Online Courses Accessibility For Low-Vision

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Abstract

This qualitative study tends to explore what accessibility design can be most important to facilitate learning in an online course for postsecondary students with low vision. The study is conducted in a U.S. public university offering online courses in the Midwest. This study was guided by two research questions: (1) What accessibility design did students with low vision who experienced online courses perceive to be helpful for their learning? (2) What accessible features would students with low vision want to exist in future online courses? The theoretical framework for this study was Universal Design for Learning (UDL). Three participants were interviewed to share their experience with online learning and to explore which accessibility aspects were perceived the most helpful for students with low vision. The finding revealed that alternative formats for materials—such as Word documents or Rich Text formats (RTF) and accessible PDF files—were the most helpful accessible text format in the online courses. In addition, the finding showed headings and color contrasting for the online content are the main aspects of design to increase accessibility and to facilitate reading for students with low vision. The last finding revealed that students with low vision need two additional accessibility design to be employed in online courses: audio response and instructor video.

Keywords – Online learning, Accessibility, Low-Vision, Visual impaired

1. Introduction

In the last two decades, due to flexibility and accessibility, online courses are becoming increasingly popular among non-traditional students and learners who have (in)visible disabilities (Summers et al., 2014). Students with disabilities need support, particularly, students with low vision need special accessible features in online courses because they have some difficulties dealing with the technologies (Crow, 2008; Fichten et al., 2009; Summers et al., 2014). Universal Design of Learning (UDL) provides several accommodations for postsecondary students with low vision through using assistive technology and providing a variety of accessible features for this type of vulnerable population (Crow, 2008). Relevant research (Lorenzin & Wittich 2019; Okiki, 2019) shows that low vision students will succeed academically when they take online courses with proper accessibility design. To explore which types of accessibility design aspects, based on
the UDL principles, are deemed to be appropriate for online settings, this qualitative study seeks to understand the perceptions of students with low vision.

2. Literature Review

2.1. Online Courses

Online courses attempt to create a type of learning environment and serve as a process of connecting students, instructors, and learning resources when they are not physically present in the same location (Park & Choi, 2009). In 1997, the first online course platform was launched at famous universities, such as Yale, Cornell, and University of Pittsburgh. In the same year, a Learning Management System (LMS) known as Blackboard™ was founded and has become widespread to deliver online instruction and it is still utilized in many educational institutions and universities across the globe (Morton, 2016). Online courses use asynchronous and synchronous technologies. Synchronous technology requires students and instructors to work at the same time but not in the same place through using video conference (Palmer, 2012). In contrast, asynchronous technology does not require students and instructors to work at the same time (Palmer, 2012). They can work independently at a convenient scheduled time for each of them.

In the last three decades, online courses have significantly increased in higher education (Betts et al., 2013). Recently, 30% of postsecondary students are enrolled in at least one online course in one of the U.S higher education institutions (Cole et al., 2014). Although online courses have increased, students with disabilities enrolling in institutions of higher education have also increased over the last twenty-five years (Lyman et al., 2016). Higher education has attempted to make online courses more effective and accessible for all students, however, some instructors and/or institutions may overlook the needs of students with disabilities (Kharade & Peese, 2012). Cook and Gladhart (2002) stated that 10% to 15% of postsecondary students identify themselves as disabled. According to the American Disabilities Act (ADA), a disability is a physical or mental impairment that substantially limits one or more major life activities. To be labeled as disabled, a person must have a history or record of such an impairment, or a person should be perceived by others as having such an impairment. These self-identified students with disabilities should have equal opportunities in their online courses as other students.

2.2. Online Courses for Students with Low Vision

Low vision is one of the common types of visual disabilities (Richardson, 2014). It is defined as the functional limitation of the eye or eyes or the vision system (The American Foundation for the Blind, 2015). The American Foundation for the Blind (AFB) defines low vision as a condition caused by eye disease in which visual acuity is 20/70 or poorer in the better-seeing eye and cannot be corrected or improved with regular eyeglasses (AFB, 2015). Students with low vision usually have several academic difficulties (Moola, 2015). One of these difficulties is using technology because sometimes they cannot adjust technology according to their needs. For purpose of this study, low vision identifies as “a person who has difficulty accomplishing visual tasks, even with prescribed corrective lenses, but who can enhance his or her ability to accomplish these tasks with the use of compensatory visual strategies, low vision and other devices, and environmental modifications” (Corn & Koenig, 1996, p.4).

Consequently, the emergence of online courses has brought challenges for students with low vision (Argyropoulos et al., 2019; Summers et al., 2014). The literature on the experiences of students with low vision is scarce, and most seminal articles focus on students with disabilities without specifying the type of disability (Lorenzin & Wittich 2019; Okiki, 2019). However, some
relevant studies (e.g., Lee & Oh, 2017; Richardson, 2014) had observed that students with low vision are not often active in online courses due to the challenges they face in interacting with learning materials. On the contrary, several studies suggest online courses are beneficial for students with low vision since they provide remote learning experience (Barnard et al., 2012; Haegele et al., 2018; Kharade & Peese, 2012) and allow instructors to provide remote instructional assistance to the students anytime and anywhere even if they live far from the main campuses of the universities (Holmgren, 2018).

Online courses benefit students with low vision because they can find a solution for the challenges attending physically on campus, which poses great difficulty for them (Kharade & Peesa, 2012; William et al., 2006). Kharade and Peesa (2012) addressed that the flexibility in the location, scheduling, and delivery of online courses reduced the challenges for attending on campus by providing flexibility in time and place of delivery. Feucht and Holmgren (2018) reported that students with low vision drop out because they cannot drive to the campus and do not live close to the campus. Walking around campus is also a challenge because sometimes it requires students with a very low vision to use aids such as a cane or a guide dog. This is because in some cases students with low vision cannot even see the small things, or in other cases, students with low vision cannot see things in bright or dark places. Therefore, they often have a difficult time self-navigating outside of well-known environments and prefer to be indoors (Long et al., 1990), and some prefer to study and work in small physical spaces (Haegele et al., 2018). As a result, low vision affects a person’s ability to learn or perform many job duties, which severely limits his/her main life opportunities for education and employment (Long et al., 1990). Therefore, online courses became such a great option for students with low vision to complete their educational degrees and be more motivated to succeed (Kharade & Peese, 2012).

Besides flexibility, online courses allow students with low vision to adjust the instructional material through assistive technologies according to their needs (Crow, 2008; Fichten et al., 2009) during learning, reading, writing and acquiring academic and nonacademic skills (Hewett et al., 2017; Rosner & Perlman, 2018). In addition, using assistive technologies in online courses help students facilitate learning and receive equal learning opportunities (Hewett et al., 2017). Because of this equality, students with low vision can be more active and motivated to participate in online activities such as discussion and group work. Assistive technologies help to improve the quality of learning for students with low vision (Crow, 2008). Online courses with assistive technologies encourage students with low vision to be active participants and share the ideas with classmates and instructors remotely in online course activities (Crow, 2008; Fichten et al., 2009; Hewett et al., 2017).

2.3. Accessibility

Accessibility is an important priority in online courses delivered by top universities such as Harvard University, UC Berkeley, and MIT (Alahmadi, 2017). Following their trend, many colleges and universities have started to make program and policy changes in their online courses (Zuriff, 1996). Accessibility addresses the design of technology rather than the needs of specific individuals (Alahmadi, 2017). Accessibility means using course materials and tools by all types of students, regardless of their physical and/or developmental impairments. When a course is accessible, most of the students even those with disabilities can reach the material equally. All can get access to the course delivery system, navigate the course content, submit assignments, and successfully use all course tools. The most common example of accessibility includes obtaining printed materials in alternate formats (Pittman, et al., 2014). Other examples involve the inclusion
of a statement of support for students with disabilities in the course syllabus. In addition, all video
content (web, DVD, and VHS) should be captioned, and transcripts of audio-based material and
video-based materials should be available if they cannot be captioned.

There are several benefits of accessibility in online courses. The accessibility allows
students to use flexible materials that can be adjusted according to their special needs and
preferences (McKenna & Velasco, 2018; Pittman, et al., 2014). Audio, images, graphics,
animations, video, or text which are often the tools to present information and the relationships
between objects, actions, numbers, or events. However, visual representations are not equally
accessible to all students, particularly visually impaired students (McKenna & Velasco, 2018).

3. Theoretical Framework

Most institutions of higher education in the U.S. incorporate the principles of Universal
Design for Learning (UDL) into the educational and instructional materials. UDL is a framework
for improving instruction because it helps provide equal opportunities for all learners to succeed.
This strategy provides flexibility in how learners to access, engage with and demonstrate what they
understand and increases the quality of learning materials for everyone (Rose & Mayer, 2008).
UDL principles support students with low vision who have some challenges in online courses by
providing resource and flexibility access to engage the students complete learning (Houston,
2018). Most of the research has found that UDL is essential for integrating students with visual
impairments into higher education (Al-Azawei et al., 2016; Houston, 2018; McKenna & Velasco,
2018). According to CAST (2008) and Rose and Mayer (2008), there are three UDL principles:
representation, action and expression and engagement. The first principle of UDL is
“Representation,” which involves providing learners with various ways of acquiring information
and knowledge that have a connection to the accessibility formats, which require instructors to
provide various resources to facilitate students’ access to the learning materials. The second
principle is “Action and Expression,” which provides students with various routes to access the
necessary materials using assistive technology. The third principle is “Engagement,” which
enables an instructor to tap into students’ interests, challenges them appropriately, and motivates
them to learn through facilitating resources.

This study sought to explore the perceptions of the current experiences of students with
low vision in online courses to identify what accessibility design aspects offer the greatest support
based on UDL guidelines and would be beneficial. This research is intended to provide
recommendations for future instructors and instructional designers to consider when creating
online courses for students with low vision.

4. Methodology

4.1. Setting, Sample and Participants

The study took place at a U.S. public university in the Midwest with a total enrollment of
students 17,169 for Fall 2018. According to the university website (2018), there are 12,788
undergraduates, 4,121 graduates and 260 college of law. As the mission states, the school
celebrates its diverse population in all its forms, including gender, race, ethnicity, ability,
spirituality, sexuality, age, and individual identities. This Midwest public university offers
approximately 20 undergraduate and graduate degrees online and about 10 additional certificates
fully online.

For this study, purposeful sampling was used because the researcher purposefully selected
the students with low vision who were enrolled in online course settings. Creswell (2009) stated
that in qualitative research, researchers identify participants and sites using purposeful sampling based on places and people that can best help a researcher understand the central phenomenon. The participants were from different major and educational level and ages range from 22 to 54 years old. All the participants registered in the disability resources center (DRC) and had number of online courses taken between 3 to 6 courses. The participants had different low vision types; Retinitis Pigmentosa, Optic Nerve Coloboma, and Blurred Vision.

4.2. Research Questions
1) What accessibility design did students with low vision who experienced online courses perceive to be helpful for their learning?
2) What accessible features would students with low vision want to exist in future online courses?

4.3. Data Collection
To obtain data, three students were interviewed, and the interviews were audio-recorded. Interviews were conducted either face-to-face or by telephone depending on the participants’ preference. The duration of each interview was 45 to 60 minutes. They were asked around 20 questions, consisting demographic questions, questions related to their experience with online courses, and questions regarding accessibility and assistive technologies that helped them overcome their challenges.

4.4. Data Analysis
Using a professional transcription service (Rev.com) to transcribe the interviews. Then, the textual data of the interviews has been read multiple times to gain a deeper understanding on information contributed by participants (Creswell, 2012). Prior to proceeding to the data analysis, a codebook was created based on each research question: accessibility coded as AA and highlighted in pink; assistive technology coded as AT and highlighted in blue; and the wish list of the students with low vision coded as WLA and highlighted in red. The data had been analyzed line-by-line to code thoroughly. Then, applying an open-coding strategy to analyze the responses from the interviews by looking specifically for words that are related to pre-defined codes. For example, when the participants mentioned a screen reader, the researcher coded it as AT and highlighted it in blue. According to Patton (2002), the process of coding starts with segmenting and labeling similar codes to form descriptions and broad themes. Therefore, each of the pre-defined codes labeled as themes. The themes were used to respond to each research question.

5. Findings
5.1. What accessibility design did students with low vision who experienced online courses perceive to be helpful for their learning?

The participants identified three accessibility design aspects: alternative formats for materials, headings, and color contrasting for online content as the most helpful accessibility regarding their learning experiences. Ruby responded that she has a lot of reading requirements to complete the online assignments as a graduate student. She clarified, “Word document and RTF are the most beneficial types of alternative formats for textual online materials. Having formats like word documents or RTF are super helpful to access the text and use Read Aloud feature when I need it.”

Sarah added, “I avoided reading. I avoided doing anything that wasn't just hands-on like the building because I'm actually in the construction trades.” Also, she mentioned that she has difficulty reading a book but she can read text font “Arial” and size 16 or 18. She said, “sometimes
I get notes, teacher's notes and I actually have to change the font to just an Arial font because the New Times Roman is hard for me to read. Yeah, it has too many like little curves in it and the letters are too close.” Thus, she requests alternative formats for the online textual materials to audio: “Well, everything needs to be audio for me.”

In contrast, Karen described that she prefers Adobe accessible PDF version, which includes features that allow students with low vision access text to be more readable such as taking notes, searchable text, and tracking of information.

“I would like to see that used more and more like accessible PDF documents instead of just like taking a picture. I think it's just giving me more access. For example, being able to look at like a PowerPoint in an accessible format. I can use it more easily to take notes and to keep track of information instead of having to like struggle through the slide.

Sarah and Ruby use screen reader software, which they mentioned as the most helpful assistive technology for them. Ruby said:

And so being able to have, like for example, the articles that we had to read were in two formats. They were in like a scanned in PDF and they were in like a word document. And so I was able to use my screen reader to read the word document and I had access to the course material without having to ask somebody to help me read it or help me scan it and to be able to change the scanned document.

Moreover, Sarah and Ruby use the “Read Aloud” feature in Word. For the web pages and other documents, they use screen reader software “Narrator” in Windows. They mentioned that they do not install JWAS or Kurzweil 3000 on their computers. Ruby has used JAWS in the past; however, she is not using JAWS anymore because the screen reader is available in Windows and helps her read long articles.

Additionally, the participants identified heading and color contrasting for online courses that helped them find and use online course materials. Ruby and Karen mentioned that designing online courses with headings guide them during navigating the online environment. Ruby said, “I'd say headings help split things into sections.” Karen said, “have a lot of headings to navigate that makes things easier.” In addition, Sarah mentioned that using contrast color for the text and background facilitates reading the PowerPoints. She described her current challenge reading some colors:

One of the classes I have now, he has a lecture, it's short, it's a simple lecture. But then he has a PowerPoint and that does not have any audio to it and it's kind of a struggle for me to read through that. It's actually on the university [brand]; the background is red with the black and the gray and that's actually hard to read. I think that's hard to read.

An additional accessible design that one of the interview participants reported was added description for videos. Sarah said, “I'd say more ideal description from videos” would help students with low vision understand what is happening in the video.

5.2. What accessible features would students with low vision want to exist in future online courses?

The results revealed some of the improvement accessibility suggestions that students with low vision wished would exist in online courses. Audio and instructor video were the two
alternative formats that did not exist in most of online courses. The participants described two ways of using audio in online courses: audio with PowerPoint and audio response in the discussion boards. Sarah suggested that instructors in online courses should use audio with PowerPoint slides to facilitate learning; she said “when the teacher has a PowerPoint, it’s great, but I have to read it. I want it to read to me and I want the word to stand out as are being read.” Ruby suggested adding the option of “audio” to participate in the discussion boards; she said:

*I think more audio would be really helpful. So I don't know if this is something that necessarily instructors would have jurisdiction over, but I guess just having it's different alternatives, communicating with discussion boards, you know maybe having like an audio option to leave audio responses. They're having a more simplified platform. So that would be one of the things on my wish list.*

Additionally, all the participants suggested that instructors in online courses should record videos to help the students be engaged in their learning. Karen would have more videos to understand some subjects; however, she did not specify the video types. She said, “Say we were assigned to read a chapter and then the teacher would have provided a video or something explaining certain things. I think that's always helpful.” On the other hand, Ruby and Sarah specified to receive instructor-recoded videos. Ruby said, “I wish the professors would do in-person videotaping of themselves.” Moreover, Sarah added that seeing the body language helps to engage the students in online courses; she said,

*When the instructor goes into the connect and has a PowerPoint and he's just talking, I think that's okay. But it would be really nice if you actually saw him because movement, your body gestures are engaging.*

Sarah also recommended the instructors should record video to explain the course content to improve the students’ learning performance; she said,

*Everything was online. It would have been so cool if the teacher had done what my classroom teacher did and said, “Okay, here's 20 minutes, here's the problem on the chalkboard. I'm video recording myself and this is what you do and, oh, you think about this and now, you go to the next step and you have to remember that. And then ...” That would have been great. I mean I know that some minor technical classes, safety will say, “Look, my last class was a safety class.” I mean, I can't imagine an instructor going, if I taught the class ... Ultimately I would like to teach but if I taught the class, I probably would read the book, they're like safety hazards. So let's say in the parking lot or in a building, I probably would record it. “This is a safety hazard.”*

6. Discussion

6.1. Accessibility

There were three major findings related to accessibility. The first finding revealed that alternative formats for materials—such as Word documents or Rich Text formats (RTF) and Adobe accessible PDF files—were the most helpful accessible format in the online courses. These alternative formats allowed students with low vision to make changes according to their own needs and use text-to-speech assistive technology such as screen reader software or the “Read Aloud” Word file feature. All participants highlighted that the alternative formats provided them equal
access to the online materials. In addition, this finding is consistent with literature (e.g. Pascual, 2014; Spooner, 2014) mentioned students with low vision preferred to use alternative formats because it allows them to edit and make changes that best suits their needs. For example, Sarah explained that she could only read the “Arial” font; therefore, having the materials in Word allowed her to change the font to “Arial” because “Times New Roman” was hard for her to read. This finding is consistent with Houston’s (2018) study that recommends using Sans-Serif fonts in online course materials because Serif font types help make online content more legible to all students, including those with visual impairments. Common Sans-Serif fonts include Arial, Trebuchet, and Helvetica. On the other hand, some Serif font types—such as Times New Roman, Courier, New Century Schoolbook, and Palatino—have semi-structural details or small decorative curves on the ends of some of the strokes, making the letters and symbols challenging to read. Overall, this finding aligns with UDL “representation” principles, which entail the accessibility of instructional materials for all students, including students with disabilities, providing them equal access (CAST, 2008).

The second finding was that participants identified assistive technology within alternative formats as one of the most helpful accessibility features. The finding showed that text-to-speech reader software, such as screen reader, was the most helpful assistive technology for students with low vision to read online course materials. For instance, Sarah mentioned that she always needed to use assistive technology such as a screen reader to convert the text materials to audio. Also, other participants mentioned that using a screen reader reduced their challenges when reading online materials, as they did not have to seek assistance in reading the materials. In addition, the finding showed that Word processing was the most helpful assistive technology because of its “Read Aloud” feature. These findings are consistent with the literature that identified text-to-speech assistive technology as the most beneficial to suit the individual needs of students with low vision (e.g., Hersh & Johnson, 2010; Fichton et al., 2009; Nees & Berry, 2013). In addition, this finding is tied to the “action and expression” UDL principle, which asserts that individuals with disabilities should get opportunities for independence through the use of assistive technologies as they help them in overcoming barriers in the educational environment (CAST, 2008).

However, the findings of this study were not consistent with some literature on magnifiers as helpful assistive technology. The participants expressed that they have visual condition abilities to read the original document. Karen mentioned that magnifying or enlarging text were not helpful for her in online courses. Sarah mentioned that she avoids reading and she prefers using speech to text assistive technology to receive information through audio mode. According to this finding, magnifiers as the main method of providing accommodations were less useful than the ability to choose which forms of assistive technology were most beneficial for the online courses. Therefore, the participants needed to hear the information or conversations in online courses, so they did not need to use a magnifier but use speech to text features such as “Read Aloud” or screen reader. This finding evidence that online course designers should provide more accessible types of online materials to allow individuals to choose which type of assistive technology will work best for them such as text-to-speech.

The third finding showed two aspects of design to increase accessibility and to facilitate reading for students with low vision: headings and color contrasting for the online content. The participants indicated that headings is helpful to direct their attention toward key concepts and facilitate navigation; however, the study did not reveal adequate headings styles for students with low vision. This finding is consistent with literature (e.g., Kearns et al., 2013) that recommends
online course designers to design online materials with headings and use high-contrast colors, plain backgrounds, and scalable text for low vision or colorblind students as they allow them to skim the page quickly. Headings allow students with low vision to locate the information more easily and grasp the main ideas of the text (e.g. Fichten et al., 2009; Houston, 2018).

Online materials with low contrast can be difficult to read for students with low vision, making color contrast necessary to improve accessibility (e.g. Houston, 2018). Sarah mentioned that she had difficulty reading the online PowerPoint slides because of the black and gray text font contrasted in a red background. She expressed this background color was not suitable for her visual condition. However, this study did not expand on color contrasted of online materials. Houston (2018) suggests avoiding some color combinations that are not easy to read for students with low vision, such as blue links on black backgrounds, red text on green backgrounds, or other combinations where contrast is not enough. Although, Houston (2018) study did not find a list of color combinations that can assure accessibility for students with low vision, his study suggests that materials in online courses should be presented using a dark font color contrasted with a pale background.

Finally, UDL principles and literature (e.g. Kharade & Peese, 2012; Pittman & Heiselt, 2014) address additional beneficial accessibility aspects for students with low vision, but the findings of this study showed some of these aspects were not applicable in participants’ online courses. Aspects that were not present in online courses for most of the participants in this study were closed captions on video media; a transcript of the video or audio presentation; visual analogs to represent emphasis and prosody (e.g., emoticons, symbols, or images); and text descriptors for any relevant image, graph, or chart. However, Sarah mentioned that added description for videos was helpful to understand the video contents. This finding supports UDL representation principle which suggests that presenting information in several formats increase accessibility.

6.2. Wish List for Students with Low Vision in Online Courses

The findings revealed that students with low vision need two additional accessibility design aspects: audio response and instructor video. Students with low vision can benefit from submitting their responses to discussion board as audio files. This would reduce time spent on formatting the answer, such as using a screen reader to double-check response and allow them to focus on content. This finding is consistent with (e.g. Ching & Hsu, 2015) that addressed audio discussion modality in online courses; however, the literature does not address the needs of students with low vision.

In addition, the participants expressed the need for videos in which their instructor presents the content. This finding is consistent with the literature (e.g. Choi & Johnson, 2015) that addressed the positive effects that instructor-recorded videos explaining content have on students as they improve students’ understanding and engagement with the materials. Relevant literature (Kim et al., 2019) suggests that audio representation of the content helped make curricula more accessible to students with low vision. Therefore, the findings of this study showed the need for inclusion of audio discussion modality and instructor’s audio representation of the content to reduce the challenge and enhance the learning of students with low vision.

7. Recommendation, Implication and Conclusion

The findings of this study serve as a foundation for future research on this topic. The literature review presents research on universal design for learning (UDL), especially as it relates
to accessibility and assistive technology for students with low vision. This study will help instructors and online designers who might teach online courses or might want to improve online courses. This study could primarily impact those students with low vision take online courses and face challenges, so they will have a better learning experience in online courses. Literature (e.g., Barnard-Brak & Sulak, 2010) found that students with invisible disabilities often are not comfortable disclosing their disabilities. The findings of this study also indicate online instructors should provide audio response to accommodate students with low vision in online courses.

Based on the interpretations of the findings, this study focused on one type of visual impairment; however, a much broader future study can include other visual impairment types. In addition, this case study focused on the fully online courses, so future research can be replicated in blended courses, including face-to-face and online sessions of similar size and student population. The UDL theoretical framework can help future researchers replicate the study by focusing on specific principles of universal designs for learning (UDL) because such factors affect students with low vision engagement in online courses. Other research can expand the case study to examine students’ and/or professors’ perceptions of the accommodations and assistive technology for engaging students with low vision in online courses. In addition, this study was limited to students with low vision; therefore, future studies can expand this case study to examine instructors’ challenges when providing helpful accommodations for students with disabilities in online courses.

The findings for this study showed students with low vision identified a screen reader as the most helpful assistive technology in online courses. Future studies can employ a quantitative approach to compare two groups of students with low vision to examine the effectiveness of using specific assistive technology in online courses. In addition, this study’s findings included the students with low vision preference for information delivery methods; future studies can employ quantitative methods to compare groups of students receiving different information delivery methods in online courses to understand the relationship between information delivery method and learning performance.

The overall purpose of this qualitative case study was to explore the most helpful accessibility design and assistive technology for students with low vision in online courses. Individual interviews were conducted to obtain in-depth data. This study found that the most helpful aspects for online content accessibility for students with low vision are headings, color contrasting, and alternative formats for materials, such as Word documents, Rich Text formats (RTF) or Adobe accessible PDF files. Overall, this study reveals that online courses require the inclusion of more accommodations and better implementation of UDL principles to meet the needs of students with low vision. The consideration of the findings of this study may bring about significant understanding and renovation in the online courses design that will guarantee equal learning opportunities for students with low vision. Online designers, instructors and disability resource centers may benefit from this study as the findings can guide their decisions on providing support to students with low vision.
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Appendix A
Semi-Structured Guiding Interview

Part 1:
1. When were you diagnosed with low-vision?
2. In which educational level you did recognize you needed more support and accommodations from the school or teachers/instructors?
3. Do you have other family members who have the same or a similar condition?
4. Do you learn from them? Or did you teach them how to deal with low vision in academic setting?

Part 2:
1. As a student with low-vision, do you prefer online or face-to-face courses?
   Face-to-face course
   Online course
   Hybrid/Blended course
   All types of courses
   a. Why do you prefer that type of course?

2. What are the information delivery methods (text such as pdf or word document, audio, video) that you find to be most beneficial with regard to your learning in the past online courses?
   a. How did you use those methods of delivering information to help your personal learning preferences?
   b. What currently unavailable methods of providing the information would you like to become available in the future?

3. How has accessibility and assistive technology helped you to overcome challenges in your online courses? What were these challenges?

4. Which types of accommodations and assistive technologies could contribute better to your engagement, participation and learning of the content of your online courses?

5. According to your experience, what accessibility accommodations in online courses were helpful to you and how were they helpful (to navigate the online courses, to better understand online instruction and/or to complete online activities)?
   a. What accessibility design did you need in online courses but did not get to help you understand the material?
   b. What kind of visual information were you looking for in online courses?
   c. What kind of auditory information were you looking for in online courses?

6. What is your wish list regarding accessibility accommodations you’d prefer in an online course? Can you describe a specific experience where you felt like you didn’t have access to services or accommodations that you thought would be helpful in your education?
7. Is there anything else you would like the researchers to know about your online course experience regarding your low-vision?

8. What question should I have asked, but didn’t?