accessibility of online education courses at colleges and universities for blind and low-vision students. The following research questions guided the study.

RQ1: Given the Delphi methodology, what are the barriers to accessible online education courses at colleges and universities for blind and low-vision students?

RQ2: Given the Delphi methodology, what are the solutions to removing barriers to accessible online education courses at colleges and universities for blind and low-vision students?

To achieve this purpose, a three round Delphi study was developed. The first round consisted of seven open-ended questions (see Table 2). From participant responses a 25-question survey was developed for Rounds Two and Three. This chapter will first explain the way in which the three-round Delphi survey was conducted and second, study findings will be presented.

Study Sample Characteristics

The Listserv of the NFB, NABS was used to invite 650 individuals to participate in the study. Fifty-two individuals responded, expressing an interest to participate. All 52

were emailed a link to the survey. Of these, 43 agreed to participate in the first round of the Delphi. Before beginning the open-ended survey questions, participants were asked six demographic questions (refer back to Table 2). Forty-one participants responded to the demographic questions.

Regarding the participants' major course of study, the sample included rehabilitation counseling, counseling, special education, psychology, and social work. Twenty-four participants selected the "other" category. Responses in the "Other" category included music – organ performance, business, public administration, recording and live sound, journalism, early childhood education, law, political science, human resource management, orientation and mobility, global development studies, business administration, general studies, enterprise development, communications, sports management, computer science, sociology, public health, children development/child life, stenography, information systems management/contract management, and business development management. None of the participants selected disability studies or higher education administration as their major course of study.

Participants were also asked, if when taking an online course, whether they were able to complete the class. Thirty-one (76%) declared they were able to finish the course while ten (24%) stated they were not able to finish the course.

Examining these demographic data, it is apparent that these students were a well-educated sample (refer back to Table 2). Twenty-seven percent of this sample reported holding graduate degrees (17% holding a master's degrees + 5% were doctoral students). Considering everyone with a bachelor's degree or higher, nearly one-third of the group

were college or university graduates and when reporting year in school, 41% identified as graduate students.

A second characteristic of this sample is the high number of respondents (almost one-half) whose major area of study was in areas that are traditionally defined as the "social services professions." Further, an analysis of the individuals in the "other" category, included an individual in each of the following degree programs: early childhood education, orientation and mobility, children development, sociology, and human resource management, all of which could be considered as social services degree programs. The distribution of degree programs is tri-modal, with special education, psychology, and business/computer being the three modes.

The panel for this Delphi study was relatively homogeneous, in terms of amount of education and area of study. Having acknowledged this, it should be noted that there was a wide range in reported level of education, from freshman to doctoral graduates. There was also a wide range in majors from computer science to organ performance. Researchers using the Delphi technique do not always agree on the necessity of equivalence of expertise. Hsu and Standford (2007) addressed this difference in assumptions, "An assumption concerning Delphi participants is that they are equivalent in knowledge and experience (Altschud & Thomas, 1991). However, this assumption might not be justified. More specifically, the expertise of Delphi panelists could be unevenly distributed" (p. 5).

The Delphi Survey

A framework for the present study was developed using five perceived barriers that may influence accessibility for blind and low-vision students. This was based on the research questions and the preliminary results of a study conducted by the Center for Online Learning and Students with Disabilities (Deshler et al., 2012). The findings of this study are organized and presented according to the established framework (i.e., inconsistent policies, lack of accessibility and universal design, lack of instructor training, lack of monitoring and accountability, and inequities in access to bandwidth infrastructure and devices). From this framework, seven open-ended questions were created (see Table 3) and sent to study participants. From participant responses a 25-question survey was developed for Rounds Two and Three. Each survey item, along with

Table 3

Round One Open-Ended Questions, N =38

No.	Survey question
1.	What are the barriers you have experienced in taking an online course?
2.	How well does the accessibility policy at your institution address accessibility issues for online learning?
3.	To your knowledge, how well are universal design principles being implemented when designing online courses at your college or university?
4.	In your experience, how well are faculty/instructors trained or have an understanding of accessibility when developing online courses?
5.	What systems are in placed at your institution to monitor online courses being developed and hold faculty and curriculum developers accountable for courses that are not designed with accessibility in mind?
6.	How is access to appropriate AT being addressed at your institution for blind and low-vision students?
7.	In your perspective, what are the solutions to removing barriers that blind and low-vision students face in online courses?

the mean and standard deviation is found in Appendix B. A comparison of the mean and standard deviation of the score for each survey item from Rounds Two and Three is found in Table 4 and shown in the bar charts in Appendix C. Survey items with a standard deviation of the score above 1.00 were not ranked but are listed in Table 5. Figure 1 is a visual representation of the priority ranking of survey items with a standard deviation of the score below 1.00, which is also found in Table 6.

Inconsistent Policies and Guidelines

The Round One question corresponding to "Inconsistent Policies and Guidelines" was, "How well does the accessibility policy at your institution address accessibility issues for online learning?" Responses coded according to the established research questions included, "policy not in place," "not able to locate policy," "not very well," "too much allowance for instructors to choose inaccessible content," "no policy for online programs or online message systems," "policy doesn't address accessibility enough," "addressed well." A number of participants responded with "don't know." The following Round Two and Round Three Likert-type scale ranking survey items were developed from these responses.

Q2: An ineffective accessibility policy contributes to inaccessible online courses.

Q3: Comprehensive accessibility guidelines are sufficient in lieu of policy to ensure accessible online courses.

Both Q2 and Q3 addressed a barrier to online education. Thirty-three participants responded to Round Two and 29 responded to Round Three.

Standard deviation of the scores for Q2 and Q3 were above 1.00 and therefore not ranked as priority for participants (see Table 4 and Table 5).

Table 4

Round Two and Round Three Mean and Standard Deviation of the Score Comparison

Survey questions	R2 Mean	R2 *SD*	R3 Mean	R3 *SD*
1. Accessible design of online courses should be a priority to the institution.	6.59	1.14	6.76	0.50
2. An ineffective accessibility policy contributes to inaccessible online courses	6.52	1.10	6.34	1.24
3. Comprehensive accessibility guidelines are sufficient in lieu of policy to ensure accessible online courses	2.67	1.89	2.38	1.88
4. Effective monitoring procedures should be in place to ensure accessible online courses	6.79	0.41	6.790	0.48
5. Institutions should seek input from students regarding the accessibility of online courses	6.85	0.50	6.89	0.31
6. Instructional materials should always be created with accessibility in mind.	6.94	0.24	6.90	0.30
7. Instructional materials should be created in an accessible format when requested.	6.33	1.36	6.76	0.57
8. Online course information should be provided only in an accessible electronic format.	5.76	1.74	6.03	1.38
9. Online course information should be provided in multiple accessible formats.	6.70	0.58	6.48	0.72
10. Accessible instruction materials should be available at the time materials are posted.	6.76	0.60	6.72	0.64
11. Accessibility should be a priority for institutions when purchasing learning management systems.	6.85	0.43	6.90	0.30
12. It is important that blind and low vision user testing be done prior to the purchase of learning management systems.	6.88	0.41	6.76	0.43
13. . It is adequate to conduct accessibility evaluations of courses by accessibility professionals.	4.09	2.39	4.00	2.36
14. Courses should always be designed with accessibility in mind.	6.82	0.72	6.76	0.50
15. Courses should be made accessible when requested.	5.94	1.74	6.28	1.46
16. Institutions should provide appropriate assistive technology when it is essential to use their equipment to access course related information or required software.	6.52	1.05	6.45	0.81

(*table continues*)

Survey questions	R2 Mean	R2 *SD*	R3 Mean	R3 *SD*
17. It is acceptable for institutions to require that blind and low-vision students provide their own assistive technology to participate in online courses.	3.48	2.18	3.07	1.98
18. Faculty members and course developers should be adequately trained in developing accessible online courses.	6.76	0.49	6.83	0.46
19. Online courses that are designed with accessibility still pose barriers because of poor usability design.	5.91	1.24	5.83	0.91
20. It's important that students have the opportunity to evaluate the accessibility of online courses.	6.70	0.58	6.72	0.52
21. It's important that students have the means to report inaccessible online courses.	6.91	0.29	6.86	0.34
22. It's important that faculty have disability awareness training.	6.67	0.53	6.69	0.59
23. Often when inaccessibility is reported and problems are addressed, the solutions are temporary.	6.24	0.95	6.10	0.96
24. It is necessary that disability services office personnel have a good understanding about accessibility.	6.73	0.62	6.86	0.57
25. Often disability service personnel have a good understanding about accessibility.	3.76	1.83	3.69	1.91

Note. Round 2 (R2) $N = 33$; Round 3 (R3) $N = 29$.

Lack of Accessibility and Universal Design

The Round One question asking about "Lack of Accessibility and Universal Design" was, "To your knowledge, how well are universal design principles being implemented when designing online courses at your college or university?" Responses were coded according to the established research questions which included, "not seen them implemented," "not implemented well," "designed without consideration for blind and low-vision students," "slides and webcast tools not accessible," "courses designed for aesthetics," "JAWS unable to read 3rd party vendor software," "efforts being made,"

Table 5

Round Three Standard Deviation of the Score Above 1.00 - Not Ranked

Question (N = 29)		*SD* score
Q2.	An ineffective accessibility policy contributes to inaccessible online courses.	1.24
Q3.	Comprehensive accessibility guidelines are sufficient in lieu of policy to ensure accessible online courses.	1.88
Q8.	Online course information should be provided only in an accessible electronic format.	1.38
Q13.	It is adequate to conduct accessibility evaluations of courses by accessibility professionals.	2.36
Q15.	Courses should be made accessible when requested.	1.46
Q17.	It is acceptable for institutions to require that blind and low-vision students provide their own assistive technology to participate in online courses.	1.98
Q25.	Often disability service personnel have a good understanding about accessibility.	1.91

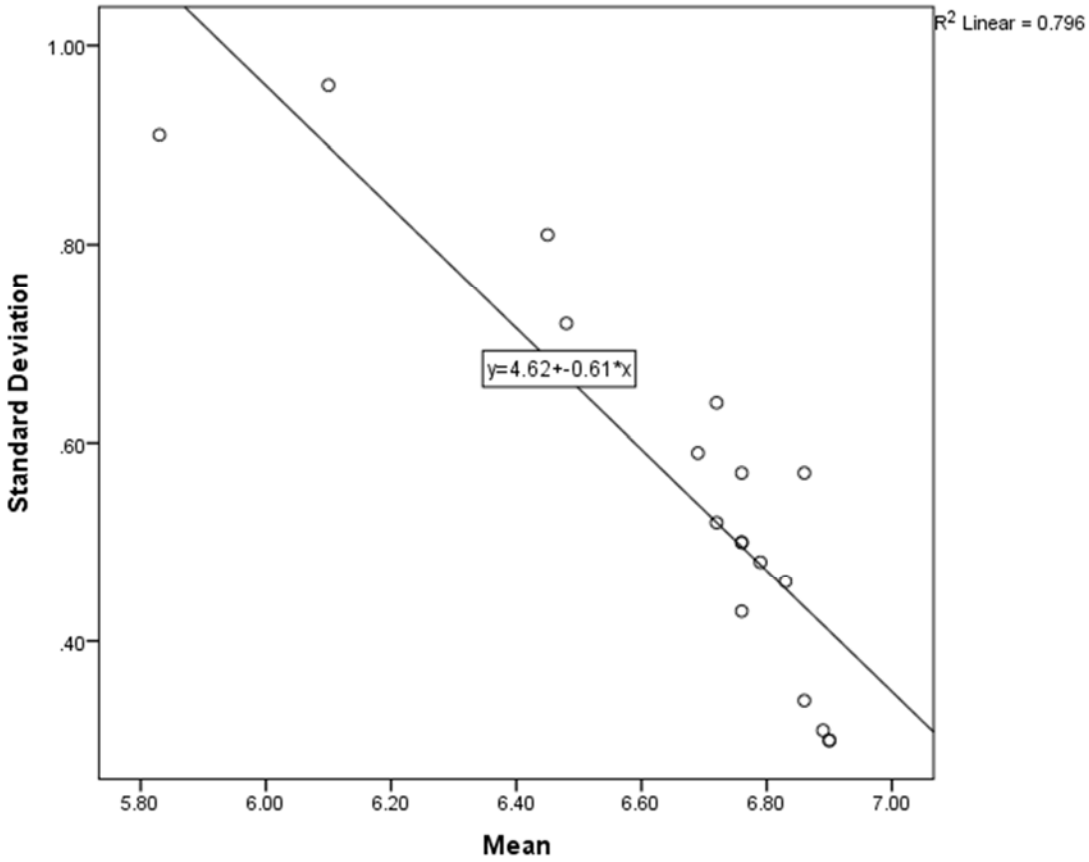

Figure 1. Scatterplot with fit line.

Table 6

Priority Ranking According to Round Three Standard Deviation of the Scores

Ranking	Question		R2 Mean	R2 *SD*	R3 Mean	R3 *SD*
1.	Q6.	Instructional materials should always be created with accessibility in mind.	6.94	0.24	6.90	0.30
2.	Q11.	Accessibility should be a priority for institutions when purchasing learning management systems.	6.85	0.43	6.90	0.30
3.	Q5.	Institutions should seek input from students regarding the accessibility of online courses.	6.85	0.50	6.89	0.31
4.	Q21.	It's important that students have the means to report inaccessible online courses.	6.91	0.29	6.86	0.34
5.	Q12.	It is important that blind and low vision user testing be done prior to the purchase of learning management systems.	6.88	0.41	6.76	0.43
6.	Q18.	Faculty members and course developers should be adequately trained in developing accessible online courses.	6.76	0.49	6.83	0.46
7.	Q4.	Effective monitoring procedures should be in place to ensure accessible online courses.	6.79	0.41	6.79	0.48
8.	Q14.	Courses should always be designed with accessibility in mind.	6.82	0.72	6.76	0.50
9.	Q1.	Accessible design of online courses should be a priority to the institution.	6.59	1.14	6.76	0.50
10.	Q20.	It's important that students have the opportunity to evaluate the accessibility of online courses.	6.70	0.58	6.72	0.52
11.	Q24.	It is necessary that disability services office personnel have a good understanding about accessibility.	6.73	0.62	6.86	0.57
12.	Q7.	Instructional materials should be created in an accessible format when requested.	6.33	1.36	6.76	0.57
13.	Q22.	It's important that faculty have disability awareness training.	6.67	0.53	6.69	0.59
14.	Q10.	Accessible instructional materials should be available at the time materials are posted.	6.76	0.60	6.72	0.64
15.	Q9.	Online course information should be provided in multiple accessible formats.	6.70	0.58	6.48	0.72
16.	Q16.	Institutions should provide appropriate assistive technology when it is essential to use their equipment to access course related information or required software.	6.52	1.05	6.45	0.81

(*table continues*)

Ranking	Question	R2 Mean	R2 *SD*	R3 Mean	R3 *SD*
17.	Q19. Online courses that are designed with accessibility still pose barriers because of poor usability design.	5.91	1.24	5.83	0.91
18.	Q23. Often when inaccessibility is reported and problems are addressed the solutions are temporary.	6.24	0.95	6.10	0.96

Note. Round 2 (R2) $N = 33$; Round 3 (R3) $N = 29$.

"well or sufficiently implemented." A number of participants responded with "don't know." The following Round Two Likert-type scale ranking questions were created from these responses.

Q1: Accessible design of online courses should be a priority to the institution.

Q5: Institutions should seek input from students regarding the accessibility of online courses.

Q6: Instructional materials should always be created with accessibility in mind.

Q7: Instructional materials should be created in an accessible format when requested.

Q8: Online course information should be provided only in an accessible electronic format.

Q9: Online course information should be provided in multiple accessible format.

Q10: Accessible instructional materials should be available at the time materials are posted.

Q11: Accessibility should be a priority for institutions when purchasing learning management systems.

Q12: It is important that blind and low vision user testing be done prior to the purchase of learning management systems.

Q14: Courses should always be designed with accessibility in mind.

Q15: Courses should be made available when requested.

Q19: Online courses that are designed with accessibility still pose barriers

because of poor usability design.

Q23: Often when inaccessibility is reported and problems are addressed, the solutions are temporary.

In Round Two, 34 participants responded to Q1 while 33 participants responded to Q5, Q6, Q7, Q8, Q9, Q10, Q11, Q12, Q14, Q15, Q19, and Q23. Twenty-nine participants responded to these questions in Round Three.

Q10, Q14, Q19 and Q23 addressed barriers to online education, while Q1, Q5, Q6, Q7, Q9, Q11, and Q12 addressed solutions to barriers to online education. All had standard deviation of the scores below 1.00 and were ranked in importance for participants accordingly (See Table 4 and Table 6).

Both Q8 and Q15 addressed solutions to barriers to online education. However, the standard deviation of the scores for Q8 and Q15 were above 1.00 and therefore, not ranked as priority for participants (see Table 4 and Table 5).

Lack of Instructor Training for Online Courses

The Round One question corresponding to "Lack of Teacher Training for Online Courses" was, "In your experience, how well are faculty/instructors trained or have an understanding of accessibility when developing online courses"? Responses coded according to the established research questions included, "I don't believe they get training," "not well," "not knowledgeable about accessibility," "efforts made to train but lack awareness and understanding," "are trained." The following Round Two Likert-type scale ranking questions were created from these responses.

Q18: Faculty members and course developers should be adequately trained in developing accessible online courses.

Q22: It's important that faculty have disability awareness training.

Q24: It is necessary that disability service office personnel have a good understanding about accessibility.

Q25: Often disability service personnel have a good understanding about accessibility.

There were 33 participants in Round Two and 29 participants in Round Three. Round Two and Round Three findings are as follows.

Q18, Q22, and Q24, addressed solutions to barriers to online education. All had standard deviation of the scores below 1.00 was ranked in importance for participants accordingly (See Table 4 and Table 6).

Q25 addressed a solution to a barrier to online education. However, the standard deviation of the score for Q25 was above 1.00 and therefore, not ranked as a priority for participants (see Table 4 and Table 5).

Lack of Monitoring and Accountability

The Round One question corresponding to "Lack of Monitoring and Accountability" was, "What systems are in place at your institution to monitor online courses being developed and hold faculty and curriculum developers accountable for courses that are not designed with accessibility in mind?" Responses coded according to the established research questions included, "none," "no official system exists," and "don't know." The following Round Two Likert-type scale ranking questions were created from these responses:

Q4: Effective monitoring procedures should be in place to ensure accessible online courses.

Q13: It is adequate to conduct accessibility evaluations of courses by accessibility

professionals.

Q20: It's important that students have the opportunity to evaluate the accessibility of online courses.

Q21: It's important that students have the means to report inaccessible online courses.

Thirty-three participants responded to the above questions in Round Two and 29 participants responded to them in Round Three.

Q4, Q20, and Q21 addressed solutions to barriers to online education. All had standard deviation of the scores below 1.00 was ranked in importance for participants accordingly (see Table 4 and Table 6). Q13 addressed a solution to barriers to online education. However, the standard deviation of the score for Q13 was above 1.00 and therefore, not ranked as priority for participants (see Table 4 and Table 5).

Inequities in Access to Bandwidth and Infrastructure and Devises

The Round One question corresponding to "Inequities in Access to Bandwidth and Infrastructure and Devises" was, "How is access to appropriate AT being addressed at your institution for blind and low-vision students?" Responses coded according to the established research questions included, "it's available," "well supported," "available in library/computer lab but limited," "available in disability resource office," "available but not helpful," "must provide own assistive devises," and "not available." The following Round Two Likert-type scale ranking questions were created from these responses.

Q16: Institutions should provide appropriate assistive technology when it is essential to use their equipment to access course related information or required software.

Q17: It is acceptable for institutions to require that blind and low-vision students to provide their own assistive technology to participate in online courses.

Thirty-three participants responded to Q16 and Q17 in Round Two and 29 responded to Round Three questions.

Q16 addressed a solution to barriers to online education. It had a standard deviation of the score below 1.00 was ranked in importance for participants accordingly (See Table 4 and Table 6). Q17 also addressed a solution to barriers to online education. However, the standard deviation of the scores for Q17 was above 1.00 and therefore, not ranked as priority for participants (see Table 4 and Table 5).

Summary

This chapter presented the results of the three-round Delphi survey according to the established framework of perceived barriers. Table 4 presented the 25 survey questions along with the mean and standard deviation of the scores of Round Two and Round Three. These scores were analyzed and the questions were ranked in priority according to Round Three standard deviation of the scores. Those survey items with a standard deviation of the score above 1.00 were not ranked. They are presented in Table 5. Table 6 presented 18 questions that had a standard deviation of the score below 1.00 and were ranked from highest priority (lowest standard deviation of the score) to lowest priority (highest standard deviation of the score). Where the standard deviation of the score was the same, the Round Two standard deviation of the score was used to determine agreement and importance for participants. Always having instructional materials created with accessibility in mind was ranked highest in importance for participants. Having accessibility as a priority for institutions when purchasing learning

management systems was a close second. Student input regarding accessibility and having the ability to report inaccessibility was also ranked high in importance for participants. Also ranked in importance for participants was having faculty and course developers trained to develop accessible online courses, have disability awareness training for instructors, and have instructional material in multiple formats. Table 6 presented the seven survey questions that had standard deviation of the scores above 1.00 and, therefore, were not ranked. These questions addressed ineffective accessibility policies, accessibility guidelines, students providing their own AT, and disability service personnel having a good understanding about accessibility. Chapter V will present a discussion of the findings, its implications, limitations, and recommendations for further research.

CHAPTER V

DISCUSSION

The primary purpose of this study was to determine if accessibility to college and university online education courses is currently an issue for blind and low-vision students and, if so, what are the perceived barriers that contribute to inaccessibility. A review of the literature in Chapter III demonstrated that barriers exist to online education accessibility for blind and low vision college and university students. The literature also revealed that accessibility policies for online learning programs tend to be inadequate; although, it did provide both positive and negative examples of accessibility to online education courses. However, the literature does not clearly state if there is a general awareness of inaccessibility to online education courses among colleges and universities. Therefore, this study examined the experiences and perspectives of blind and low vision college and university students when accessing online education courses at colleges and universities. The following research questions guided the study:

RQ1: Given the Delphi methodology, what are the barriers to accessible online education courses at colleges and universities for blind and low-vision students?

RQ2: Given the Delphi methodology, what are the solutions to removing barriers to accessible online education courses at colleges and universities for blind and low-vision students?

A framework for the present study was developed using five perceived barriers that may influence accessibility for blind and low-vision students. This was based on the research questions and the preliminary results of a study conducted by the Center for Online Learning and Students with Disabilities (Deshler et al, 2012). This chapter

provides a summary of the findings, as well as a discussion of the implications, limitations, and recommendations for future research.

Five Perceived Barriers That May Influence College and University Online Education Accessibility

A three round Delphi survey was developed to discover blind and low-vision college and university students' experiences and perceptions when accessing online education courses. This was accomplished within the established framework. The first round consisted of seven open-ended questions (see Table 2). From participant responses, a 25-question survey was developed for rounds two and three. The following is a discussion of the findings.

Inconsistent Policies and Guidelines

The standard deviation of the scores for both Likert-type scale ranking questions relating to this factor were above 1.00, and therefore not ranked as priority for participants (see Table 5). However, the responses to Round One open-ended questions indicated that participants were not well informed of the accessibility policy at their college or university or they thought it to be ineffective in addressing inaccessibility. One participant stated that too much allowance was given for instructors to choose inaccessible content. When Bradbard et al. (2010) analyzed the web accessibility policies at land-grant universities in the U.S., they discovered that policies lacked clear guidance on what constituted an accessible website, leaving course designers and instructors unsure of expectations. Moreover, when colleges and universities lack a clear,

mandatory, and functioning accessibility policy, faculty may create and maintain their own online education course websites with limited instruction, guidance, and support from their institution. Without a viable accessibility policy in place, accommodations in online education courses may be made on an "ad hoc" basis at the discretion of the instructor or department (Barnard-Brak & Sylak, 2010).

Although, not ranked in importance, it was clear that most participants endorsed (M = 6.34) the statement that an ineffective accessibility policy contributes to inaccessible online courses and thought less so (M = 2.38) that comprehensive accessibility guidelines are sufficient in lieu of policy to ensure accessible online courses. It may be considered that a lack of awareness or understanding regarding an accessibility policy may influence its perceived importance.

Lack of Accessibility and Universal Design

Twelve Likert-type scale ranking questions in this study were related to this perceived barrier in the established framework. Of all the Likert-type scale ranking questions in the survey, participants indicated that having instructional materials always created with accessibility in mind is most important (SD = 0.30, M = 6.90) when accessing online education courses. The second most important item for participants (SD = 0.30, M = 6.90) was that accessibility should be a priority for institutions when purchasing learning management systems. It was also highly important to participants (SD = 0.31, M = 6.89) that institutions seek input from students regarding the accessibility of online courses. It was also considered important (SD = 0.43, M = 6.76) that blind and low vision user testing be done prior to the purchase of learning

management systems.

There is agreement that planning for accessibility while an online education course is being developed is far simpler and incurs less expense than scrambling to make accommodations after the course has begun and a student discloses a disability (Burgstahler, 2002, 2006; Burgstahler et al., 2004; Santovec, 2005). Much of the literature associated with online accessibility focuses on what creates barriers for blind and low-vision students and how to create universal design, such as providing documents in multiple formats (Lorenzetti, 2004; Optiz 2002), creating websites with consistent and predictable navigation patterns (Burgstahler, 2002; Keeler & Horney, 2007), organizing according to similar content, and use clear and simple language (Burgstahler, 2002), limiting colors and multiple fonts (Opitz, 2002; Wall & Sarver, 2003), displaying simplistic and uncluttered content by implementing the maximum use of white space, and use large letters and bullet points to separate information (Keeler & Horney, 2007; Opitz, 2002). Other recommendations include using limited graphics (Edmonds et al., 2005).

It is widely known how to create accessible content and universal design. This study demonstrated how students perceived those barriers, how it affects them and what they would like to see happen. Carnevale (1999) stated that poorly conceived design creates needless barriers leading to “limited mastery of curricular material, inability to participate with peers, frustration with completing lessons, low grades or inability to complete the lesson or course” (Keeler & Horney, 2007 p. 69). Thus, some students may abandon their education pursuits (Kharade & Peese, 2012). Education is critical for blind and low-vision students to become employed, participate in their communities and

become independent.

Lack of Instructor Training for Online Courses

Responses from Round One participants included disability service personnel in the Round One open-ended questionnaire as needing training for working with people with disabilities. Responses in Round Two and Round Three indicated it is a priority to participants (*SD* = 0.57, *M* = 6.86) for disability service personnel to have a good understanding about accessibility. It was also important to participants that faculty members and course developers be adequately trained in developing accessible online courses (*SD* = 0.43, *M* = 6,83) and that they receive disability awareness training (*SD* = 0.59, *M* = 6.69).

Training faculty and course designers on accessibility is foundational in eliminating barriers to online education courses (Barnard-Brak & Sulak, 2010; Burghstahler, 2002; Burghstahler et al., 2004; Edmonds, 2004a; Fitchen, 2009; Kharade & Peese, 2012; Lorenzetti, 2004; Paist, 1995; Veal et al., 2005). This study extends training to include ongoing accessibility awareness training for faculty and course developers, and for disability service personnel to receive accessibility training. This will allow for university and college personnel to work more effectively with students with disabilities.

Lack of Monitoring and Accountability

Responses to Round One open-ended questions indicated that study participants weren't aware of any systems in place to monitor the accessibility of online courses or

none existed. Although, it was important to study participants that effective monitoring procedures are in place to monitor accessibility (*SD* = 0.48, *M* = 6.79). Moreover, of even greater importance to participants is that students have a means to report inaccessible online courses (*SD* = 6.86, *M* = 0.34).

There is little discussion in the literature regarding the monitoring and accountability for accessibility to online education courses at colleges and universities. Nonetheless, after accessibility policies, procedures and guidelines are in place, colleges and universities have an obligation to consistently monitor and evaluate progress toward full accessibility (Burgstahler, 2002; Burgstahler et al., 2004; Muwanguzi & Lin, 2010).

Responses from study participants reflect the findings from previous studies that show that 18% of the colleges and universities surveyed, reported they followed established accessibility guidelines to a major extent, 28% followed guidelines to a moderate extent, 18% followed guidelines to a minor extent, and 3% admitting they did not follow guidelines at all and 33% did not know if their online offerings were compliant with established policies (Tabs et al., 2003). This study extends beyond the concept of colleges and universities monitoring their online offerings and emphasizes the importance of students having the means to report inaccessible content.

Inequities in Access to Bandwidth Infrastructure and Devises

Responses to Round One open-ended questions regarding access to bandwidth infrastructure and devises indicated that appropriate assistive devices are available at some colleges and universities, but not all. Responses to the survey items demonstrated

that it was a priority to participants that institutions provide appropriate assistive technology when it is essential to use their equipment to access course related information or required software (M = 6.45, SD = 0.81). In contrast, participants did not find it acceptable for institutions to require that blind and low-vision students to provide their own assistive technology to participate in online courses (M = 3.07, SD = 1.98).

Deshler et al. (2012) stated that there is a digital divide between those who have access to information technology and those who do not. Similar to socioeconomic divides, individuals with low incomes, those living in rural areas, members of a minority or ethnic group and/or people with disabilities are more likely to be affected (Burgstahler, 2002). However, there is a second digital divide comprised of people with disabilities who can be further segregated when they are not able to access information technology, with or without their assistive devices. Although, much has been done to improve universal access to technology, blind and low-vision students continue to struggle with poorly designed interfaces that do not allow them to access large portions of information on academic websites with their assistive devices, thus denying students basic human rights to education (Parry, 2010).

Implication

This study could primarily impact those who face accessibility issues, namely, the students. If university policy makers will take into consideration the findings of this study, the students will have a better learning experience in higher education. Also, instructors will have a better understanding of what blind and low-vision students face

when they attempt to access online courses. Instructors can make sure the courses they teach have taken accessibility into consideration and provide equal access for these students. Additionally, when universities create policy or address accessibility within the university issues and concerns can be raised will help them craft better policy that will result in full inclusion for all students. The feedback and input they get from students will be critical in how they craft policy. Moreover, policy makers will get firsthand experiences of students who are directly impacted by accessibility policies and can take these into considerations when crafting policy.

Limitations

An important requirement of Delphi studies, the assumption of "equal expertise" among the participants, might be questioned. The demographic data showed that participants ranged from university freshman to doctoral students, a large range in educational achievement. "Expertise" was defined, for this present study, as experience in taking online college and university courses. Thus, it could be inferred that college freshman would have taken fewer online courses than respondents with more education, and, thus, be less of an "expert." The necessity of homogeneity of expertness has been discussed by Hsu and Sandford (2007) and Skulmonski et al. (2007). The demographic data obtained showed a highly educated group with more than one half claiming areas of study in the "helping professions." A high-quality sampling frame was utilized and those who responded considered themselves experts in barriers to online college and university courses for students who are blind. The way in which this weakness could be ameliorated

is the provision of more detailed demographic questions. However, increasing the homogeneity of expertise would perhaps decrease the size of the sample.

Two questions, Q7 “Instructional materials should be created in an accessible format when requested.” and Q15 “- Courses should be made accessible when requested.” were not worded effectively and did not convey the researchers intended meaning. Thus, they may have been misunderstood by participants and did not draw the desired data.

One possible limitation of the study concerns the question, “What barriers have you encountered in online accessibility?” This may be considered a leading question. On the other hand, the Delphi method does not include hypothesis testing and panelists did have the opportunity to say that they had never encountered any barriers in accessibility in distance education. The personal experience of the researcher, combined with a thorough review of the literature, probably contributed to the wording of this question. Further, the information sent to potential panelists, to solicit participation and build rapport, clearly stated the purpose of the study “to study the accessibility of online education courses at colleges and universities for blind and low-vision students” (p. 25). Thus, for this study, the definition of “expert” included those who had experienced barriers. Indeed, every panelist stated that he or she had experienced barriers.

Recommendations

Blind and low vision college and university students are directly impacted by inaccessible online education courses. Yet, it is their first-hand experiences and

perspectives that are less likely to be considered when developing policies and guidelines for accessibility at colleges and universities. Interestingly, Oertle and Bragg (2014) focused on community college students with disabilities because “community college enrollment of students with disabilities is growing faster than at 4-year institutions” (p. 59). One finding of Oertle’s and Bragg’s review of the literature found that internet and technological accessibility “was no better for community colleges with policies than those without policies” (p. 63).

However, it is acknowledged that student experiences and perspectives are only one aspect in developing effective accessibility policies and guidelines. Thus, it is recommended that the current three-round Delphi study be extended to include three other groups: all members of the National Association of Blind Students, web accessibility experts, and Disability Resource Center personnel or the Association of High Education and Disability (AHEAD). The same Delphi survey and process would be followed as with the current study. Each group would participate in the Delphi survey separately. As with the current study, each survey item would be ranked according to the third round standard deviation of the scores. A comparison of the results would be done to examine priority ranking across all groups. Feedback from such an instrument could prove critical in crafting effective accessibility legislation, policies and guidelines for colleges and universities as well as on the State and Federal levels.

Law and policy makers often seek for appropriate research as a guide when formulating bills. They do not wait for better information to come but will use what is available. It would be beneficial to have as a resource the above-described recommended

research as a guide to specify what needs to be accomplished to ensure that online education courses are accessible to blind and low-vision students.

Conclusion

Education is directly related to blind and low-vision individuals becoming fully employed and independent. Inaccessibility to online courses is a significant problem that is perpetuated by the lack of awareness and care given by courseware developers, course designers, instructors, and college and university administrators. It is of highest importance to blind and low-vision college and university students that instructional materials always be created with accessibility in mind. It is important to them to have input regarding the accessibility of online courses, be involved with user testing before course management systems are purchased, and have a means of reporting inaccessibility. Students want colleges and universities to have monitoring procedures in place to ensure online accessibility and to require that instructors and disability service personnel participate in disability awareness training. Strong accessibility policies prevent discrimination and stigma and allow students with disabilities to disclose their disabilities to instructors (Richardson, 2009). Moreover, accessibility policies influence market pressures, which are more likely to bring course management software into compliance with Section 508 guidelines (Schettler, 2002). It is imperative that colleges and universities have strong and appropriate accessibility policies that will force a market driven solution to accessibility. College and university accessibility policy affects all other aspects of the framework established for this study. Bill Gates envisioned that with

new technologies and greatly increased bandwidth, the power of information would be accessible to “anyone, anytime, anywhere.” Let us make this vision a reality for all blind and low-vision students so they can achieve their career goals, be fully independent and contributing members of society.

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APPENDICES

Appendix A

Institutional Review Board Approval Letter

Expert!Consensus!on!Barriers!to!College!and!University!Online!Education!for!! Students!with!Blindness!and!Low!Vision!

Introduction!

You are invited to participate in a research study conducted by Robert L. Morgan, Ph.D., and Sachin D. Pavithran, MS, in the Department of Special Education and Rehabilitation at Utah State University. The purpose of this research is to identify the barriers that blind and low vision students face when accessing online education courses. About 15 students will participate in this study.!

This letter includes detailed information on the research to help you decide whether to participate in this study. Please read it carefully and ask any questions you have before you agree to participate. To be eligible to participate in this study, you need to meet the following criteria: (a) be blind or have low vision; (b) be currently enrolled in a two-year college or four-year university; (c) have ever been enrolled in an online course at a college or university: (d) have used any assistive technology devices to access the computer; (e) and be 18 years of age or older.!

Procedures!

Your participation will involve taking part in a three-round survey that will gather your thoughts about the accessibility of online education courses. In the first round you will be asked to answer open-ended questions. The second and third rounds will have multiple-choice questions. This study will be conducted over a period of two months. You will have 10 days to complete and return each of the rounds. You will have control over the place and time that you complete the three surveys.

Confidentiality!

Research records will be kept confidential, consistent with federal and state regulations. Only the researchers will have access to the data, which will be kept on a password protected computer or password protected survey account. To protect your privacy, personal/identifiable information will not be collected; the surveys will be disbursed to you directly via email, which will be used only for connecting your responses and for compensation purposes. Your identity will not be connected to responses; we will only know that you completed the surveys. Potential identifiers (i.e., region of postsecondary education, type of postsecondary education institution, etc.) are broad enough to prevent identification of respondents in reporting results. To protect your privacy we ask that you do NOT identify yourself by name or the name of your college or university when answering the open-ended questions.!It is unlikely, but possible, that others (Utah State University or state or federal officials) may require us to share the information you give us from the study to ensure that the research was conducted safely and appropriately. We will only share your information if law or policy requires us to do so. !

Voluntary!Participation!&!Withdrawal!

Your participation in this research is completely voluntary. If you agree to participate now and change your mind later, you may withdraw at any time by informing the researchers that you will be withdrawing from the study. !

Compensation!

For your participation in this research study, you will be entered into a drawing for one of three $100 prepaid Visa cards. Your email address will be used strictly for the purpose of contacting the winners and for emailing links to the second and third survey rounds. Your email will be kept confidential and not used for study purposes. You must complete all three survey rounds to be eligible to enter the drawing. Winners will be drawn at the conclusion of the third and final round of the study and will be notified within a week after completing the final survey.!

!

IRB!Review!

The Institutional Review Board (IRB) for the protection of human research participants at Utah State University has reviewed and approved this study. If you have questions about the research study itself, please contact the Principal Investigator at (435) 797-3251 or bob.morgan@usu.edu. If you have questions about your rights or would simply like to speak with someone other than the research team about questions or concerns, please contact the IRB Director at (435) 797-0567 or irb@usu.edu.!

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!

Informed!Consent!

By continuing on to the survey you agree to participate in this study. You know what you will be asked to do. You also agree that you have asked any questions you might have, and are clear on how to stop your participation in the study if you choose to do so. You also are indicating that you are at least 18 years of age or older. Please be sure to retain a copy of this form for your records.!

Appendix B

Delphi Rounds 2 and 3 Means and Standard Deviations

Delphi Survey Rounds 2 and 3 Means and Standard Deviations

Q1 - Accessible design of online courses should be a priority to the institution. (1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree or disagree, 5 = somewhat agree, 6 = agree, 7= strongly agree)

	Round 2	Round 3
Mean	6.59	6.76
Standard Deviation	1.14	0.50
n	34	29

Q2 - An ineffective accessibility policy contributes to inaccessible online courses. (1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree or disagree, 5 = somewhat agree, 6 = agree, 7= strongly agree)

	Round 2	Round 3
Mean	6.52	6.34
Standard Deviation	1.10	1.24
n	33	29

Q3 - Comprehensive accessibility guidelines are sufficient in lieu of policy to ensure accessible online courses. (1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree or disagree, 5 = somewhat agree, 6 = agree, 7= strongly agree)

	Round 2	Round 3
Mean	2.67	2.38
Standard Deviation	1.89	1.88
n	33	29

Q4 - Effective monitoring procedures should be in place to ensure accessible online courses. (1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree or disagree, 5 = somewhat agree, 6 = agree, 7= strongly agree)

	Round 2	Round 3
Mean	6.79	6.79
Standard Deviation	0.41	0.48
n	33	29

Q5 - Institutions should seek input from students regarding the accessibility of online courses. (1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree or disagree, 5 = somewhat agree, 6 = agree, 7= strongly agree)

	Round 2	Round 3
Mean	6.85	6.89
Standard Deviation	0.50	0.31
n	33	28

Q6 - Instructional materials should always be created with accessibility in mind. (1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree or disagree, 5 = somewhat agree, 6 = agree, 7= strongly agree)

	Round 2	Round 3
Mean	6.94	6.90
Standard Deviation	0.24	0.30
n	33	29

Q7 - Instructional materials should be created in an accessible format when requested. (1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree or disagree, 5 = somewhat agree, 6 = agree, 7= strongly agree)

	Round 2	Round 3
Mean	6.33	6.76
Standard Deviation	1.36	0.57
n	33	29

Q8 - Online course information should be provided only in an accessible electronic format. (1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree or disagree, 5 = somewhat agree, 6 = agree, 7= strongly agree)

	Round 2	Round 3
Mean	5.76	6.03
Standard Deviation	1.74	1.38
n	33	29

Q9 - Online course information should be provided in multiple accessible formats. (1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree or disagree, 5 = somewhat agree, 6 = agree, 7= strongly agree)

	Round 2	Round 3
Mean	6.70	6.48
Standard Deviation	0.58	0.72
n	33	29

Q10 - Accessible instructional materials should be available at the time materials are posted. (1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree or disagree, 5 = somewhat agree, 6 = agree, 7= strongly agree)

	Round 2	Round 3
Mean	6.76	6.72
Standard Deviation	0.60	0.64
n	33	29

Q11 - Accessibility should be a priority for institutions when purchasing learning management systems. (1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree or disagree, 5 = somewhat agree, 6 = agree, 7= strongly agree)

	Round 2	Round 3
Mean	6.85	6.90
Standard Deviation	0.43	0.30
n	33	29

Q12 - It is important that blind and low vision user testing be done prior to the purchase of learning management systems. (1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree or disagree, 5 = somewhat agree, 6 = agree, 7= strongly agree)

	Round 2	Round 3
Mean	6.88	6.76
Standard Deviation	0.41	0.43
n	33	29

Q13 - It is adequate to conduct accessibility evaluations of courses by accessibility professionals. (1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree or disagree, 5 = somewhat agree, 6 = agree, 7= strongly agree)

	Round 2	Round 3
Mean	4.09	4.00
Standard Deviation	2.39	2.36
n	33	29

Q14 - Courses should always be designed with accessibility in mind. (1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree or disagree, 5 = somewhat agree, 6 = agree, 7= strongly agree)

	Round 2	Round 3
Mean	6.82	6.76
Standard Deviation	0.72	0.50
n	33	29

Q15 - Courses should be made accessible when requested. (1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree or disagree, 5 = somewhat agree, 6 = agree, 7= strongly agree)

	Round 2	Round 3
Mean	5.94	6.28
Standard Deviation	1.74	1.46
n	33	29

Q16 - Institutions should provide appropriate assistive technology when it is essential to use their equipment to access course related information or required software. (1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree or disagree, 5 = somewhat agree, 6 = agree, 7= strongly agree)

	Round 2	Round 3
Mean	6.52	6.45
Standard Deviation	1.05	0.81
n	33	29

Q17 - It is acceptable for institutions to require that blind and low-vision students provide their own assistive technology to participate in online courses. (1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree or disagree, 5 = somewhat agree, 6 = agree, 7= strongly agree)

	Round 2	Round 3
Mean	3.48	3.07
Standard Deviation	2.18	1.98
n	33	29

Q18 - Faculty members and course developers should be adequately trained in developing accessible online courses. (1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree or disagree, 5 = somewhat agree, 6 = agree, 7= strongly agree)

	Round 2	Round 3
Mean	6.76	6.83
Standard Deviation	0.49	0.46
n	33	29

Q19 - Online courses that are designed with accessibility still pose barriers because of poor usability design. (1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree or disagree, 5 = somewhat agree, 6 = agree, 7= strongly agree)

	Round 2	Round 3
Mean	5.91	5.83
Standard Deviation	1.24	0.91
n	33	29

Q20 - It's important that students have the opportunity to evaluate the accessibility of online courses. (1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree or disagree, 5 = somewhat agree, 6 = agree, 7= strongly agree)

	Round 2	Round 3
Mean	6.70	6.72
Standard Deviation	0.58	0.52
n	33	29

Q21 - It's important that students have the means to report inaccessible online courses. (1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree or disagree, 5 = somewhat agree, 6 = agree, 7= strongly agree)

	Round 2	Round 3
Mean	6.91	6.86
Standard Deviation	0.29	0.34
n	33	29

Q22 - It's important that faculty have disability awareness training. (1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree or disagree, 5 = somewhat agree, 6 = agree, 7= strongly agree)

	Round 2	Round 3
Mean	6.67	6.69
Standard Deviation	0.53	0.59
n	33	29

Q23 - Often when inaccessibility is reported and problems are addressed, the solutions are temporary. (1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree or disagree, 5 = somewhat agree, 6 = agree, 7= strongly agree)

	Round 2	Round 3
Mean	6.24	6.10
Standard Deviation	0.95	0.96
n	33	29

Q24 - It is necessary that disability services office personnel have a good understanding about accessibility. (1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree or disagree, 5 = somewhat agree, 6 = agree, 7= strongly agree)

	Round 2	Round 3
Mean	6.73	6.86
Standard Deviation	0.62	0.57
n	33	29

Q25 - Often disability service personnel have a good understanding about accessibility. (1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree or disagree, 5 = somewhat agree, 6 = agree, 7= strongly agree)

	Round 2	Round 3
Mean	3.76	3.69
Standard Deviation	1.83	1.91
n	33	29

Appendix C

Bar Chart Comparisons of Delphi Rounds 2 and 3

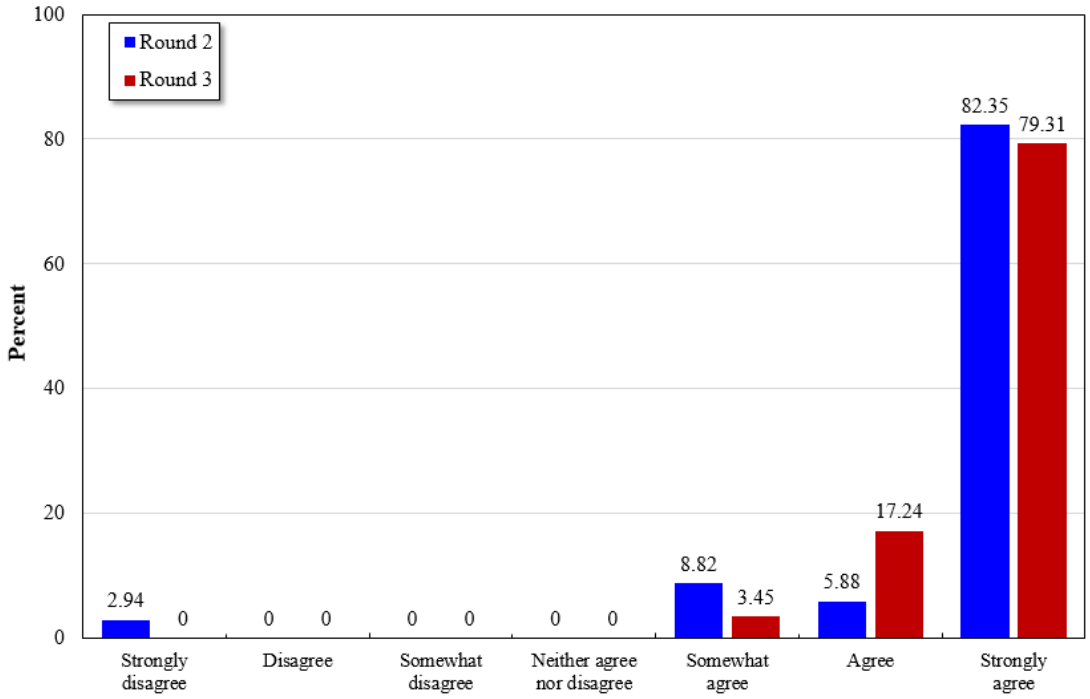

Figure C1. Q1: Accessible design of online courses should be a priority to the institution.

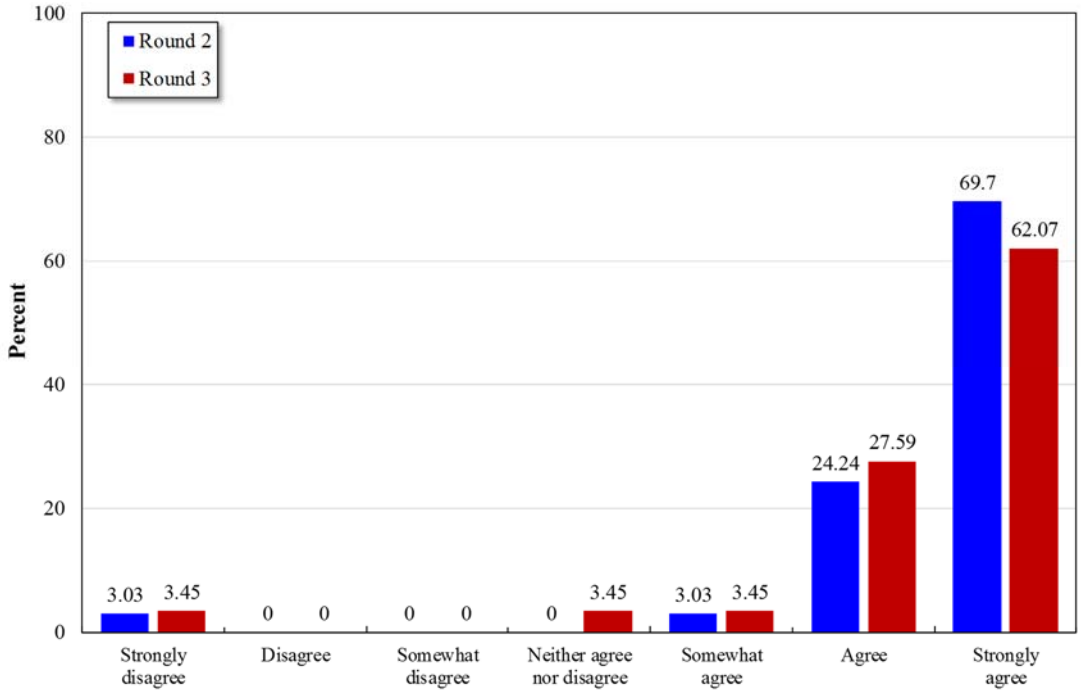

Figure C2. Q2: An ineffective accessibility policy contributes to inaccessible online courses.

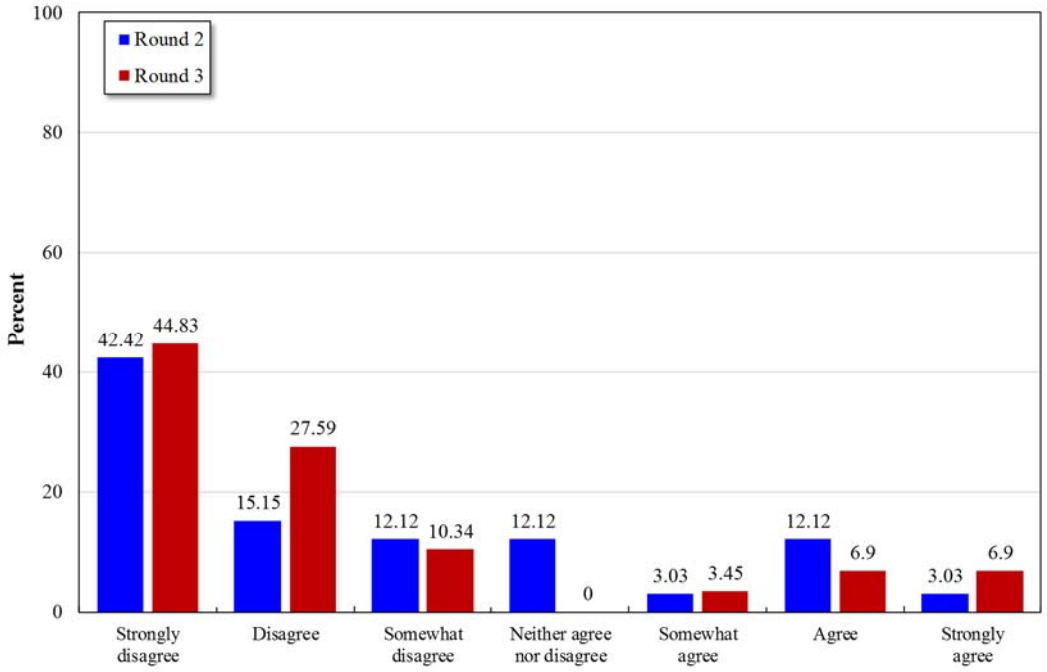

Figure C3. Q3: Comprehensive accessibility guidelines are sufficient in lieu of policy to ensure accessible online courses.

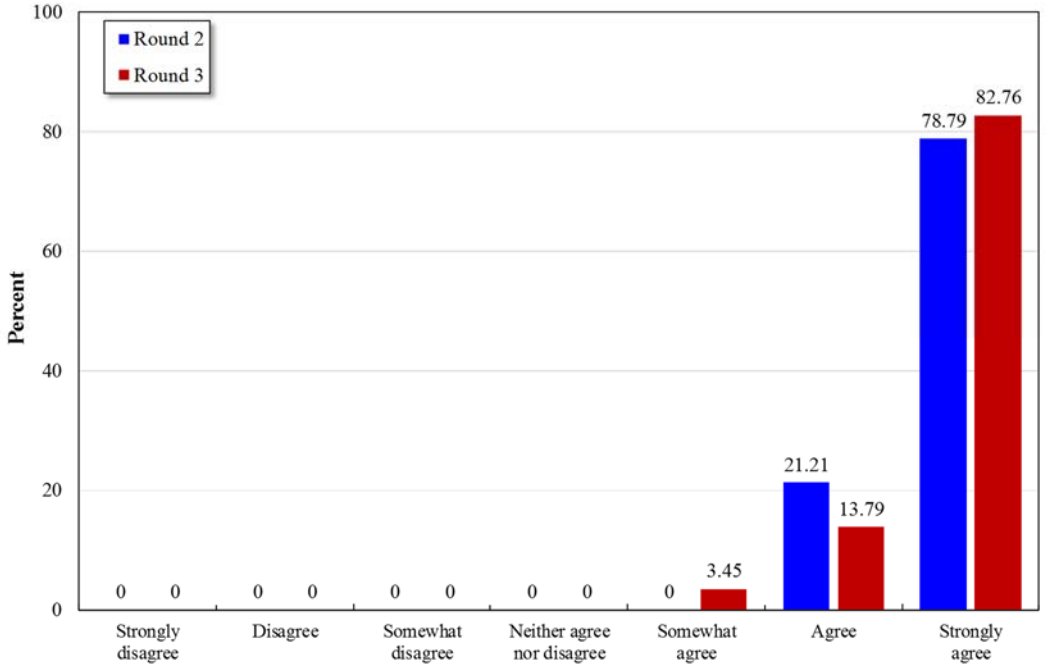

Figure C4. Q4: Effective monitoring procedures should be in place to ensure accessible online courses.

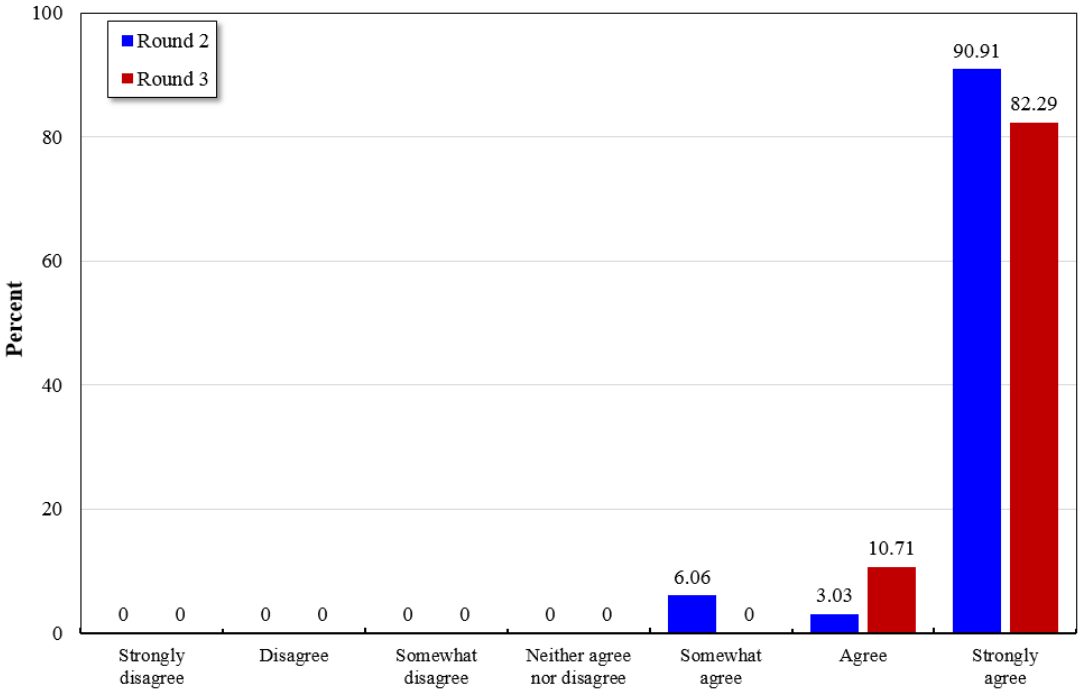

Figure C5. Q5: Institutions should seek input from students regarding the accessibility of online courses.

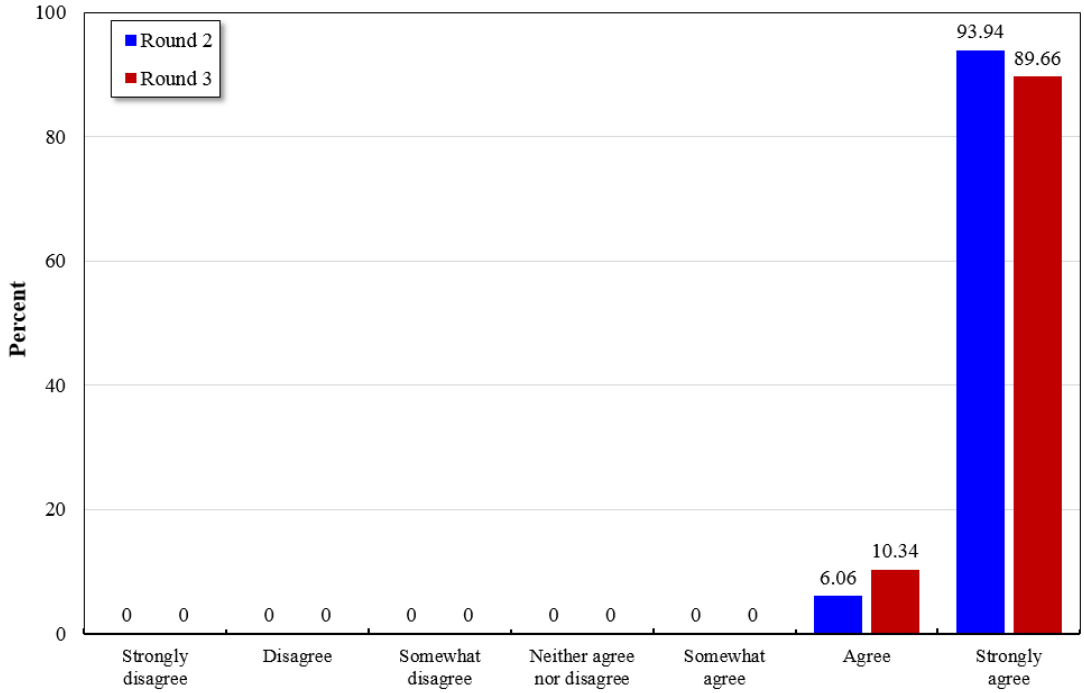

Figure C6. Q6: Instructional materials should always be created with accessibility in mind.

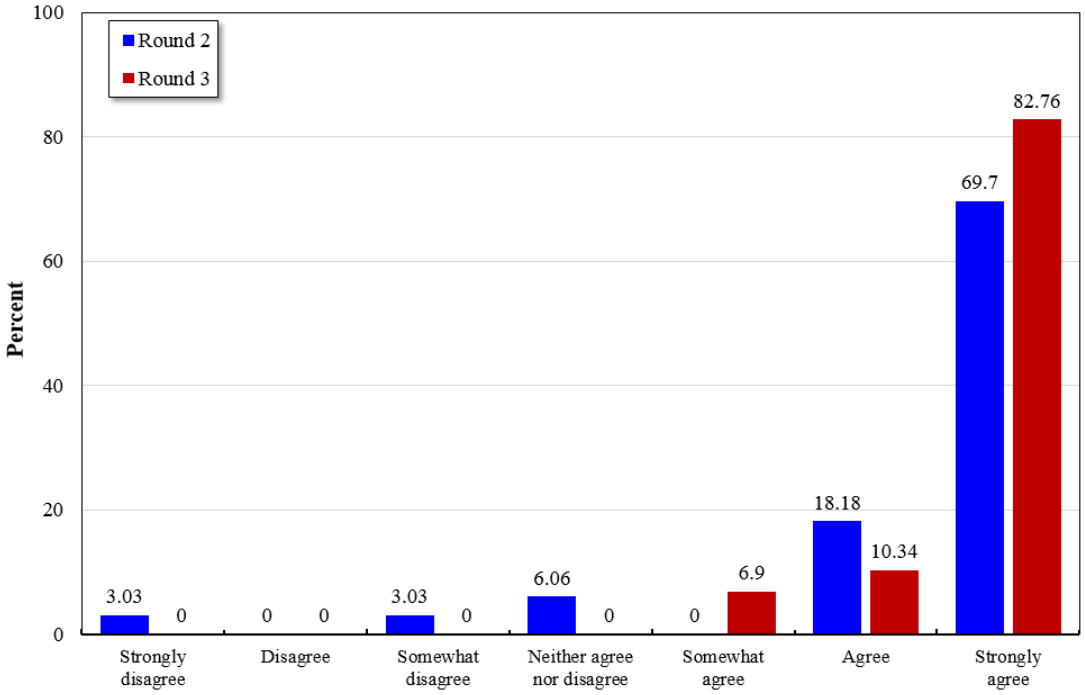

Figure C7. Q7: Instructional materials should be created in an accessible format when requested.

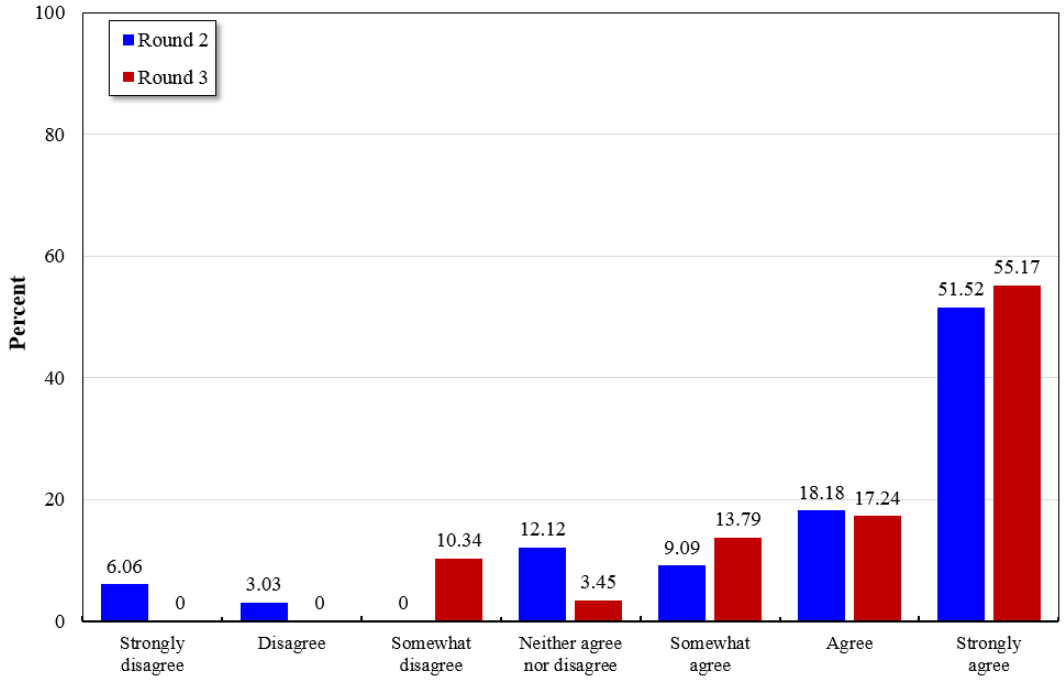

Figure C8. Q8: Online course information should be provided only in an accessible electronic format.

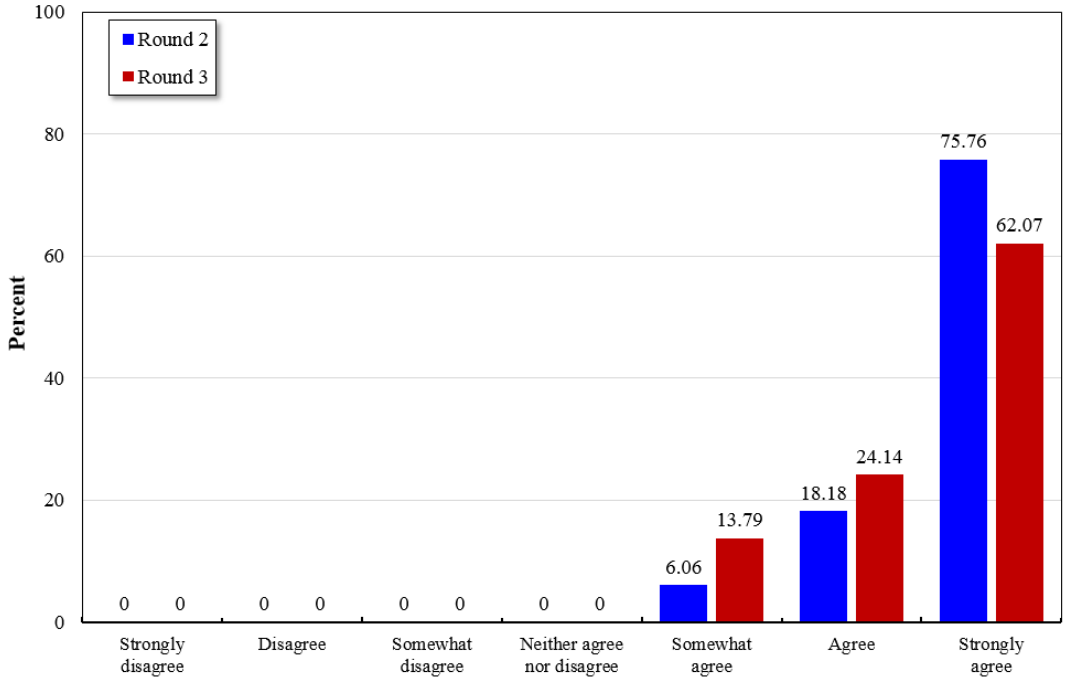

Figure C9. Q9: Online course information should be provided in multiple accessible formats.

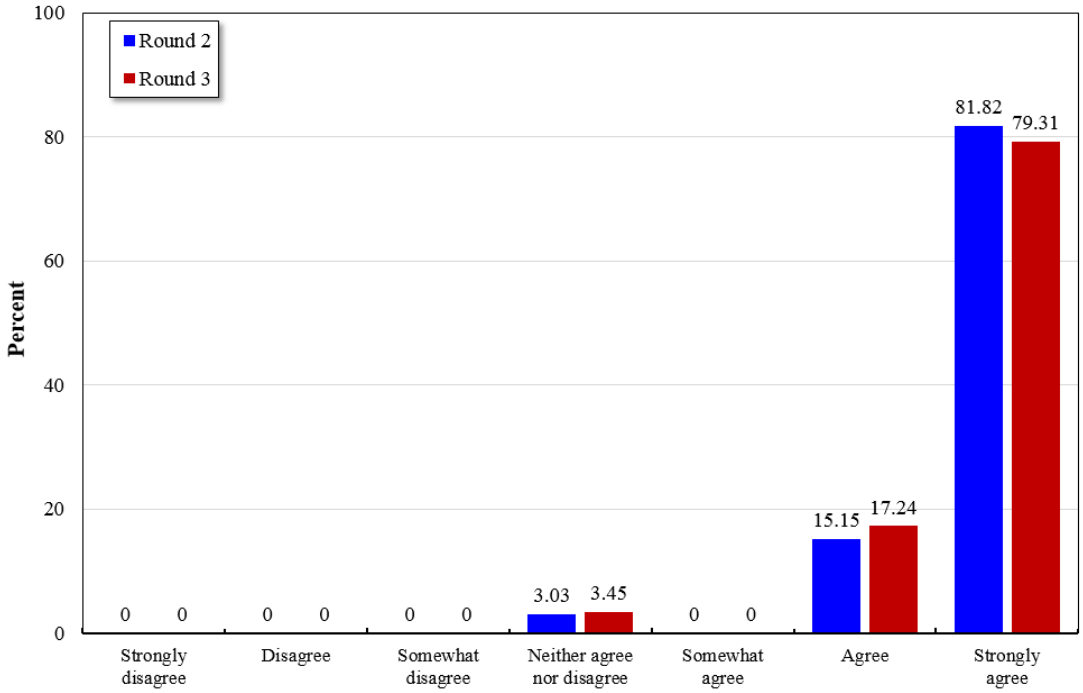

Figure C10. Q10: Accessible instructional materials should be available at the time materials are posted.

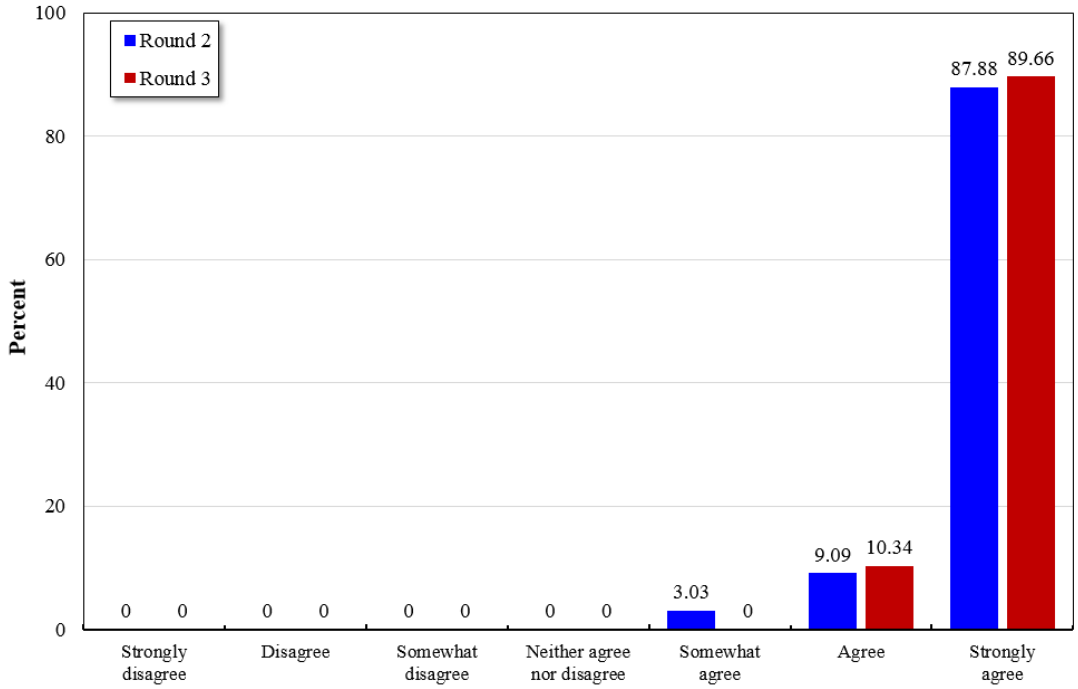

Figure C11. Q11: Accessibility should be a priority for institutions when purchasing learning management systems.

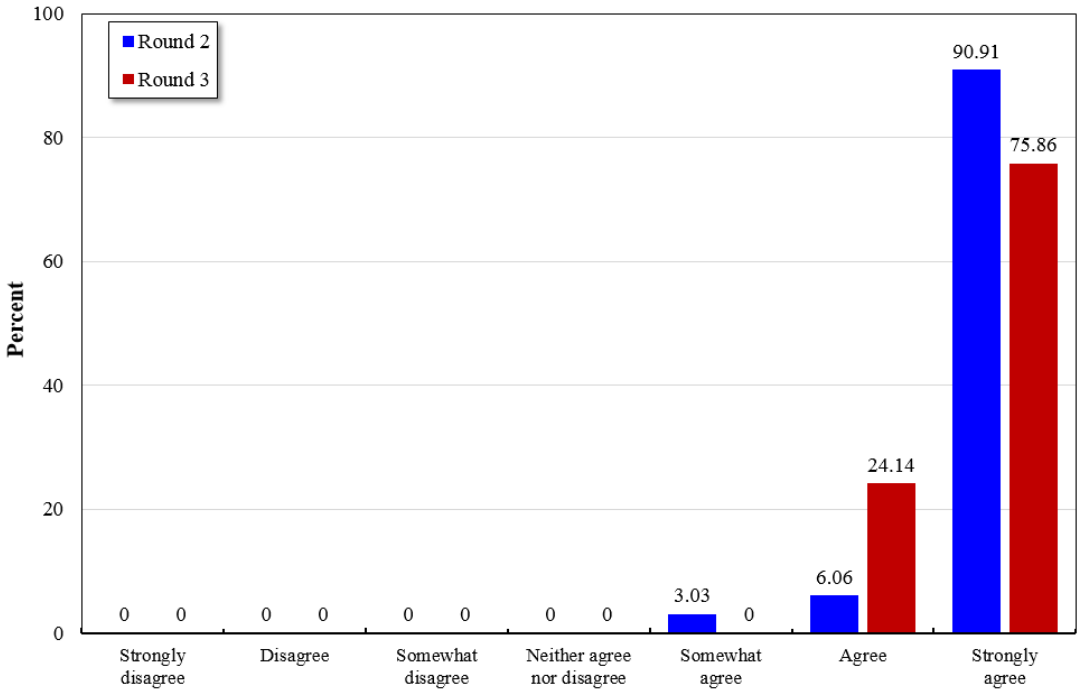

Figure C12. Q12: It is important that blind and low vision user testing be done prior to the purchase of learning management systems.

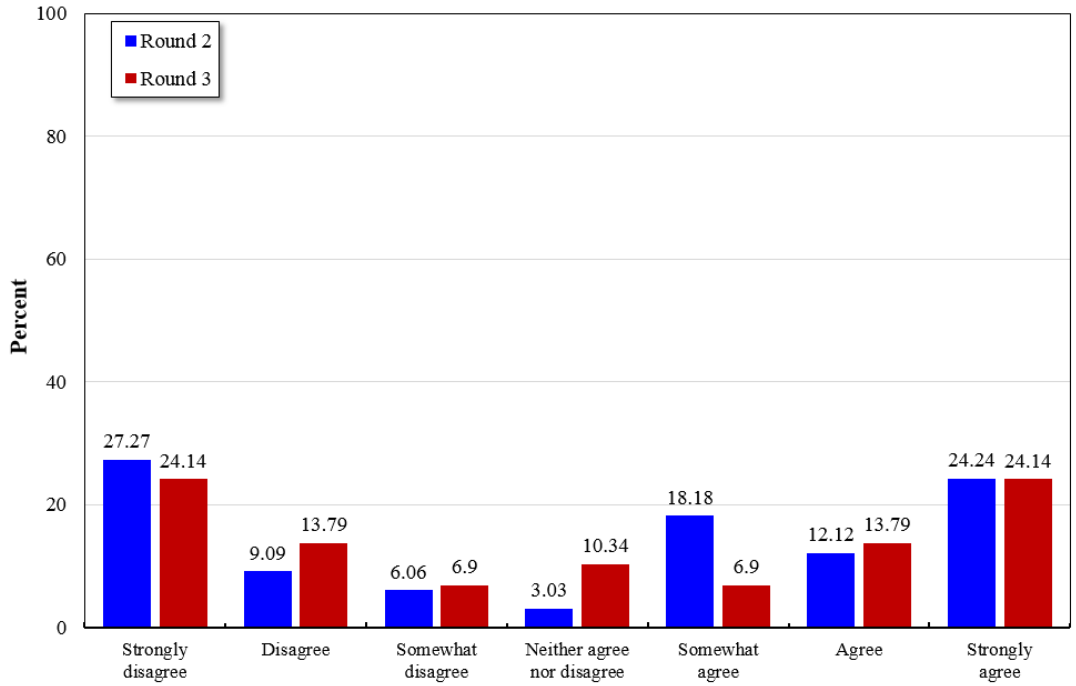

Figure C13. Q13: It is adequate to conduct accessibility evaluations of courses by accessibility professionals.

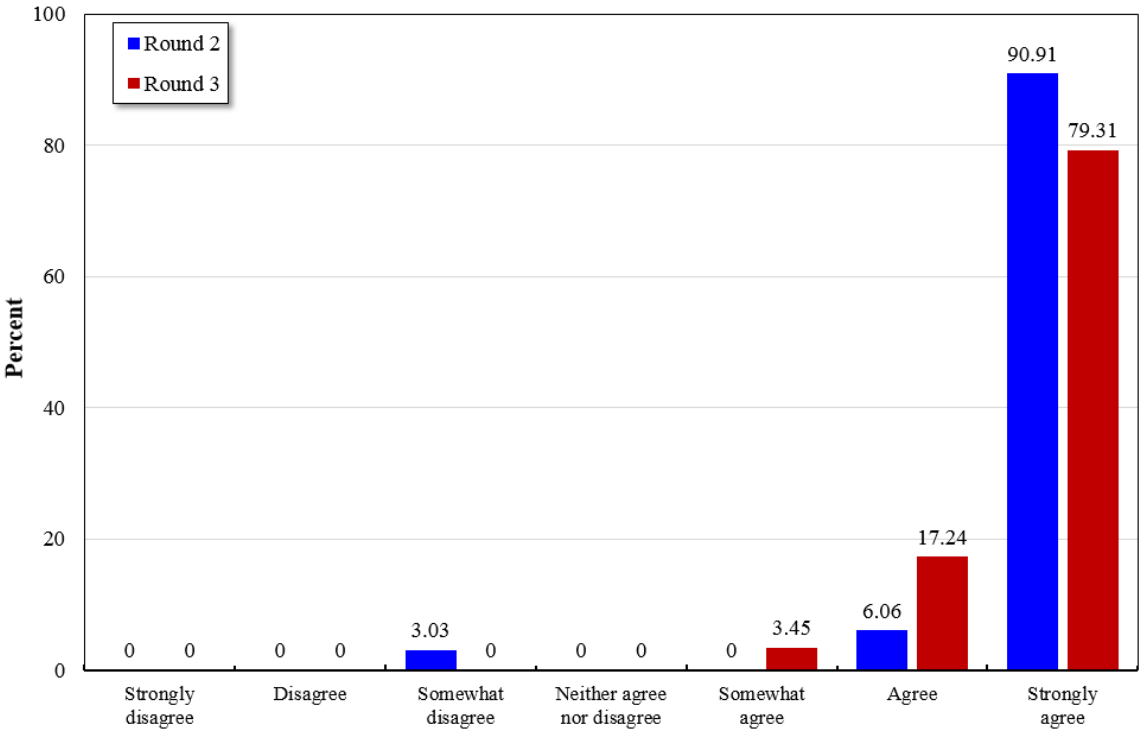

Figure C14. Q14: Courses should always be designed with accessibility in mind.

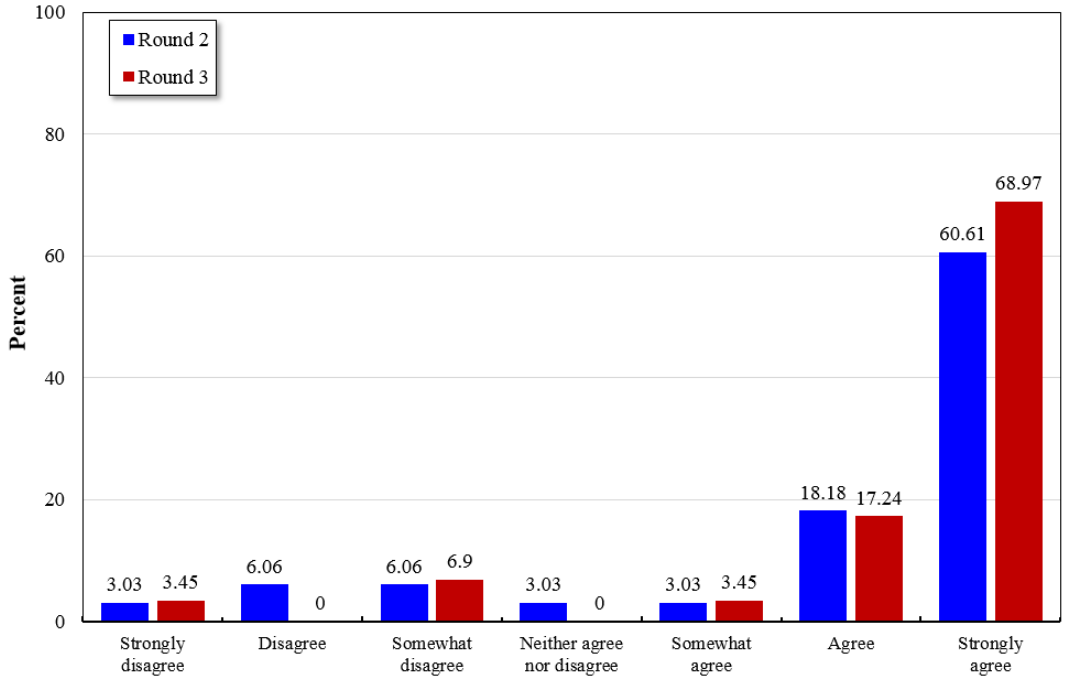

Figure C15. Q15: Courses should be made accessible when requested.

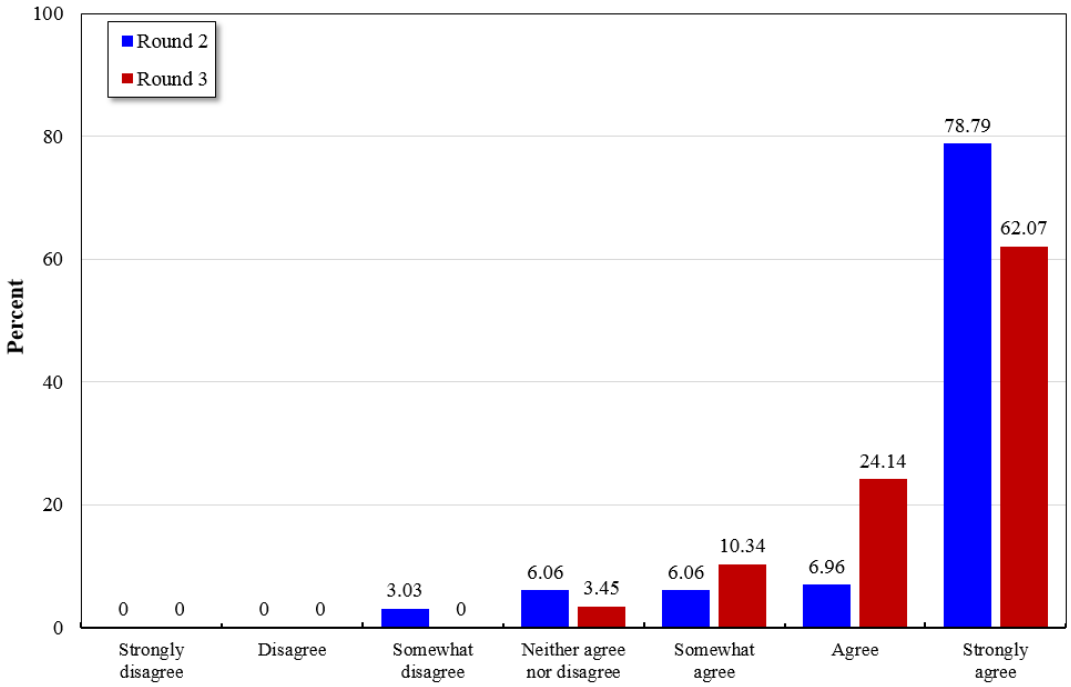

Figure C16. Q16: Institutions should provide appropriate assistive technology when it is essential to use their equipment to access course-related information or required software.

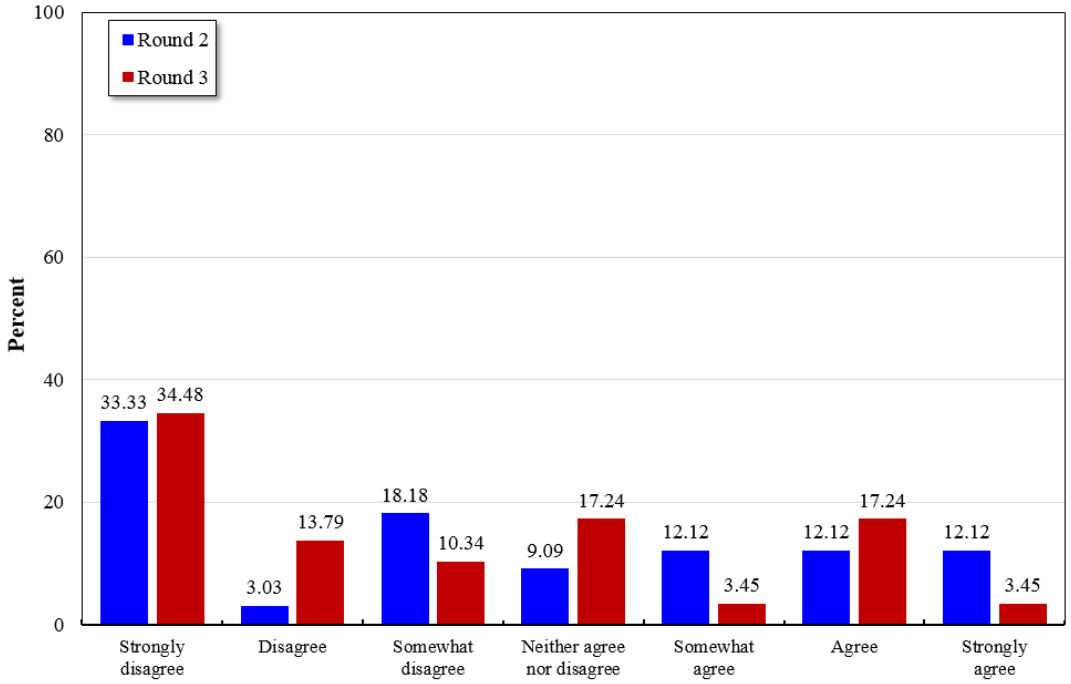

Figure C17. Q17: It is acceptable for institutions to require that blind and low-vision students provide their own assistive technology to participate in online courses.

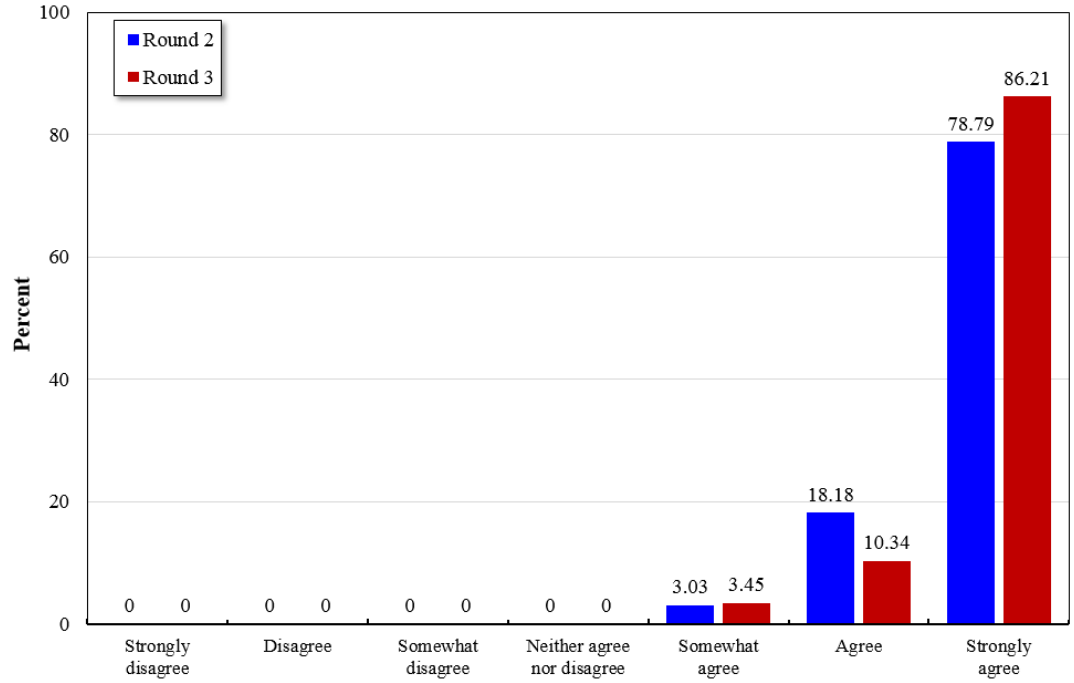

Figure 18. Q18: Faculty members and course developers should be adequately trained in developing accessible online courses.

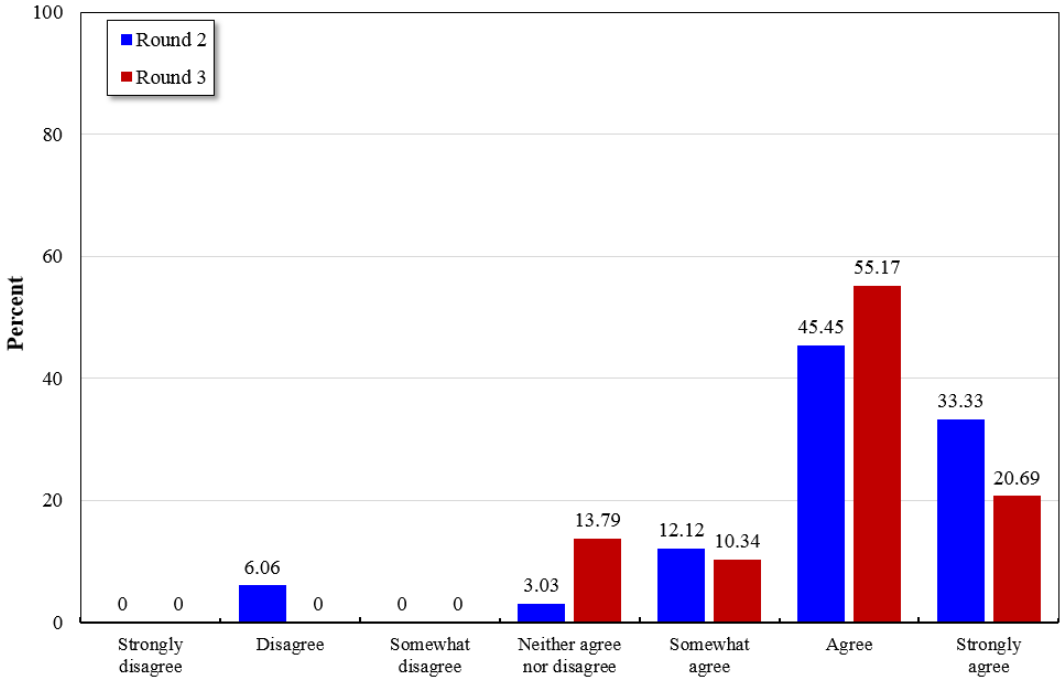

Figure C19. Q19: Online courses that are designed with accessibility still pose barriers because of poor usability design.

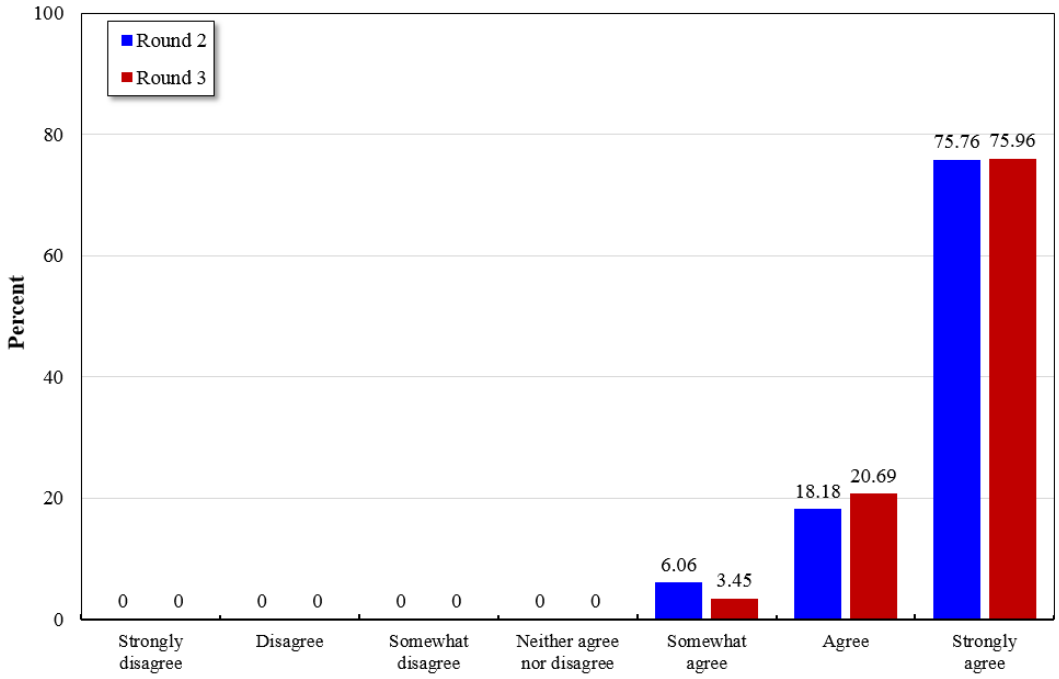

Figure C20. Q20: It's important that students have the opportunity to evaluate the accessibility of online courses.

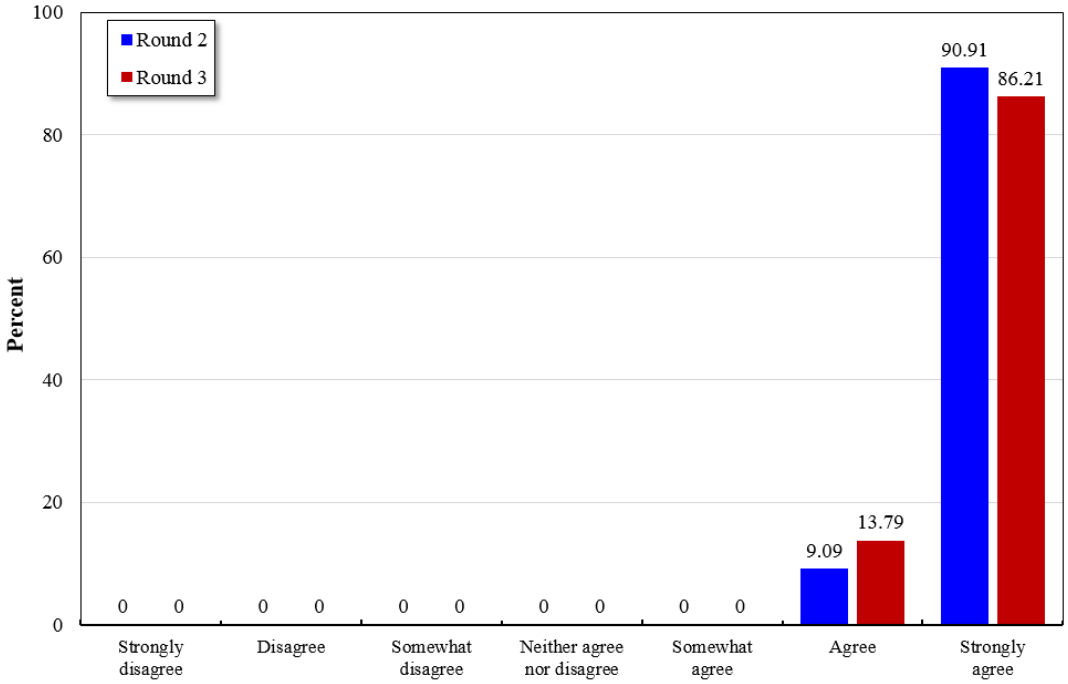

Figure C21. Q21: It's important that students have the means to report inaccessible online courses.

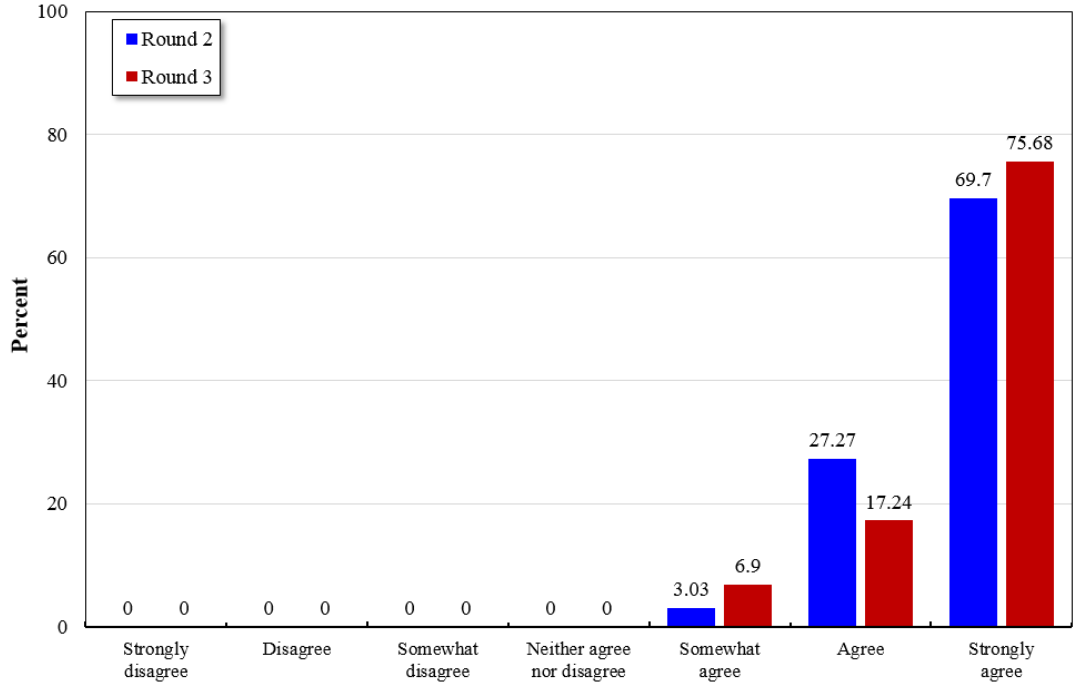

Figure C22. Q22: It's important that faculty have disability awareness training.

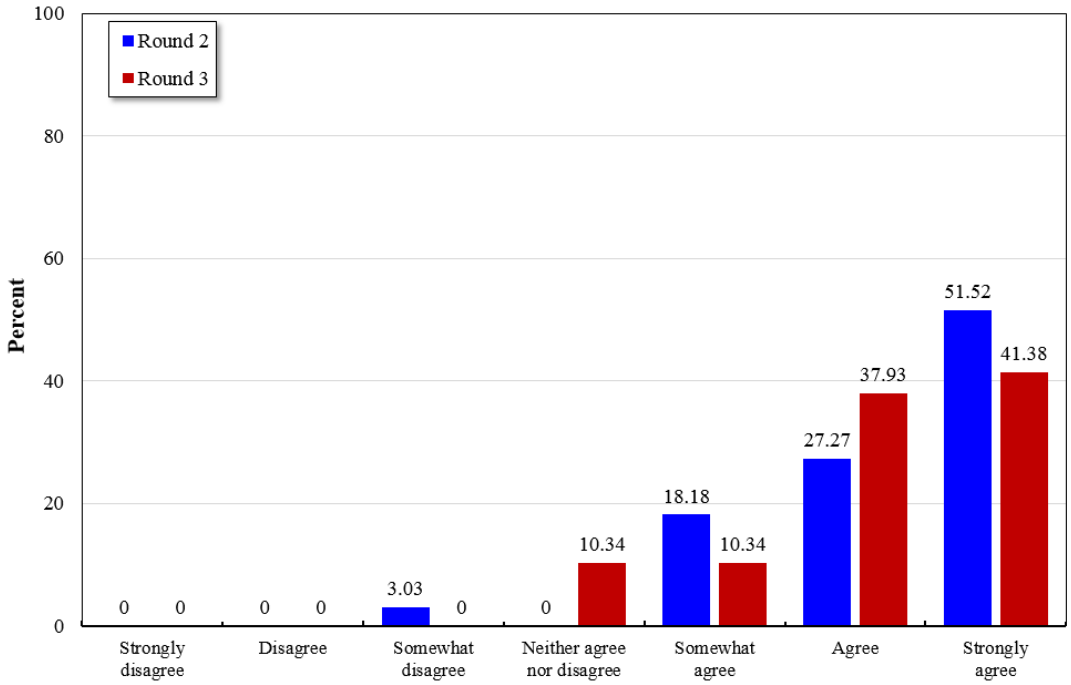

Figure C23. Q23: Often when inaccessibility is reported and problems are addressed, the solutions are temporary.

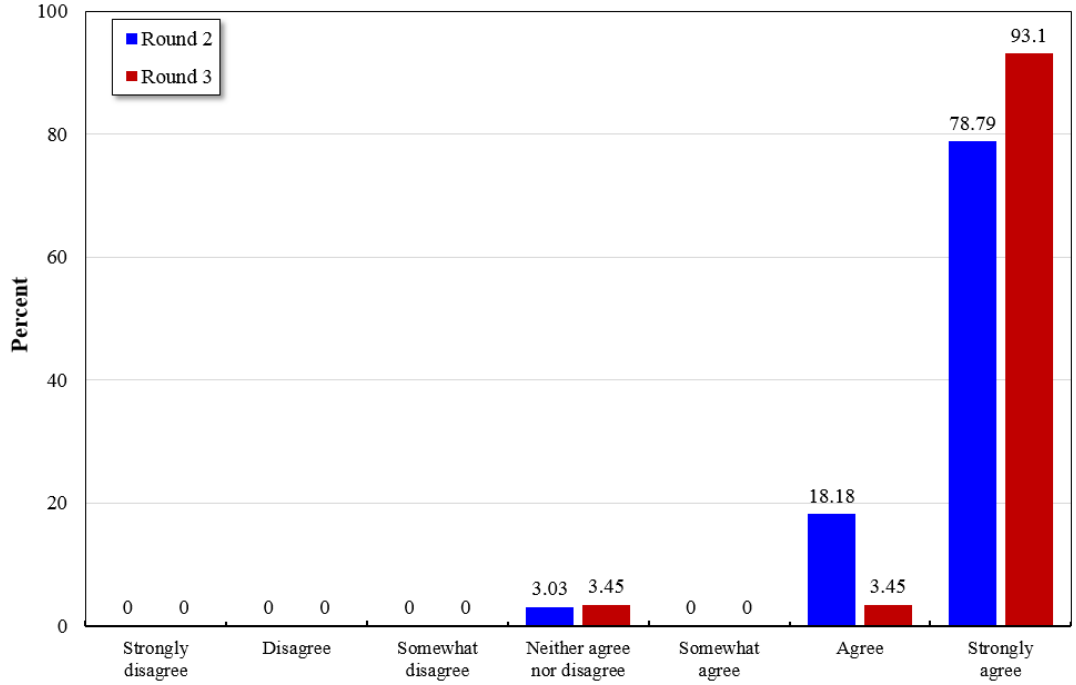

Figure C24. Q24: It is necessary that disability services office personnel have a good understanding about accessibility.

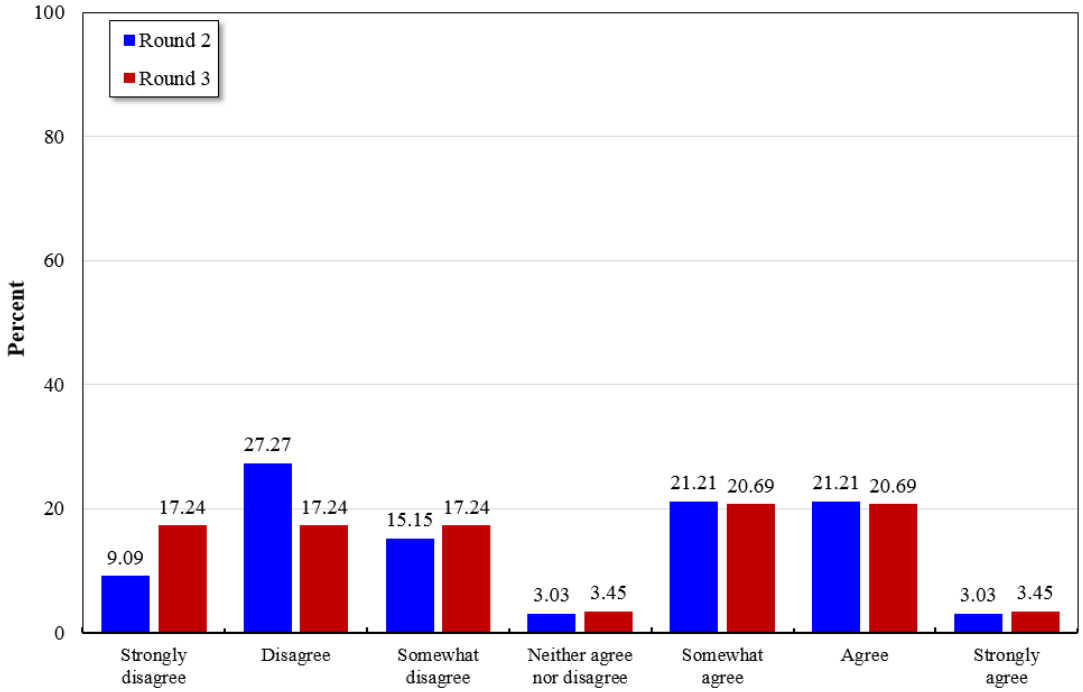

Figure C25. Q25: Often disability service personnel have a good understanding about accessibility.

CURRICULUM VITAE

SACHIN D. PAVITHRAN

E-mail: sachin.pavithran@usu.edu Phone: (435) 797-6572

PROFESSIONAL PROFILE

Over sixteen years' experience working in the disability field, with focuses in research, accessibility, program implementation, and policy development, both domestically and internationally. Specific experience includes policy and regulatory analysis at a federal agency; budget and personnel management, program implementation, and acquisition of funding through competitive grants at a university research center; training, design, and evaluation of accessible websites as administrator of a federal program; legislative advocacy and relationship building with Members of Congress and State Legislature; and consulting with towns, states, and foreign nations to make education more inclusive, public transit systems more accessible, and disability-related practices better aligned with relevant compliance obligations as an international consultant-for-hire. In-depth knowledge disability-related states and regulations, and unique insight into treatment of people with disabilities in different cultures.

EDUCATION

- PhD candidate in Disability Disciplines, Utah State University, May 2017.
- M.S., Rehabilitation Counseling, Utah State University, May 2008
- B.S., Marketing, Utah State University, December 2000
- B.S., Business Information Systems, Utah State University, May 1999

CURRENT PROFESSIONAL POSITIONS

Presidential Appointee, United States Access Board, Washington, D.C.; Appointed by President Obama, December 2012 – Present; Elected Chairman in March 2015.

- Served as chairman March 2015- March 2016.
- Lead an independent, federal agency comprised of industry representatives, federal employees and technology experts.
- Carry out Congress' charge to conduct regulatory assessments and rulemakings related to technology and disability access.
- Serve in various supervisory roles, such as Chair of the Information and Communications Technologies Committee (Jan 2013 – Present), Chair of the Self-Service Transaction Machines Committee (Jan 2013 – Mar 2015) and

Former Chair of the Planning and Evaluation Committee (Mar 2013 – Mar 2014).

- Conduct extensive review and update of guidelines under Titles II and III of the Americans with Disabilities Act (ADA) as the implementing regulations pertain to equal access in buildings, newly-constructed sites, new alterations, and buildings that house federally-funded programs under the Architectural Barriers Act.
- Develop new guidelines to extend scope of Title II regulations to include standards for passenger vessels (i.e. cruise ships, ferries), and evaluate the need to update other transportation-related standards, like guidelines for access to public transportation facilities and rail vehicles, and the Public Right-of-Way Accessibility Guidelines.

Program Director, Utah Assistive Technology Program (UATP); Funded by the U.S. Department of Health and Human Services; Logan, UT; December 2011 – Present.

- Manage various annual state and federal budgets associated with UATP.
- Supervise and evaluate performance of UATP staff.
- Coordinate and monitor staff implementation of Utah State Plan for assistive technology (AT), as described in the AT Act of 1998.
- Oversee the collection and management of program data; including the submission of that data in an annual report to the funding agency.
- Ensure compliance with consumer responsive policies and procedures in UATP activities.
- Serve as UATP's representative on community-based boards and committees.
- Participate in disability advocacy activities, including policy development for federal disability legislation.

Project Director & Principal Investigator, Utah Americans with Disabilities Act Research Committee; Funded by Meeting the Challenge, Inc., Colorado Springs, CO; June 2008 – Present.

- Facilitate research projects that relate with Title I, II, & III of the Americans with Disabilities Act.

Disability Policy Analyst, Center for Persons with Disabilities; Utah State University, Logan, UT; January 2008 – Present.

- Research and analyze federal and state policy that impacts people with disabilities.
- Educate members of Congress, state legislators and their staff on a variety of legislative initiatives, including hearings to evaluate the efficacy of the state vocational rehabilitation program, legislation to establish an accessibility requirement for technology developed and procured by the state government ("mini-508"), and a federal initiative to develop guidelines for accessible material used at institutions of higher education,
- Collaborate with federal and state agencies to implement policies and practices to effectively serve people with disabilities.

Associate Director, Interagency Outreach Training Initiative Projects, Center for Persons with Disabilities; Utah State University, Logan, UT; January 2008 – Present.

- Coordinate training programs as prescribed by funding agency.

Legislative Director, National Federation of the Blind of Utah; Salt Lake City, UT; January 2008 – Present.

- Conduct two large-scale yearly meetings, and various intermittent meetings, with members of Congress, advocating for legislative initiatives that improve the lives of blind people.
- Manage and cultivate relationships with Congressional staff through routine communications and attending district events.
- Lead the coordination of grassroots efforts in UT on behalf of the National Federation of the Blind headquarters.

PREVIOU.S. PROFESSIONAL POSITIONS

International Consultant, Various Projects; January 2009 – November 2012

- Consulted with governmental agencies and NGOs in Turkey to improve inclusion of people who are deaf or hard of hearing in education systems.
- Worked with National Council on Disability Affairs for the Philippines government on implementation of disability law and policy in the Philippines.
- Assisted Ministry of Education of Egypt to implement policies to provide civil rights and support services for people with disabilities.
- Collaborated with Ministry of Social Welfare and Labor of Syria to implement disability-related policies.
- Provided guidance to Damascus University in Damascus, Syria on how to include and accommodate students with disabilities in their university system.

Program Coordinator, Utah Assistive Technology Program; June 2009 – December 2011.

- Ensured compliance with consumer responsive policies and procedures in UATP activities.
- Collaborated with state agencies, including Independent Living Centers, Vocational Rehabilitation agencies, and Protection and Advocacy agency, to conduct outreach and public awareness activities on a regular basis.
- Participated on community-based boards and committees at the state and national level.
- Designed and maintained UATP and UATF websites to ensure conformance with accessibility standards.

ADA Coordinator, Utah ADA Project, Center for Persons with Disabilities; Utah State University, Logan, UT; July 2005 – December 2011.

- Coordinated ADA training and technical assistance to employers and community

organizations.

Assistive Technology Specialist, Utah Assistive Technology Program; Logan, UT; June 2002 - June 2009.

- Demonstrated and trained individuals with disabilities throughout Utah on AT devices.
- Assisted individuals with disabilities and their families to acquire assistive technology.

Training and Development Specialist, Web Accessibility in Mind Project, Center for Persons with Disabilities; Utah State University, Logan, UT; October 2000 – June 2005.

- Developed and implemented training for the design of websites as per guidelines published under Section 508 of the Rehabilitation Act and other consensus standards, including Web Content Accessibility Guidelines developed by the World Wide Web Consortium.
- Evaluated products related to web accessibility and design.

Database and Network Administrator, UNITOR; Dubai, United Arab Emirates; May - August 1998.

- Provided training to company employees for a newly-installed system.
- Configured the networks between Windows 95 work stations to Windows NT file server.
- Installed software packages and configured terminals to meet employee needs.

System Analyst, Microlink Computers [IBM]; Dubai, United Arab Emirates; May - August 1997

- Designed a system that suited job requirements.
- Configured and set up networks and systems.
- Identified major projects, potential customers, and new products.
- Negotiated with clients; served as liaison with consultants and programmers.
- Assisted customers with technical support.

INSTRUCTIONAL EXPERIENCE

- Instructor, Culturally Valid Practices in Rehabilitation, Utah State University
- Instructor, Policies and Procedures in Special Education, Utah State University

BOARDS/ORGANIZATIONS

- Association of University Centers on Disabilities National Board, December 2016 – Present.
- Assistive Technology Act Programs National Board, October 2011 – Present.
- Research & Development Committee, National Federation of the Blind, March

2008 – Present.
- Advisory Council of the Utah Center for Assistive Technology, Utah State Office of Rehabilitation, January 2008 – Present.
- Board Member, National Federation of the Blind of Utah, May 2007 – Present.
- National Multicultural Council, Association of University Centers for Disabilities, January 2007 – Present.
- Legislative Affairs Committee of the Association of University Centers on Disabilities, November 2007 – Present.
- Advisory Committee on Disability Issues, Senator Orrin Hatch, January 2006 – Present.
- State Rehabilitation Council, Utah State Office of Rehabilitation, October 2009 – September 2014.
- Division of Services for the Blind and Visually Impaired Advisory Board, March 2009 – June 2014.
- National Clearinghouse of Rehabilitation Training Materials, Department of Special Education, College of Education, Utah State University, June 2006 – December 2010.
- Standing Policy Committee, Assistive Technology Act Programs, November 2007 – January 2010.
- Utah Rehabilitation Association, Utah State Office of Rehabilitation, January 2007 – December 2009.

HONORS AND AWARDS

- Kurzweil Technologies 2007 Kurzweil Foundation Award, Presented by Ray Kurzweil, For Academic Excellence and Service to the Community.
- Kenneth Jernigan Scholarship Presented by the National Federation of the Blind, in Recognition of Extraordinary Achievement and Promise, 2007.

PRESENTATIONS

National & International

Pavithran, S. *Breaking Barriers Through Networking.* Keynote Speech at 3M Healthcare Conference, Salt Lake City, UT, (April 2014).

Pavithran, S. *Accessible Instruction: The New Standard in Academia.* National Council on Rehabilitation Education Conference. Washington, D.C., (November 2013).

Pavithran, S. *Refocusing Our Practice: Setting Priorities for Success.* Keynote address at the National Council on Rehabilitation Education Conference. Washington, D.C., (November 2013).

Hammond, M. & **Pavithran, S.** *Increasing Safety and Empowerment to Prevent Abuse*.

IASSID World Congress. Halifax, Nova Scotia, (July 2012).

Hammond, M. & **Pavithran, S.** *Training Advocates and Law Enforcement on Communication and Accommodations.* IASSID World Congress. Halifax, Nova Scotia (July 2012).

Root-Elledge, S., Hammond, M. & **Pavithran, S.** *WY and UT UCEDDS implement AT Act Programs*. Association of University Centers for Disabilities Conference, Washington, D.C., (November 2011).

Blair, M. & **Pavithran, S.** *Universal Design for Learning: Definition and Examples*. Assistive Technology Industry Association Annual Conference, Orlando, FL. (January 2010).

Pavithran, S. Hammond, M. & Sheen, J. *Inclusion of People with Disabilities in Employment Training*. LDS Humanitarian Center. Manila, Philippines (January 2010).

Pavithran, S., Hammond, M., & Sheen, J. *Connecting disabilities with existing and future development activities*. Asian Development Bank. Manila, Philippines (January 2010).

Hammond, M., Sheen, J. & **Pavithran, S.** *Using Technology for Distance Education.* Association of University Centers on Disabilities. Washington, D.C. (November 2009).

Hammond, M., **Pavithran, S.** (Poster) *Disability Training for Faith Leaders*. Association of University Centers on Disabilities. Washington, D.C. (November 2009).

Pavithran, S. & Hammond, M. *National Needs and the Center for Persons with Disabilities*. National Council on Disability Affairs. Manila, Philippines (February 2009).

Hammond, M. & **Pavithran, S.** *Inclusion of People with Disabilities in Employment Training*. LDS Humanitarian Center. Manila, Philippines (February 2009).

Pavithran, S. & Blair, M. *AT in Employment: How AT is used to Comply with Title I of the Americans with Disabilities Act.* Assistive Technology Industry Association Annual Conference, Orlando, Florida (30 Jan 2009).

Hammond, M. & **Pavithran, S.** *Disability Community Training.* (Poster) Association of University Centers on Disabilities. Washington, D.C. (November 2008).

Millington, M. & **Pavithran, S.** *Community Inclusion: Building Alliance on the Web.* NCRE Conference, San Diego, California (22 Sept 2008).

Pavithran, S., Hammond, M., & Blair, M. *Assistive Technology for the Blind: Devices and Funding Resources.* PACRIM Conference, Honolulu, Hawaii (15 April 2008).

Pavithran, S. & Blair, M. *Overcoming the Barriers of Training and Device Demonstration Around the State.* Assistive Technology Industry Association Annual Conference, Orlando, Florida (1 Feb 2008).

Blair, M. & **Pavithran, S.** *Assistive Technology in Utah: State Level Initiatives and an Intervention for Young Children and Their Families.* Association of University Centers for Disabilities Conference, Washington, DC (13 Nov 2007).

Pavithran, S., and Blair, M. *Lessons Learned in AT Training and Device Demonstrations in the State of Utah*. Assistive Technology Industry Association Annual Conference, Orlando, Florida (26 Jan 2007).

Price, R., and **Pavithran, S.** *Strategies in Using Assistive Technology for Helping Students in K – 12, with Visual Impairment to be more Independent.* PACRIM Conference, Honolulu, Hawaii, (February 2005).

State & Local

Hammond, M., **Pavithran, S.**, Koenig, H. & Mathis, S. *Assisting those with Disabilities*. Domestic Violence Advocate Annual Training. Salt Lake City, Utah, (November 2011).

Blair, M. & **Pavithran, S.** *Federal Disability Legislation and Policy.* Annual Meeting of the Utah Rehabilitation Association, Salt Lake City, Utah (April 2008).

Blair, M. & **Pavithran, S.** *Federal Disability Legislation and Policy*. Annual Meeting of the Utah Rehabilitation Association, West Jordan, Utah (May 2007).

Pavithran, S., Price, R., Bacon, E., Braithwaitte, L., Hammond, M. *Assistive Technology for the Visually Impaired or Blind*. Presented at various school districts in the State of Utah. Sponsored by the IOTI Grant, (Sept. 2006 – May 2007).

Pavithran, S., and Menlove, T. *Independence is Priceless: The Utah Assistive Technology Foundation.* Family Links Conference, Salt Lake City, Utah (April 2003).

Pavithran, S., and Menlove, T. *Assistive Technology: The Key to Independence*. Tenth Annual Conference of the Early Intervention Research Institute, Logan, Utah (March 2003).

Pavithran, S., and Menlove, T. *The Utah Assistive Technology Foundation.* Third Annual Southern Utah Autism Conference, Cedar City, Utah (April 2002).

Pavithran, S., Richins, G., and Menlove, T. *Accessing the Center for Persons with*

Disabilities. Family Links Conference, Salt Lake City, Utah (April 2002).

Pavithran, S. *Utah Assistive Technology Program.* Celebrate Disabilities Conference at Utah State University, Logan, Utah (March 2002).

Pavithran, S., Price R., and Menlove, T. *Utah Assistive Technology Program.* Disability Awareness Month Open House at Utah State University, Logan, Utah (March 2002).

PUBLICATIONS

Recent Reports

Pavithran, S. (2014, 2013, 2012, 2011, 2010, 2009) *Annual Report of the Utah Assistive Technology Program (UATP).* Submitted to the Rehabilitation Services Administration (RSA), U.S. Department of Education Washington, DC.

Hammond, M. & **Pavithran, S.** (2014, 2013, 2012, 2011, 2010, 2009, 2008). Annual Report of the Utah Alternative Financing Program. Submitted to the Rehabilitation Services Administration (RSA), U.S. Department of Education Washington, DC.

Non-Refereed Articles

Pavithran, S., and Butikofer, H. (2005). *Assistive Technology: The Utah State University Assistive Technology Laboratory.* The Utah Special Educator, 25(5), 42-43.

Pavithran, S. (2004). *Email Access: From the Perspective of an Individual with Visual Impairment.* Online publication available at: http://webaim.org/techniques/articles/email.

Anderson, S., **Pavithran, S.**, & Bohman, P. (2004). *Accessible taxes? A blind man's experience with the United States' tax system.* Online publication available at: http://www.webaim.org/techniques/articles/taxes.

PRODUCTS

Executive Producer (2008). *Focus on Ability*. Three 30 second video commercials highlighting employee abilities. Produced for Meeting the Challenge, Inc. Colorado Springs, CO.

Co-Producer (2007). *Good Access is Good Business: Reasonable Job Accommodations*. A DVD produced for Meeting the Challenge, Inc. Colorado Springs, CO. (Approx. 28 minutes)

Co-Producer (2006). *Good Access is Good Business: Accessibility of Private Recreation*

Areas on Public Land. A DVD prepared for Meeting the Challenge, Inc. Colorado Springs, CO and the U.S. Forest Service, Washington, DC. (Approx. 23 minutes)

FUNDED PROPOSALS

Total Funds: $3.4 million

Hammond, M. & **Pavithran, S.** (2011). Preventing violence and increasing justice, equity and access. Center for Persons with Disabilities, Utah State University. $49,000.

Pavithran, S. & Burgess, A. (2011) *State Plan for Assistive Technology 2012–2014*. Submitted to the Rehabilitation Services Administration, U.S. Department of Education. Washington, DC. (Funded: $442,000 each year for three years).

Hammond, M. & **Pavithran S.** (2009). Increasing knowledge and sensitivity of faith-based organizations about disabilities. Center for Persons with Disabilities, Utah State University. $40,000.

Hammond, M., Sheen, J. & **Pavithran, S.** (2008). Increasing knowledge, collaboration and proposals in the Middle East, Asia and South America. Center for Persons with Disabilities, Utah State University. $20,000.

Hammond, M. & **Pavithran, S.** (2008). Disability Sensitivity and Communication Agency Training. Interagency Outreach Training Initiative. Center for Persons with Disabilities, Utah State University. $40,000.

Phillips, C., Blair, M. & **Pavithran, S.** (2008) *State Plan for Assistive Technology 2009–2011*. Submitted to the Rehabilitation Services Administration, U.S. Department of Education. Washington, DC. (Funded: $443,000 each year for three years).

Hammond, M. & **Pavithran, S.** (2008). Utah Assistive Technology Foundation. Utah State Office of Vocational Rehabilitation. $30,000.

Hammond, M. & **Pavithran, S.** (2007). Utah Assistive Technology Foundation. O.C. Tanner Foundation. $1,000.

Kulyukin, V., Blair, M., & **Pavithran, S.** (2003). *Universal Access to Indoor Environments through Distributed Tracking and Guidance*. Submitted to the National Science Foundation, Arlington, VA. (Funded: $500,000, one year).

Kulyukin, V., Blair, M., & **Pavithran, S.** (2002). *Distributed Tracking and Guidance in Indoor Environments*. Submitted to the Community/University Research Initiative Program, Utah State University, Logan, UT. (Funded $25,000: one year).

LANGUAGES

- Hindi, Malayalam, Urdu

TECHNICAL SKILLS

Assistive Technology

- Screen Reading Software (JAWS, Window Eyes, Voice Over)
- Duxbury Systems
- Open Book Reader
- Kurzweil 1000
- Zoom Text
- Magic
- Braille Note
- KNF-B Reader
- Victor Reader Stream

Programming Languages

- Visual C++
- COBOL
- S.Q.L.
- Visual Basic
- HTML