

UNDERSTANDING THE TECHNOLOGY BARRIERS EXPERIENCED BY STUDENTS  
WITH DISABILITIES IN HIGHER EDUCATION

By

Mary E. Walz

Bachelor of Arts from Emmanuel College (1999)  
Master of Information and Library Science from University of North Carolina at Chapel Hill  
(2005)

A DISSERTATION

Presented to the Affiliated Faculty of  
The College of Graduate and Professional Studies  
at the University of New England

Submitted in Partial Fulfillment of Requirements  
For the Degree of Doctor of Education

It was presented on  
04/19/2024  
and reviewed by:

Megan Williams, Ed.D., Dissertation Chair  
University of New England

Blake Clifford, Ed.D., Second Reader  
University of New England

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Mary E. Walz


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Doctor of Education Final Dissertation Approval Form

This Dissertation was reviewed and approved by:

Dissertation Chair Signature: 

Dissertation Chair (print name): Megan Williams

Second Reader Signature: 

Second Reader (print name): Blake Clifford

Date: 4/25/24

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ABSTRACT

The purpose of this qualitative interpretative phenomenological analysis study was to explore the lived experiences and perceptions of college students with disabilities while using technology to pursue postsecondary education. The research problem explored technology barriers students with disabilities might face while participating in their courses due to the inaccessibility of learning materials. The literature reviewed contained many themes, including disability in higher education, assistive technology, digital accessibility, course design, inclusive pedagogy, universal design, and open educational resources. Data for this qualitative study was collected through semi-structured interviews with 12 participants who were active degree-seeking students with a disability who had completed at least one semester. The findings from this study revealed the following four themes: (1) inconsistent LMS usage as a barrier, (2) use of assistive technology, (3) feeling their needs are not understood, and (4) technology as key to their success. The results of this study show that participants experienced difficulties navigating, finding, and using digital course materials and felt that faculty do not generally understand their needs as students with disabilities. The results also indicated that participants felt that technology had removed many barriers experienced as students with disabilities and made postsecondary education possible for them.

**Keywords:** *disability, assistive technology, course materials, text-to-speech, digital accessibility*

## ACKNOWLEDGEMENTS

I would like to thank the participants of my study. Their engagement and eagerness to participate in my research inspired me to give voice to their experiences as disabled students. I appreciate the time and effort of all my participants as they shared their experiences, and I will continue to advocate for their needs.

I extend heartfelt thanks to my advisors, Dr. Megan Williams and Dr. Blake Clifford, for your invaluable guidance, support, and encouragement throughout my dissertation journey. Your thoughtful feedback, insights, and expertise were instrumental to me completing my study. I truly feel lucky to have had the two of you on my team.

Many thanks to my colleagues Dr. Kellie Campbell and Dr. Yasmine Ziesler for your support throughout this journey. I appreciate the time you spent brainstorming with me and how you always checked in on me and my progress.

I would like to thank my parents, who have always been my biggest fans and whose encouragement helped make this goal a reality. Thank you for all the phone calls and support. You have always believed in me.

And most importantly, my husband Kris. Your love and support sustained me during this journey. Your endless encouragement and understanding fueled my perseverance and made this possible. Your unwavering belief in me has been my anchor.

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## CHAPTER ONE: INTRODUCTION

The number of college students with disabilities in the United States has been rising, more than tripling over the last 20 years (Francis et al., 2019), and the National Center for Education Statistics (2018) reported that 19% of the undergraduate population is students with disabilities. Of the students with disabilities who received support in secondary education, it is estimated that only 35% of those students registered with their disability services office during postsecondary education, leaving the majority of students with disabilities without specialized disability support once they enter higher education (Newman et al., 2021). Since only a fraction of students with disabilities register with disability services offices in postsecondary education, it is difficult to determine the actual number of postsecondary students with disabilities (Burgstahler, 2021; Newman et al., 2021).

Researchers have reported that students with disabilities in higher education persist and complete their program at lower rates than students without disabilities (De Los Santos et al., 2019; Newman et al., 2021). Kutscher and Tuckwiller (2019) identified factors that affect the academic performance of students with disabilities in three categories: personal characteristics, academic and social engagement, and accommodations. The authors found that personal characteristics like self-awareness and self-confidence, support from faculty and peers, and accommodations to meet their individual needs contributed positively to their persistence (Kutscher & Tuckwiller, 2019).

Civil rights protections are provided for college students with disabilities under Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act (ADA) of 1990, which require institutions of higher education to provide students with disabilities equal access to programs and services (Kim & Kutscher, 2021). Higher education institutions are mandated to

provide reasonable adjustments in the form of modifications made to instructional or curricular requirements, which allow students to participate fully in their courses (Lee et al., 2021). To access these supports, students must disclose their disability to the disability services office and provide documentation to formally request these services (Francis et al., 2019), which is often considered a barrier due to the shame or embarrassment the student might face making this request (De Los Santos et al., 2019).

Disability services offices on campus offer support and facilitate the process of providing reasonable adjustments for students with disabilities, and faculty carry out the approved accommodations (Moriña & Biagiotti, 2022). Students have reported that faculty members are often suspicious of accommodations lowering academic standards or feel that implementing the accommodations will require too much work (Shpigelman et al., 2022), and many students feel negative faculty attitudes are a barrier to their success (Lopez-Gavira et al., 2021). Lopez-Gavira et al. (2021) also reported that students with hidden disabilities like attention-deficit/hyperactivity disorder (ADHD) or autism spectrum disorder, as opposed to visible physical disabilities like limited mobility or vision impairment, felt more faculty were distrustful of their need for accommodations and were reluctant to make adjustments.

College students with disabilities use a combination of mainstream and assistive technologies to support their learning (Seale et al., 2021). Mainstream technologies are technologies like mobile phones and laptops used widely by the majority of students to access course materials and complete their coursework (Seale et al., 2021), while people with disabilities use assistive technologies to increase and improve functional capabilities (Assistive Technology Industry Association, n.d.). Assistive technology (AT) supports students with performing academic tasks, academic performance, and engagement with academic materials,

and the use of AT has been shown to increase students' sense of autonomy and self-confidence (McNicholl et al., 2023). Assistive technology can benefit a diverse range of students with disabilities in higher education, and effective use of AT has been shown to increase students' well-being and self-efficacy in completing academic tasks (McNicholl et al., 2023). With more learning delivered in electronic formats, disability services offices will rely on assistive technology to provide accommodations to ensure access to content and materials, and institutions see AT as core to supporting students with disabilities (Malcolm & Roll, 2017a).

Due to the increased use of digital technologies and content in postsecondary settings, including learning management systems, e-books, videos, websites, and more, students with disabilities can experience barriers to digital accessibility (Lazar, 2022). Having course materials in a digital format does not guarantee that students with disabilities can use them effectively (Perera-Rodríguez & Moriña Díez, 2019). Digital forms, portable document format (pdf) documents, and videos are examples of materials that can be inaccessible in the postsecondary education environment, with the reasons for inaccessibility varying by format; such as video content without captions (Lazar, 2022).

There has been a growing movement in postsecondary education to incorporate Universal Design for Learning (UDL) frameworks on campus, which meet the needs of a range of abilities through the implementation of inclusive environments and facilitate learning in a way that promotes the success of students with and without disabilities (Reardon et al., 2021). Frameworks like these are pivotal in promoting fundamental principles such as fair access, clear information, and easy-to-use interfaces (Reardon et al., 2021). Moreover, it is worth noting that UDL and similar frameworks can be incredibly beneficial for a wide range of student populations, including those with disabilities (Fleet & Kondrashov, 2019). One of the benefits of

a UDL approach is the ability to meet the needs of students with disabilities without them having to disclose their disability (Fleet & Kondrashov, 2019). Given the estimates that 35% of students with disabilities do not register with their disability services office and receive accommodations (Newman et al., 2021), UDL is an important approach if higher education institutions want to meet the needs of students with disabilities (Reardon et al., 2021).

Numerous factors influence the postsecondary education experience of students with disabilities, encompassing the roles of disability services offices, faculty attitudes, the use of assistive technologies, and the implementation of UDL frameworks. Disability services offices are available to provide accommodations to students and ensure the institution is meeting its legal obligations (Lee et al., 2021). It is the responsibility of faculty members to implement the approved accommodations, yet some students have faced both positive and negative attitudes toward their disability from faculty members (Kutscher & Tuckwiller, 2019; Lopez-Gavira et al., 2021). Students with disabilities often use assistive technologies in an attempt to participate equally, and with the increase in digital course content (Lazar, 2022), disability services offices are relying more on assistive technology in the provision of accommodations (Malcolm & Roll, 2017a). Implementing UDL frameworks promotes an equitable learning environment for all students and strives to meet the needs of students with disabilities without accommodations (Fleet & Kondrashov, 2019).

### **Definition of Key Terms**

**Accessibility.** Consideration of the needs of people with disabilities when designing products, services, and facilities, so these can be used by people of all abilities (Centers for Disease Control, n.d.).



**Americans with Disabilities Act (ADA).** United States federal civil rights laws first introduced in 1990 to ensure equal opportunity for people with disabilities by prohibiting discrimination based on disability in the areas of employment, state and local government, public accommodations, commercial facilities, transportation, and telecommunications (ADA, 2020).

**Accommodations.** Supports provided by an institution of higher education to ensure equitable access for students with disabilities (Lindsay et al., 2018).

**Assistive technology.** Equipment or software that enables and promotes the inclusion and participation of people with disabilities by increasing or improving functional capabilities (Assistive Technology Industry Association, n.d.).

**Canvas.** The specific learning management system software used at the study's site.

**Digital equity.** Ensuring students have equitable access to and training on devices, software, and the internet (Fingal, 2021).

**Disability.** A mental or physical impairment that limits one or more major life activities, a history of an impairment, or a perception by others as having an impairment (ADA, 2020).

**Learning management system.** Online software application for creating, delivering, and managing educational course content (Turnbull et al., 2020).

**Optical character recognition (OCR).** Software used to recognize and convert text from a digital image (Ko & Petty, 2022).

**Section 504 of the Rehabilitation Act of 1973.** Section E of Section 504 requires public and private postsecondary education institutions that award financial aid to provide accommodations for students with disabilities (Madaus, 2011).

**Speech-to-text.** Also called voice recognition, software that translates the spoken voice into written text (Ko & Petty, 2022).

**Text-to-speech.** Software that reads aloud the digital text of varying formats, like books, articles, and websites, using computer-synthesized voices (Raffoul & Jaber, 2023).

**Universal Design.** Describes a concept that strives to meet the needs of a range of abilities by implementing inclusive environments. There are several adaptations for education, including Universal Design for Learning and Universal Design for Instruction (Reardon et al., 2021).

### **Statement of the Problem**

The problem addressed in this study was the technology barriers students with disabilities might face while participating in their courses due to the inaccessibility of learning materials, which can negatively impact course participation and academic outcomes (Seale et al., 2021). While increased technology can have various benefits for students with disabilities, like video captions for the deaf or screen readers for the blind, using these technologies can often expose barriers to learning (Andersen & Jensen, 2018; Bong & Chen, 2021; McNicholl et al., 2021). There is evidence that the inaccessibility of learning management systems, websites, lecture materials, and social media negatively influences the experience of students with disabilities (Seale et al., 2021). Malcolm and Roll (2017a) identified challenges faced by students with disabilities in accessing digital learning materials as a potential variable contributing to college dropout in this population. The types of digital materials this population of students might struggle with can include documents incompatible with text-to-speech software and video content lacking captions.

While legal frameworks in the United States mandate equal educational access for students with disabilities, the practical challenges they face in higher education persist, as evidenced by lower retention rates, prolonged degree completion times, and increased dropout rates (De Los Santos et al., 2019). To mitigate these challenges, students often seek support

through disability services offices, where the provision of tailored accommodations is crucial for their academic success (Kutscher & Tuckwiller, 2019). Students apply for accommodations through disability services offices on campus, and student use of specialized disability services is often seen as an essential component of their academic success (Kutscher & Tuckwiller, 2019). Kutscher and Tuckwiller (2019) found that accommodations matched to individual student needs are perceived by students as the most effective accommodations.

With the increase in course content and activities delivered in electronic formats, disability services offices are increasingly relying on assistive technology in approved accommodations (Malcolm & Roll, 2017a). This reliance on assistive technology not only facilitates access to academic content but also enhances engagement and enables students to effectively perform academic tasks, thereby contributing positively to their educational experience (McNicholl et al., 2021). Common assistive technologies in higher education include text-to-speech software, note-taking devices, and video captioning software (Bong & Chen, 2021). Assistive technology was found to be beneficial to students with a wide variety of types of disabilities (McNicholl et al., 2023).

Faculty awareness is a factor in the successful use of assistive technology in the classroom, and it has been found that assistive technology cannot be used effectively when course instructors receive inadequate training (Fernández-Batanero et al., 2022). Researchers have recommended training for faculty and staff who work with students with disabilities, including hands-on use of assistive technology to understand how assistive technology works or does not work with their own course materials (Andersen & Jensen, 2018; Bong & Chen, 2021). Perera-Rodríguez and Moriña Díez (2019) found it commonplace for class activities, notes, and exams to be in inaccessible formats, leaving students with disabilities unable to effectively use

those materials. Seale et al. (2021) noted that inaccessibility to course materials, course pages, and video content has a detrimental effect on the experience of students with disabilities. Lazar (2022) cautioned that these barriers in accessibility may lead to the exclusion of this population from the university experience. Overall, this evidence underscores the critical need for faculty training in assistive technology and accessible course design to ensure that students with disabilities are not excluded from the full university experience due to inaccessible materials and teaching methods.

### **Purpose of the Study**

The purpose of this qualitative interpretative phenomenological analysis study was to explore the lived experiences and perceptions of college students with disabilities related to the use of technology to pursue postsecondary education. Technology, for the purposes of this study, is broadly defined as devices or applications and includes online learning applications, specialized assistive technology like screen readers or adaptive keyboards, mainstream technologies like tablets or mobile phones, and social networking applications (Seale et al., 2021). There are increasing applications of technology in the postsecondary learning environment (Lazar, 2022), so understanding where barriers exist could help inform institutional policy, technology strategy, and faculty training initiatives. This study will use the ADA (2020) definition of disability, which is “a person who has a physical or mental impairment that substantially limits one or more major life activities, a person who has a history or record of such an impairment, or a person who is perceived by others as having such an impairment” (para 3). Given the large number of students with disabilities who do not register with disability services offices, Newman et al. (2021) stressed the importance of understanding “how to provide effective support to *all* students with disabilities on campus, including those who choose not to

formally disclose their disability” (p. 354). Understanding how to better support students with disabilities could help increase student persistence and program completion with this population (Kutscher & Tuckwiller, 2019).

### **Research Questions and Design**

Research questions are central to the study and reflect the thinking of the researcher (Merriam & Tisdell, 2015). This qualitative interpretative phenomenological analysis study will seek to understand the lived experiences of barriers students with disabilities experience using technology to support their learning. Interpretative phenomenological analysis research focuses on lived experiences, and Cilesiz (2011) recommended phenomenological methodologies as a valuable approach to understanding experience with technology in education, with the ability to understand not only the experience of using technology but also any educational outcomes associated with the use. This research design was chosen for its emphasis on the participant’s voice, in this case, college students with disabilities. The study will focus on the following questions:

Research Question One: How do college students with disabilities describe their experience accessing digital course materials?

Research Question Two: How do college students with disabilities describe the support they currently receive in their use of technology?

Research Question Three: How do college students with disabilities describe the technology they perceive as contributing to their success in their academic pursuits?

### **Conceptual and Theoretical Framework**

Ravitch and Riggan (2017) described the conceptual framework as a structure for the research, tying together elements of the topic, like the theoretical framework and the literature

review. The authors explained that the researcher's identity and goals shape the conceptual framework. Personal experience with disability and technology led to interest in this topic of study. Working in digital accessibility and assistive technologies drove an increase in understanding of disabled students' use of technology. Consequently, personal experience with an institution that is greatly expanding hybrid instructional methods amplified the need to understand barriers to using technology because they will be essential for strategic planning and institution-wide faculty training.

The theoretical framework used for this study is critical disability theory (CDT), which provides a theoretical framework for studying the challenges experienced by people with disabilities (Hosking, 2008). The six principles of CDT introduced by Rocco (2005) have significance in this study's purpose, problem, and themes. Non-inclusive environments, including in education, are discriminatory to disabled people (Smith et al., 2021), and a goal of CDT is a society free of barriers for people with disabilities (Procknow et al., 2017).

### **Assumptions, Limitations, and Scope**

This qualitative interpretative phenomenological analysis study focused on students with disabilities and their use of technology for their coursework. When conducting qualitative research, it is important to consider the methodology used by the researcher, their involvement in the study, and the impact they may have on the findings and conclusions drawn (Bloomberg, 2022). Subjectiveness should be recognized throughout the study through assumptions, limitations, and scope (Creswell & Creswell, 2018).

#### **Assumptions**

Bloomberg (2022) described the importance of the researcher's positionality in qualitative research because of its influence on each phase of the study, from beginning to end.

The author noted the importance of balancing the topic and the positionality of everyone involved in the study, including the researcher. Assumptions are ideas or beliefs the researcher considers to be true, and the researcher uses those beliefs to perform the study and draw conclusions from the observations (Bloomberg, 2022). For this study, it will be assumed that the participant students used technology to pursue postsecondary education. It will also be assumed that they were willing participants and would be active, honest, and stay on topic while sharing their experiences (Bloomberg, 2022).

### **Limitations**

Limitations are inherent weaknesses or challenges, typically in the design, that can affect the interpretation of the study's findings (Bloomberg, 2022). A noted limitation of interpretative phenomenological research is that the results cannot be generalized to other settings or populations (Bloomberg, 2022). A limitation of this study is that interviews could be a method of participation that is less preferable for some of the population being studied. For example, autistic students often struggle with verbal communication (Kuder & Accardo, 2018). This limitation can be mitigated by sending participants the question ahead of time and using the closed captions in Zoom while conducting the interviews. Another limitation is the potential for researcher biases to influence data analysis, which can be overcome with participant member checks of the transcript (Bloomberg, 2022).

### **Scope**

The scope of a study details the depth of the research that was explored in relation to the research questions (Bloomberg, 2022). This study is designed to explore the experiences of students with disabilities in their use of technology for their postsecondary academic pursuits. Students included in the study will be enrolled in a member institution of the state college

system, and students without disabilities will be excluded from the study. The researcher will conduct semi-structured interviews to focus on the lived experience of technology use within this population of students with disabilities.

### **Rationale and Significance**

The rationale of a study is a logical argument used to justify the research (Bloomberg, 2022). To maintain student success for students with disabilities, who persist in and complete their programs at lower rates than students without disabilities, it is important to understand the needs and barriers of students with disabilities to be better supported by the institution (De Los Santos et al., 2019). Students with disabilities make up 19% of the undergraduate population in the United States (National Center for Education Statistics, 2018). Therefore, a better understanding of the barriers to their use of technology to support coursework can be used to help support their needs. Students with disabilities can experience technology challenges with assistive technology (McNicholl et al., 2021), mainstream devices like laptops or tablets (Seale et al., 2021), and inaccessible digital course materials (Bong & Chen, 2021). While some of these topics have been studied separately from the student's perspective, there is a gap in the literature that looks holistically at the technology barriers and support needs of postsecondary students with disabilities. The researcher's hope is to use what is learned in the study to improve the experience and outcomes of students with disabilities at the study site and potentially contribute more broadly to the body of knowledge on supporting students with disabilities in higher education.

### **Summary**

Conducting this interpretative phenomenological analysis research will help us understand and address technology barriers faced by students with disabilities. To meet the legal



obligations of civil rights protections provided under ADA and Section 504 of the Rehabilitation Act of 1973, accommodations are provisioned through disability services offices. Students report a mix of positive and negative perceptions in how well faculty implement approved accommodations (Kutscher & Tuckwiller, 2019; Lopez-Gavira et al., 2021), and students perceive that the accommodations that are tailored to their individual needs to be most effective (Kutscher & Tuckwiller, 2019). With the increased use of digital course content, even for in-person classes (Lazar, 2022), there is an increased reliance on assistive technology in approved accommodations (Malcolm & Roll, 2017a). Barriers to accessibility negatively affect the student experience for students with disabilities and can lead to exclusion from their educational experience (Lazar, 2022; Seale et al., 2021). This research sought to understand the lived experience of barriers to technology use encountered by students with disabilities pursuing postsecondary education.

## CHAPTER 2: LITERATURE REVIEW

According to data from the National Center for Education Statistics (2018), students with disabilities account for 19% of the undergraduate student population in the United States. However, many students with disabilities do not seek accommodations from disability services offices, posing challenges in accurately estimating their numbers in postsecondary education (Burgstahler, 2021). This issue of underreporting, as Newman et al. (2021) note, is evident in the fact that only a third of students who received special education in high school disclose their disability in postsecondary education. This gap in disclosure and accommodation seeking is significant, especially considering the increasing reliance on technology in higher education. The shift towards more digital and electronic formats for course content, as explored by Malcolm and Roll (2017b), introduces additional barriers for students with disabilities, exacerbating the challenges they face in engaging effectively with online content and services (Burgstahler, 2021). These challenges underline the importance of accessible technology and accommodations in ensuring that students with disabilities are not marginalized in their postsecondary education experience (Lazar, 2022).

Technology can have a range of educational, psychological, and social benefits for students with disabilities who use a mix of assistive and mainstream technologies to support their learning (McNicholl et al., 2021). Assistive technologies used in higher education include, but are not limited to, note-taking pens, special keyboards, screen reader software, speech-to-text software, and video captions (Malcolm & Roll, 2017b). Mainstream technologies are devices and software all students use, including laptops, smartphones, tablets, and learning management systems (Seale et al., 2021).

Assistive technologies have been shown to benefit students with disabilities in higher education (Clouder et al., 2020; McNicholl et al., 2021; Pontikas et al., 2020), but the use of these technologies can also expose barriers to accessibility. Researchers noted the inaccessibility of learning management systems, websites, lecture materials, and social media as having a negative influence on the experience of students with disabilities (Seale et al., 2021). The problem addressed in this study was the technology barriers students with disabilities might face while participating in their courses due to the inaccessibility of learning materials, which can negatively impact course participation and academic outcomes (Seale et al., 2021).

This chapter contains an overview of the conceptual and theoretical frameworks and a review of literature relevant to the topic of study. The theoretical framework introduces several disability theories, including the medical model of disability and the social model of disability. Identified themes of the literature include disability, assistive technology, mainstream technology, digital accessibility, and universal design.

### **Conceptual and Theoretical Framework**

The conceptual framework is described by Ravitch and Riggan (2017) as a superstructure for the research, providing the why and the how of the work. The authors suggest the conceptual framework is shaped by the researcher's personal goals, identity, and positionality. According to Ravitch and Riggan, this superstructure also contains the theoretical framework and the literature review, thereby tying together these elements of the research topic.

### **Personal Interest**

Personal experience with both disability and technology has led me to the intersection of these two topics. Because of my strong interest, I have worked closely with disability services to understand the needs of students with disabilities at the state college system where I am

employed and have sought professional development opportunities in digital accessibility and assistive technology. Additionally, my institution is going through transformational change and is greatly expanding the use of hybrid instructional methods and modalities, putting digital equity at the forefront of our discussions in information technology leadership. Working with students to understand the barriers they face in their use of both assistive and mainstream technologies will help inform our strategic planning around the increased use of technology in the classroom.

### **Topical Research**

It has been estimated that an increasing number of students with disabilities are enrolling in higher education. Reports suggest that as many as 96% of higher education classes include students with disabilities (De Los Santos et al., 2019). Support for students with disabilities is required by federal laws, but to receive such support, students must disclose their disability to their institution. De Los Santos et al. (2019) identified various reasons why students may choose not to disclose their disabilities, such as a preference to avoid being classified with a disability, feelings of shame, fear of stigma, and discomfort or embarrassment associated with disclosing their disability.

Research shows that students with disabilities have greatly benefited from assistive technologies (Clouder et al., 2020; McNicholl et al., 2021; Pontikas et al., 2020). These students believe that their postsecondary educational achievements have improved as a result of incorporating assistive technology (Malcolm & Roll, 2017b). The utilization of assistive technologies can reveal the lack of accessibility of learning management systems and course materials and these accessibility challenges have been demonstrated to adversely affect the educational experiences of students with disabilities (Seale et al., 2021).

One of the advantages of universal design for learning (UDL) is that it addresses students' learning needs without them needing to ask for accommodations, thus reducing the stigma associated with disclosing disabilities and requesting accommodations (Fleet & Kondrashov, 2019). Moreover, UDL has been demonstrated to increase the rates of course completion for students with disabilities (Mole, 2013) and is receiving more attention in accommodation plans (Edwards et al., 2022). The identification of technology-related obstacles encountered by students with disabilities has the potential to enhance the quality of services offered, and the implementation of UDL plays a key role in minimizing those barriers for students.

### **Theoretical Framework**

The theoretical framework used for this study is critical disability theory (CDT). Initially described by Rocco (2005), it was introduced to fill a need in the study and analysis of the issues faced by people with disabilities. Critical disability theory is one of many theories that have grown from critical social theory, which originated in the 1930s at the Frankfurt School in Germany as a means to study society (Meekosha & Shuttleworth, 2009). Hosking (2008) described critical theory's goal as increasing individuals' freedom and eliminating the subjugation of certain groups based on their social status, authority, ethnicity, or other societal classifications. CDT was introduced as an explanatory and normative theoretical approach to understanding disability (Hosking, 2008).

Rocco and Delgado (2011) describe six critical disability theory principles:

1. Disabled people have a unique voice and complex experience.
2. Disability should be viewed as a part of a continuum of human variation.
3. Disability is socially constructed.
4. Ableism is invisible.

5. Disabled people have a right to self-determination.
6. The commodification of labor and disability business combine to maintain a system of poverty and isolation among people with disabilities (pp. 7-8).

People with disabilities are often invisible in society, and ableist views of laziness and incompetence of people with disabilities lead to discrimination against them in hiring and education (Procknow et al., 2017). Ignoring their unique voice can further the ableism and discrimination experienced by people with disabilities (Procknow et al., 2017).

The principle of CDT that disability is socially constructed directly relates to many of the themes explored in further sections of this literature review, including the social model of disability, digital accessibility, and universal design. Smith et al. (2021) noted that CDT views disability as a “relationship between impairment, the individual’s response, and broader non-inclusive structures” (p. 1359), and the institutional barriers experienced by people with disabilities are discriminatory by nature. A society free of barriers for people with disabilities is a goal of CDT (Procknow et al., 2017).

### **Disability**

In the United States, people with disabilities receive civil rights protections under the Rehabilitation Act of 1973 and the Americans with Disabilities Act (ADA) of 1990 (Kim & Kutscher, 2021). ADA defines disability as a person with a mental or physical impairment that limits one or more major life activities, someone with a history of an impairment, or who is perceived by others as having an impairment (ADA, 2020). The number of college students with disabilities in the United States has more than tripled over the last 20 years (Francis et al., 2019), and the National Center for Education Statistics (2018) reported that 19% of the undergraduate population is students with disabilities. It is difficult to accurately estimate this number since

many students do not disclose their disability, and it has been found that only one-third of students who received special education in high school disclosed their disability in higher education (Newman et al., 2021).

### **Models of Disability**

There are several established models for understanding disability in society. The medical model of disability focuses on impairment rather than ability and is often criticized for framing disability as a problem that needs to be addressed with individualized support services (Aquino, 2016). The medical model has been challenged for creating stigmatization based on the assumption by the medical community that there is a need to cure or fix disability (Aquino, 2016). A limitation of the medical model of disability is the focus on treating the individual condition rather than examining social factors that affect the lives of people with disabilities (Miskovic & Gabel, 2012).

In the United Kingdom during the 1970s and 1980s, the social model of disability emerged as a paradigm shift in understanding disability. This model posits that the barriers experienced by individuals with disabilities are primarily the result of external societal restrictions. Shakespeare (2006) emphasized that these challenges arise from societal discrimination and exclusion rather than from the individuals' own limitations. The social model advocates for the moral responsibility of society to eliminate these barriers, as articulated by Oliver (1986), one of the model's early proponents. This approach aims to influence social policy to enhance the quality of life for people with disabilities. In line with the principles of the social model, universal design in postsecondary education strives to create accessible environments for all, as discussed by Mole (2013).

Several weaknesses of the social model of disability are noted throughout the literature, including the idea that a barrier-free world could exist and the theory's assumption that disabled people are oppressed (Shakespeare, 2006). The social constructionist model, as described by Gabel (2010), argues that broader cultural beliefs about what constitutes normalcy fundamentally shape the construction of disability. This perspective introduces a critical examination of the concept of normalcy and its relationship to the prevalence of ableism in society. Ableism arises when society perceives individual abilities as essential, and ableism results in people with disabilities being excluded because they do not fit this idea of normalcy (Hutcheon & Wolbring, 2012).

More recently, scholars have argued the need to introduce the concepts of human rights and social justice into the models of disability. Berghs et al. (2019) suggested going beyond a focus on accommodations and needs and that the model "should be a means to change society (and its collective values), in addition to upholding the human dignity of disabled people's lives in every aspect of society" (p. 1037). The authors asserted that instead of aspirational ideas of equality of opportunity, equitable norms be established as a matter of justice and rights. Liasidou (2014) argued disability is a social justice and equity issue, and described the need to shift the focus from deficit to accessibility in order to meet the needs of students with disabilities. The author urged a change away from exclusionary organizational practices and processes that lead to social disadvantage for students with disabilities.

### **Disability in Higher Education**

The history of providing postsecondary education in the United States for students with disabilities began in the 1860s with the founding of both the Columbia Institution for the Deaf and Dumb and the earliest iteration of Gallaudet College, called the National Deaf-Mute College



(Madaus, 2011). Throughout the late 19th and early 20th centuries, there were isolated examples of students with disabilities attaining postsecondary degrees, including Helen Keller at Radcliffe College. After World War I, the Smith-Sears Veterans' Rehabilitation Act of 1918 led to some educational assistance for disabled veterans in the form of vocational rehabilitation programs (Chatterjee & Mitra, 1998).

After World War II came the Serviceman's Readjustment Act of 1944, more commonly known as the GI Bill. This availability of educational funding for veterans led to a surge of students with disabilities enrolling in postsecondary education (Madaus, 2011). Madaus (2011) noted that a variety of services have been developed to assist disabled veterans in achieving academic success, including adaptations in transportation such as ramps and parking privileges, housing accommodations like proximity to classes and first-floor rooms, and modifications to classroom experiences, including the provision of note-takers and priority seating. The author reported that many of the adjustments and accommodations developed during this time are still in use today.

By the 1960s, disability advocates began to recommend a range of services to be offered to students with disabilities, including training for instructors on student needs, priority seating, lecture recordings, and alternate testing locations (Madaus, 2011). The civil rights movement empowered disability advocates to fight for improved and increased services for people with disabilities (Chatterjee & Mitra, 1998). During this time, key tenets of disability services in higher education were developed, like the idea that students with disabilities can attain the same level of success as their peers with the support of accommodations (Madaus, 2011).

## **Current Legal Protections**

In the United States, legal protections for postsecondary students with disabilities are provided through Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act (ADA) of 1990 (Kim & Kutscher, 2021; Madaus, 2011). Section 504 requires institutions of higher education that receive federal money to provide protections and accommodations for students with disabilities (Kim & Kutscher, 2021; Madaus, 2011). ADA provides civil rights protections for all aspects of life for people with disabilities, influencing the way colleges deliver services to this population (Kim & Kutscher, 2021).

Postsecondary institutions in the United States are legally obligated to ensure equal access to education for students with disabilities (Newman et al., 2021), and the provision of individualized accommodations is consistent with the principles of the medical model of disability. Accommodations are in response to an identified impairment, and according to Hutcheon and Wolbring (2012), disability policy often uses wording such as ‘burden’ or ‘obligation’ to describe accommodations. The authors describe this way of provisioning services as passive and reactive and state that it sometimes conflicts with the individual’s beliefs about themselves. As a result, the student’s identity is at the center of the balance of power between themselves and the institution, and “these power relations are quite evident in students’ hesitancy to self-advocate” (Hutcheon & Wolbring, 2012, p. 46).

## **Disability Services**

To ensure higher education institutions are meeting their legal requirements under Section 504 of the Rehabilitation Act and the Americans with Disabilities Act, most colleges and universities in the United States have an office that provides disability services (Newman et al., 2021; Smith et al., 2021). Examples of accommodations for students with disabilities can include

additional time for tests, note-taking assistance, assistive technology, and physical accommodations (Lindsay et al., 2018). The provision of accommodations is a deficit-based approach and is in alignment with the medical model of disability (Aquino, 2016). Smith et al. (2021) cautioned that there is an “implicit assumption that individualized accommodations ‘level the playing field,’ thus allowing universities to overlook institutional barriers” (p. 1360).

Disability services offices determine eligibility and provide accommodations with the goal of increasing positive outcomes for students with disabilities (Römhild & Holleder, 2023). The authors reported mixed impacts of specialized disability services on the academic success of this population. They noted that academic supports offered to all students, such as coaching and tutoring, had a significantly positive effect on the GPA of students with disabilities. A study by Chiu et al. (2019) reported on the important role the disability services office plays in providing accommodations, making health referrals, and advocating for educational access for students who disclose their disability.

Newman et al. (2021) reported that only one-third of students who received special education in high school disclosed their disability in postsecondary education. This leaves faculty and staff “unaware of the large number of students with disabilities attending their institutions, enrolling in courses, participating in cocurricular programs, and using support services” (Newman et al., 2021, p. 358). Lindsay et al. (2018) described disability disclosure as a personal issue that may depend on disability type, self-advocacy, and the availability of support. College students also do not always self-identify as a person with a disability, and their experiences with disability are individualized (Brown et al., 2019).

To understand the reasons students might not disclose their disability to the disability services office and receive accommodations, Lindsay et al. (2018) categorized these barriers into

groups: stigma and discrimination, lack of knowledge of supports, type of course and instructor, and coping style and disability type. The authors explained that students with disabilities often experienced discrimination and felt like they would only be seen as their disability while pursuing higher education rather than being seen as normal. Smith et al. (2021) described the need for students to disclose and provide documentation of their disability as putting them in an adversarial power dynamic that can make them reluctant to disclose their disability for fear of stigma and discrimination.

Faculty perceptions were also found to be a barrier to student disability disclosure, and students reported that faculty viewed accommodations with suspicion and requiring too much effort to implement (Shpigelman et al., 2022). Some faculty perceived accommodations as lowering the academic standards of their course or requiring too much work (Shpigelman et al., 2022). The authors also reported faculty indifference toward students' right to accommodations as a barrier to student access. Lindsay et al. (2018) also reported faculty unresponsiveness to accommodation requests and the finding of a perception that students with disabilities are an inconvenience to faculty.

### **Assistive Technology**

Assistive technologies (AT) are used to support people with disabilities in increasing functional abilities and have been found to provide many benefits to students with disabilities (McNicholl et al., 2023). AT commonly used in postsecondary education includes note-taking devices, video captioning software, and text-to-speech software (Bong & Chen, 2021). The rapid change of technology presents challenges for students, faculty, and staff members who assist them, especially regarding training and support needs when working with unfamiliar technology (McNicholl et al., 2021). McNicholl et al. (2023) noted the important connection between AT

and universal design for learning and said, “incorporating AT with an institution wide approach to universal design for learning is key for promoting a sense of inclusion for SWD while also reducing the need for accommodations” (p. 7).

### **Benefits of Assistive Technology**

Examining the benefits of assistive technologies for students with disabilities in higher education, McNicholl et al. (2021) found significant positive impacts in three areas: academic engagement, psychological well-being, and social participation. The authors described improvements in the performance of academic tasks and increases in both engagement with educational materials and academic performance with the use of assistive technology. Clouder et al. (2020) described types of assistive technology software found to benefit college students with neurodivergent disabilities, including transcription software, text-to-speech systems, recording devices, and mind-mapping tools. The authors also found adherence to universal design principles, like lecture capture, providing course materials in alternative formats, and the use of technology in the classroom to be beneficial to neurodivergent students.

In addition to aiding in the performance of academic tasks, researchers reported benefits of AT, including higher academic self-efficacy, lower stress, and increased class communication (McNicholl et al., 2023). Fernández-Batanero et al. (2022) found the use of AT by students with disabilities had a significant positive impact on academic engagement, including student participation, social skills, and increased attention. Malcolm and Roll (2017a) reported students with disabilities used their AT frequently and found significant benefits in note-taking, testing, reading, writing, and studying for students with disabilities.

Use of text-to-speech software has shown much benefit to students with disabilities and is one of the most common accommodations to support students with disabilities (Bruno et al.,

2021). Benefits of its use include improved reading comprehension, speed, and fluency (Raffoul & Jaber, 2023). Raffoul and Jaber (2023) also found that text-to-speech also positively contributes to motivation and outcomes in that its use increases self-confidence as a reader and promotes a better understanding of the content.

### **Challenges of Assistive Technology**

Much of the literature on the barriers and challenges students face when using assistive technologies involves inadequate training and support for students with disabilities in using the AT and faculty in accommodating the use of AT (McNicholl et al., 2021). Focusing on the difficulties students with disabilities face in acquiring necessary technology, Couzens et al. (2015) reported that students with hidden disabilities found the documentation requirements difficult, and as a result, they did not obtain the assistive technology needed to support their education. Bright (2021) cited the lack of affordability of assistive technology as a common barrier for students with disabilities, which leaves students reliant on receiving this technology from often underfunded disability services departments.

Understanding how assistive technologies like screen readers and captioning software work is integral to providing accessible digital course content to students. Bong and Chen (2021) recommend that staff and faculty who work with students with disabilities participate in training, including hands-on experiences with AT, video captioning, and other digital materials so they understand how AT works with their own course content. Andersen and Jensen (2018) also noted instructor competency as an essential factor in using AT while noting that the pace of technological change makes it difficult for educators to keep up.

McNicholl et al. (2021) found that barriers to the effective use of assistive technologies can hinder academic engagement. The authors noted that inadequate training on the use of these

technologies is a significant barrier for students with disabilities, and insufficient support on the use of AT and shortcomings of the technology itself were identified as additional barriers. Some of the weaknesses of AT identified by the authors included poor quality recordings, outdated technology, and limited screen size, and were said to limit students' ability to access course material and complete assignments.

### **Mainstream Technology**

In recent years, with the proliferation of technology students have in the form of smartphones, laptops, tablets, smartwatches, gaming devices, and more, there has been a shift in the way students with disabilities use technology (Fernández-Batanero et al., 2022; McNicholl et al., 2021). Mainstream devices offer accessibility features like screen reading, the ability to magnify the display, voice recognition features, and more. As noted by McNicholl et al. (2021), the lack of special AT equipment has normalized the use of accessibility features within the academic setting and helped students with disabilities feel more like they fit in.

In a study of students with learning disabilities, Armstrong and Gutica (2020) found that students use technology to make their lives easier, and mainstream technologies help them access, capture, and process the content in their courses. The authors found that with technology like text narration, students reported improved ability to maintain focus and reduced energy needed to complete course readings. They found that students also found smartphones helpful for capturing a photo of the board and recording lectures.

The use of mainstream technology devices like tablets, smartphones, and gaming devices was credited by Pontikas et al. (2020) with helping to improve skills, communication, and social activity of students with autism. The authors also identified that computers, tablets, virtual reality, and gaming devices helped improve time management skills and foster attention in

students with attention-deficit/hyperactivity disorder. Similarly, an experimental study by Cibrian et al. (2021) of smartwatch use by students during the COVID-19 pandemic showed the devices could provide structure to unstructured learning environments and support self-regulation and organizational skills.

Similar to the assistive technology barriers described earlier, a study by Ghanouni et al. (2020) identified several barriers experienced by individuals when using the assistive features of mainstream technology. They found that the perceived usefulness and selection of technology were important factors in choosing products. They also reported that training, the time to implement and learn new systems, cost, and uncertain outcomes were all found to be barriers to technology use.

### **Emerging Technologies**

There are emerging technologies on the horizon that offer current and future applications for students with disabilities. Augmented reality (AR) superimposes digital information over the real world (Avila-Garzon et al., 2021). Jdaitawi and Kan'an (2022) found the use of augmented reality technology provided a range of benefits for students with disabilities. The authors reported AR enhanced social and academic skills, increased engagement, and enhanced decision-making skills.

Martiniello et al. (2020) studied artificial intelligence (AI) technologies for postsecondary students with disabilities. The authors defined AI as “computing systems that are able to engage in human-like processes such as learning, adapting, synthesizing, self-correction and use of data for complex processing tasks” (p. 17). A common example of this is digital assistants like Siri or Alexa. The authors found many potential AI tools and applications, like smartwatches, digital assistants, digital coaches, and smart glasses, for students with disabilities in the areas of



emotional and mental health, medical regulation, accessing materials in alternate formats, organizational skills, and executive functioning aids. Martiniello et al. (2020) identified a need for increased training and support.

### **Digital Accessibility**

Technologies and digital content used and provided by institutions of higher education must provide equal access for all students, including those with disabilities (Lazar, 2022). Lazar (2022) noted that because colleges and universities are decentralized, with much of the decision-making within departments and divisions, the methods for institutional management of digital accessibility are more difficult, leading to pervasive problems with inaccessible content. The author recommended centralized coordination of digital accessibility efforts and noted that barriers to accessibility can lead to complete exclusion from the university experience for students with disabilities.

A noted barrier to digital accessibility in higher education involves faculty training and understanding of the inaccessibility of learning materials (Bong & Chen, 2021). The authors noted the importance of faculty understanding how assistive technologies, like speech-to-text or video captions, work with their digital course materials, and hands-on exercises with AT considerably impacted the understanding of accessibility. The authors recommended using UDL frameworks to build faculty digital accessibility capabilities because of the focus on meeting the needs of all students.

With regards to higher education faculty and staff understanding of the accessibility needs of students with disabilities, Pearson et al. (2019) found that most staff felt confident in their ability to support students with disabilities, and they overwhelmingly had confidence in their ability to recognize accessibility issues. However, Pearson et al. (2019) also revealed more

concerning findings: a majority of faculty and staff expressed dissatisfaction with the accessibility training they received and were largely unaware of the disparities in outcomes between students with and without disabilities, as well as the barriers faced by students with disabilities in their academic pursuits. The authors emphasized the critical role of institutional accessibility policy.

The digital accessibility of learning management systems (LMS) is also important to the experience of students with disabilities as they access their course materials, and Zdravkova et al. (2022) investigated the accessibility of functionalities of popular LMS systems used in postsecondary education. The authors tested four LMS systems for conformance to the Web Content Accessibility Guide (WCAG) guidelines and success criterion. They found the highest-rated LMS in terms of accessibility was Canvas, with Brightspace close behind.

Many LMS software systems, including Canvas, the LMS used at the site of this study, have built-in accessibility checking functionality for instructors to use (Bastedo & Swenson, 2019). Additionally, there are third-party products available to purchase and add to Canvas for a more robust accessibility assessment of course content (Almufarreh et al., 2021). One of these products is Blackboard Ally, which can improve institutional digital accessibility in the LMS in three ways: by providing alternative formats of course materials, offering instructor input and advice, and making institutional reporting available to administrators (Almufarreh et al., 2021).

### **Course Design**

Course design, navigation, and organization are important to the student experience with the learning management system (Munguia et al., 2020). If each course is organized differently, with content stored and presented in different ways, students have to relearn how to find the information they need for each course they take, which is inefficient and frustrating (Munguia et

al., 2020). Koh and Kan (2021) found that students value information organization and effective navigation design in the learning management system. Lewis (2021) advocated for using course templates to standardize the student experience from one course to the next. The author also discussed the need for consistent use of terminology, using the example that some courses could use the term module to refer to weekly coursework, while others use the word week, and institutional agreement on standard terminology is important to the learner's experience. Lewis (2021) also stated that using course templates is important for creating an accessible learning environment for all learners.

### **Inclusive Pedagogy**

Inclusive pedagogy is an approach to teaching and learning that seeks to support students' individual learning differences and avoids marginalizing those with unique needs (Stentiford & Koutsouris, 2021). The term inclusion is typically associated with disability because of the perception that students with disabilities are most in need of a modified pedagogical approach (Stentiford & Koutsouris, 2021), but inclusive curriculum design provides benefits to diverse student populations (Bunbury, 2020). Inclusive curriculum design should consider teaching methods, course content, and assessment methods and can help satisfy legal requirements toward students with disabilities (Bunbury, 2020).

Inclusive pedagogy seeks to move away from the traditional hierarchical teaching methods where information typically flows in one direction, and more toward an instructional model that is active and collaborative (Stentiford & Koutsouris, 2021). Friedensen et al. (2020) noted that instructor-centered methods make it difficult for students with disabilities to understand course materials and learn. There may still be individual instances where individual accommodations will be required (Bunbury, 2020), but inclusive pedagogy attempts to support

learners with individual differences in a way that is common to all (Stentiford & Koutsouris, 2021).

### **Universal Design for Learning**

The application of universal design (UD) frameworks in postsecondary education allows institutions to structure the educational environment in a way that is designed to promote the success of all students (Reardon et al., 2021). Since the original framework was introduced, several adaptations have been created, like universal design for learning (UDL) and universal design for instruction (UDI). The frameworks are based on tenets like equitable use, simple and intuitive use, and perceptible information, which benefit a diverse population of students, including those with disabilities (Fleet & Kondrashov, 2019; Reardon et al., 2021). Edwards et al. (2022) noted that UDL is increasingly being recommended by disability services offices as an accommodation, furthering the need for institutional conversations and action on UDL frameworks.

Among the many benefits of UDL, it has been found that students with disabilities are often able to have their learning needs met without having to disclose their disability and request accommodations, reducing the stigma associated with the use of accommodations and the barrier of self-advocating for accommodations (Fleet & Kondrashov, 2019). Burgstahler and Russo-Gleicher (2015) noted that students with disabilities often do not request accommodations “due to lack of awareness about support services offered, concerns about stigma associated with disclosing a disability, and/or poor self-advocacy skills” (p. 199). Table 1 shows a comparison of an accommodation approach versus a UD approach.

**Table 1***Accommodation Approach Versus UD Approach*

Accommodation approach	Universal Design approach
Access is a problem for the individual.	Access issues stem from an inaccessible, poorly designed environment and should be addressed by the designer.
Access is achieved through accommodations.	The system/environment is designed, to the greatest extent possible, to be usable by all.
Access is retroactive.	Access is proactive.
Access is exclusive/specialized.	Access is inclusive.
Access is consumable.	Access, as a part of the environmental design, is sustainable.

*Note.* From “A US model for inclusion of disabled students in higher education settings: The social model of disability and Universal Design” by H. Mole, 2013, *Widening Participation and Lifelong Learning*, 14(3), 62–86. <https://doi.org/10.5456/WPLL.14.3.62>

Studies that have investigated the feelings of students with disabilities toward UDL implementation largely found that this population of students appreciates clear expectations and predictable structure in their courses (Cumming & Rose, 2022; Griful-Freixenet et al., 2017). In addition, Liu et al. (2022) reported that students wanted increased access to class lecture materials, assignments, and assessments and noted the importance of having those materials organized in a way that is easy to navigate. The authors included a list of UDL approaches that can be implemented in the LMS system:

- 1) Allow flexible deadlines in students’ assignments or formative assessments;
- 2) Provide personalized and prompt feedback to students;
- 3) Guide students in collaborative learning and active learning;
- 4) Accommodate students who need different formats to submit their assignments;
- 5) Provide students with multiple modalities of the same content in one place;

- 6) Provide a unified calendar for all courses as deadline and content reminders;
- 7) Facilitate students' use of discussion boards and group spaces for informal meetings.

(Liu et al., 2022, p. 6)

### **Universal Design for Learning Challenges**

Several studies document the challenges of implementing UDL in higher education institutions, with much discussion around faculty knowledge and training. Reardon et al. (2021) reported on evidence of a more positive overall student perception of instruction with faculty adherence to UDL. Fleet and Kondrashov (2019) found that a unified approach is needed for UDL implementation, with faculty training, support for redesigning courses, providing effective tools, and creating a sense of responsibility. Cooperation between stakeholders like administration, faculty, students, and course designers is seen as important to UDL implementation (Fleet & Kondrashov, 2019; Mole, 2013). Fornauf and Erickson (2020) noted a barrier to UDL implementation is negative sentiment from faculty toward students with disabilities who require accommodations. Cumming and Rose (2022) reported that faculty with an inadequate understanding of the needs of students with disabilities often believed students with accommodations have unfair advantages, and these sentiments are also a barrier to effective UDL implementation.

### **Open Educational Resources**

Open educational resources (OER) are educational materials that can be freely accessed, used, and shared by anyone (Perifanou & Economides, 2023). They are publicly accessible, often stored in repositories, and are either in the public domain or are licensed for free, perpetual use with permission to modify (Moon & Park, 2021). These materials are known for the 5Rs: the rights to reuse, retain, revise, remix, and redistribute (Perifanou & Economides, 2023). OER is

where many of the concepts previously reviewed in this chapter, like inclusive pedagogy, UDL, and digital accessibility, can converge. The interconnectedness of these topics will be discussed in this section.

Adoption of OER educational materials can make postsecondary learning experiences more equitable in multiple ways. These materials reduce costs and lower students' financial barriers (Zhang et al., 2020). OER developers can also build equity and inclusion into the design process, as is often done by incorporating UDL principles into the educational materials that are produced (Johnson & Abumeeiz, 2023). The application of UDL in OER can support the inclusion and participation of students with disabilities by applying the principles of UDL to aid student engagement (Ingavélez-Guerra et al., 2022; Moon & Park, 2021).

A few studies investigated the digital accessibility of educational materials found in OER repositories, highlighting the importance of interoperability with technology used by students with disabilities and the need to remove technical difficulties with assistive technology usage (Ingavélez-Guerra et al., 2022; Moon & Park, 2021). Table 2 illustrates WCAG attributes and their direct applications in OER.

The WCAG guidelines and attributes for accessibility play an important role in removing barriers between content and assistive technology (Perifanou & Economides, 2023). Johnson and Abumeeiz (2023) advocated for embedding accessibility into OER development, saying accessibility should be part of the foundational framework when building these learning materials. Moon and Park (2021) reported that students with disabilities can face technical challenges using their assistive technology, and consideration should be paid to accessibility and usability when creating OER materials.

**Table 2***Description of the WCAG 2.0 Attribute and Guidelines Applied to OER*

Attribute	Attribute Description	Guidelines	Guidelines Description
Perceivable	The content and interfaces of OER can be perceived by users.	Text Alternatives	Provide a variety of forms that people need for non-textual content, such as large print, Braille, and so on.
		Time-based Media	Provide access to time-based media.
		Adaptable	Ensure that all OER are available in some way to all users.
		Distinguishable	Make the default presentation easy to perceive by people with disabilities.
Operable	OER, including the content and interface, must be operable for users.	Keyboard Accessible	Make all functionalities achievable by using the keyboard.
		Enough Time	Provide enough time for users to use OER.
		Seizures	Do not design OER in a way that might trigger seizures.
		Navigable	Support navigation and retrieval functions.
Understandable	OER, including the content and interface, must be understandable by users.	Readable	Make OER text readable and understandable.
		Predictable	Make OER contents display and operate predictably.
		Input Assistance	Provide more assistance to avoid and correct mistakes.
Robust	OER must be robust enough that it can be accessed by a variety of types of user agents, including assistive technologies.	Compatible	Increase compatibility with current and future agents, especially assistive technologies.

*Note.* From “Accessibility within open educational resources and practice for disabled learners:

A systematic literature review” by X. Zhang et al., 2020, *Smart Learning Environments*, 7(1), 1-



## Summary

Studies have estimated that more students with disabilities than ever are entering higher education, and up to 96% of higher education classes have students with disabilities. (De Los Santos et al., 2019). Although federal laws require support for students with disabilities, students can only receive that support when they disclose their disability to their institution. De Los Santos et al. (2019) list many barriers to students disclosing their disability, including preferring not to be labeled with a disability, feelings of shame, fear of stigmatism, and embarrassment or discomfort with the disclosure.

It has been found that assistive technologies have proven to benefit students with disabilities (Clouder et al., 2020; McNicholl et al., 2021; Pontikas et al., 2020), and they perceive their postsecondary educational outcomes to be improved with the use of assistive technology (Malcolm & Roll, 2017b). The use of assistive technologies can expose the inaccessibility of learning management systems and course materials, and these accessibility barriers have been shown to have a negative influence on the learning experience of students with disabilities (Seale et al., 2021).

Among the many benefits of universal design for learning (UDL), the learning needs of students are often met without the student having to request accommodations, and the stigma of disclosing their disability and requesting accommodations is reduced (Fleet & Kondrashov, 2019). Additionally, UDL has been shown to improve course completion rates among students with disabilities (Mole, 2013) and is being increasingly mentioned in accommodation plans (Edwards et al., 2022). Understanding the technology barriers experienced by students with disabilities could help improve the services provided, and the application of UDL helps reduce

those barriers for students. Understanding the perceptions of the technology barriers of students with disabilities could help inform training needs and institutional policy and planning.

### CHAPTER 3: METHODOLOGY

For students with disabilities, the use of assistive and mainstream technologies can expose challenges and barriers when engaging with online course content and services (Burgstahler, 2021). According to De Los Santos et al. (2019), students with disabilities have higher dropout rates, experience longer degree completion times, and have lower retention rates. The problem addressed in this study was the technology barriers students with disabilities might face while participating in their courses due to the inaccessibility of learning materials, which can negatively impact course participation and academic outcomes (Seale et al., 2021).

The purpose of this qualitative interpretative phenomenological analysis study was to explore the lived experiences and perceptions of college students with disabilities while using technology to pursue postsecondary education. Merriam and Tisdell (2015) described phenomenological research as focused on the lived experience. Cilesiz (2011) suggested that qualitative phenomenological research is a valuable method of studying experience with technology in education, “including both the process of engaging with technologies and the educational outcomes of using them” (p. 491). An interpretative phenomenological analysis research design was chosen for this research to emphasize the participants’ voice in this study, which was focused on the experiences of students with disabilities using technology in pursuit of higher education. The following questions were the focus of this research:

Research Question One: How do college students with disabilities describe their experience accessing digital course materials?

Research Question Two: How do college students with disabilities describe the support they currently receive in their use of technology?

Research Question Three: How do college students with disabilities describe the technology they perceive as contributing to their success in their academic pursuits?

The method of interpretative phenomenological analysis (IPA) was chosen for this study to best understand the significance of the lived experience of the participants. Smith et al. (2022) advocate for this interpretative method, rooted in the theory of interpretation, when looking to understand how people make sense of their experiences. Using IPA as a method to understand the experiences of students with disabilities in using technology to engage with their coursework enabled the researcher to better understand what barriers and challenges this population faces with their use of technology, further addressing the problem and purpose of this study.

This chapter provides a detailed description of the methodology used to conduct the research. The site and demographics are described, as well as sampling methods and recruitment of participants. Following that is information on data collection and analysis of that data. The chapter closes with an explanation of limitations, delimitations, and ethical issues, and a discussion of the trustworthiness of the study.

### **Site Information and Demographics**

The site chosen for this IPA research study is a state college system in the northeastern United States that includes a multi-campus four-year residential university and a state-wide community college. Between all the campuses and academic centers, the system has a headcount of approximately 11,000 students. The state system includes students in associate, bachelor, and graduate degree programs, as well as non-degree-seeking students. In addition to online students participating from out of state, in-person students attend classes at campuses distributed throughout the state. The study included degree-seeking students, and the study population was not restricted by campus, enrollment, residential status, or major. The researcher is employed in

an information technology (IT) leadership position at the system level and does not work directly with students.

### **Participants and Sampling**

This IPA research study used a purposeful sampling method to include only students with disabilities who met the criteria for inclusion in the research study. Bloomberg (2022) described purposeful sampling of participants as a way to access the data needed for the phenomenological study, and it is important to align selection with the purpose of the study. Smith et al. (2022) advised IPA researchers that their participant group should be reasonably homogenous. Criteria for inclusion included the following: age 18 or older, the student must have a disability as defined below, be an active degree-seeking student in the state college system who is enrolled at least part-time, have completed at least one semester, must be able to participate in a Zoom interview, and have no current or previous relationship with the researcher. This study used the ADA (2020) definition of disability, which is a person with a mental or physical impairment that limits one or more major life activities, or someone with a history of an impairment, or who is perceived by others as having an impairment. Students could have an official medical diagnosis of disability or be self-diagnosed. Registration with the disability services office was not required.

### **Instrumentation and Data Collection**

Semi-structured one-on-one interviews with participants were chosen as the format for this IPA research study. This format was chosen so the researcher could conduct the interviews with established questions, but also have the opportunity to follow up with additional questions (Merriam & Tisdell, 2015). Interviews were conducted with student participants from all over the state through the Zoom videoconferencing platform.

The information collected in this study was stored in password-protected OneDrive cloud storage, accessed by a password-protected computer that only the researcher had access to. The Zoom recording and Zoom transcript were downloaded and stored in OneDrive storage. Auto-generated Zoom transcripts were saved in Microsoft Word, edited by the researcher for accuracy, and prepared for the participant to review. Pseudonyms were used, and all identifying information was removed. The master list of pseudonyms was stored separately to further protect participant confidentiality. A copy of the transcript was emailed to participants for them to review for accuracy and to make any changes they wanted to make. After five calendar days, if the participant did not respond, the transcript was considered accepted. Once a transcript was accepted, the Zoom recording and Zoom transcript were deleted from the study files. Once all transcripts were accepted, the master list of pseudonyms was deleted from the study files. Going forward, the de-identified transcripts were used to conduct the study analysis. Three years from the publication of the study, all study data secured in the OneDrive storage files will be destroyed.

### **Data Analysis**

Following guidance from Moustakas (1994) to analyze participant data by putting away the researcher's personal experience, the analysis can focus on the lived experience of the participants. Alase (2017) described the process of interpretative analysis as first developing a list of significant statements and then grouping those statements into larger thematic groups. These themes are then used to understand participants' lived experiences with the phenomenon that is being studied. Specific to IPA studies, Smith et al. (2022) proposed a seven-step process for analyzing the data obtained in the study:

Step 1: Reading and re-reading

Step 2: Exploratory noting

Step 3: Constructing experiential statements

Step 4: Searching for connections across experiential statements

Step 5: Naming the personal experiential themes

Step 6: Continuing analysis of other cases

Step 7: Developing group experiential themes across cases

This process described by Smith et al. (2022) was followed, and overarching themes were identified, striving to answer the research questions in alignment with the problem and purpose of the study.

### **Limitations, Delimitations, and Ethical Issues**

In any research study, there are limitations that can affect the results or diminish interpretation, and these limitations are important to consider when analyzing the findings of a study (Bloomberg, 2022). To ensure the reliability and credibility of research, it is important for the researcher to carefully recognize and address any possible limitations. The delimitations included provide clarity on the scope of this study. The purpose of this section is to provide a clear understanding of the study's context.

#### **Limitations**

Limitations in research are inherent characteristics that impact or influence the findings of the study (Bloomberg, 2022). Limitations to this IPA research are recognized, and mitigation of limitations will be planned wherever possible. Common in phenomenological study design is researcher bias in data analysis, with biases made from personal beliefs and assumptions about the phenomenon that is being studied (Bloomberg, 2022). Another limitation of the study is that interviews could be an unfavorable method of participation for the population being studied, and

potential discomfort with the format of data collection could limit the sharing of their experience. Participants were provided with the interview questions ahead of time to help mitigate this limitation.

### **Delimitations**

Delimitations are decisions made by the researcher to purposefully narrow the scope of the study to ensure the study is feasible (Bloomberg, 2022). This study was focused on the lived experience of the use of technology for their coursework by students with disabilities and did not specifically include other experiences related to their overall college experience, like campus life or social experiences. The study did not seek to understand the experience of the use of technology by students without disabilities in their pursuit of postsecondary education.

### **Ethical Issues**

This study adhered to the standards for conducting ethical human research as outlined in the Belmont Report (National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, 1979). The Belmont Report is centered around three basic ethical principles: respect for persons, beneficence, and justice. Respect for persons encompasses two ideas: that individuals are autonomous and should be treated as such, and those with diminished autonomy should be protected (National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, 1979). The study ensured adequate information about the research was provided and allowed participants to end the interview at any time without judgment. Beneficence includes two concepts: doing no harm and maximizing possible benefits while minimizing possible harm. In this study, steps were taken to protect the confidentiality and privacy of participants (National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, 1979). Finally, the concept of justice means that the



benefits of the study are not denied without reason, and the burdens of the study are not imposed disproportionately.

### **Trustworthiness**

In qualitative research, trustworthiness is used to evaluate the credibility and dependability of the research, and transparency is a key part of establishing that trust (Bloomberg, 2022). Strategies for increasing trustworthiness can be applied throughout the research process, including in study design, data collection, and analysis (Bloomberg, 2022). Four categories for evaluating trustworthiness in qualitative research summarized below are credibility, transferability, dependability, and confirmability.

#### **Credibility**

Credibility is achieved when the researcher accurately represents the perceptions of the participants (Bloomberg, 2022). This qualitative interpretative analysis study looked at the lived experiences of students with disabilities using technology while pursuing postsecondary education. Using the interview protocols to ensure interviews are standardized, the research uncovered the unique personal experiences of the study participants. According to Bloomberg (2022), strategies to increase credibility include member checking and peer review. Member checks help to ensure researcher bias does not influence the depiction of the participant's perceptions. Member checks were performed with the participants of the study to confirm the accuracy of the transcript of their interview. Another method to increase credibility is peer review of the researcher's notes and data analysis, which can help the researcher consider the data differently. A colleague of the researcher reviewed the researcher's notes on personal and group themes as part of the peer review process.

**Transferability**

Transferability relates to whether the findings of the study “can be applicable to broader contexts” and whether “lessons learned in one setting might be useful to others” (Bloomberg, 2022, p. 304). A limitation of interpretative phenomenological research is the inability to generalize results to other contexts or populations (Bloomberg, 2022). Bloomberg (2022) recommended three strategies for increasing transferability: detailing the sampling strategy used so readers can form their own opinions on the findings, using rich descriptions to thoroughly describe participant experiences and the setting, and including detailed information to allow readers to contextualize the findings. Researchers cannot guarantee transferability, as it is up to the reader to make the decision about how the research findings can be applied (Bloomberg, 2022).

**Dependability**

Dependability is described as the “stability and consistency of data over time” (Bloomberg, 2022, p. 303). Consistently documenting the methodology procedures in a transparent manner increases the dependability of the study (Bloomberg, 2022). Bloomberg (2022) recommended strategies including triangulation and the rationale for decision-making, being detailed in the description of data collection and analysis, and reducing bias through peer review of data analysis. The researcher increased dependability by following the documented research protocols and performing a peer review with a colleague on the data analysis notes.

**Confirmability**

Finally, confirmability deals with establishing that the findings of the research are supported by the data, and that researcher subjectivity and bias do not affect the interpretation of the data (Bloomberg, 2022). Bloomberg (2022) stated that researcher objectivity is not attainable

but that “reasons must be provided for all methodological, theoretical, and analytic choices throughout the entire study so that readers can understand how and why decisions were made” (p. 303). The strategies used to strengthen dependability also aid in achieving confirmability.

### **Summary**

This chapter detailed the methodology used in the study to learn about the lived experiences of students with disabilities and their use of technology to support learning in postsecondary education to understand barriers or challenges they may experience with technology. Participants in the study included actively enrolled students with disabilities at a state college system in the northeastern United States. Purposeful sampling was used to identify participants who met the following criteria: the student must have a disability, be an active degree-seeking student in the state college system who is enrolled at least part-time, have completed at least one semester, must be able to participate in a Zoom interview, and have no current or previous relationship with the researcher. Registration with the disability services office was not required.

Zoom interviews were recorded, and auto-generated transcripts were edited by the researcher for accuracy and saved in Microsoft Word. Transcripts were then sent to participants for member checking. Data analysis followed the seven-step procedure outlined by Smith et al. (2022). Limitations and ethical considerations were addressed in this chapter, and steps were taken throughout the study design to account for those ethical issues and limitations. Additionally, there were actions to strengthen the study’s trustworthiness, including credibility, transferability, dependability, and confirmability.

## CHAPTER 4: RESULTS

The use of technology can create barriers and challenges for postsecondary students with disabilities as they interact with digital course content and services provided in their courses (Burgstahler, 2021). De Los Santos et al. (2019) found that students with disabilities drop out more often, take longer to complete their degrees, and have lower rates of retention compared to their peers without disabilities. The problem addressed in this study was the technology barriers students with disabilities might face while participating in their courses due to the inaccessibility of learning materials, which can negatively impact course participation and academic outcomes (Seale et al., 2021).

The purpose of this qualitative interpretative phenomenological analysis study was to explore the lived experiences and perceptions of college students with disabilities while using technology to pursue postsecondary education. According to Cilesiz (2011), qualitative phenomenological research can be an effective approach to investigate the experience of using technology in education, “including both the process of engaging with technologies and the educational outcomes of using them” (p. 491). The research design selected for this study was interpretative phenomenological analysis, allowing the participants’ experiences to be illuminated. The following questions were the focus of this research:

Research Question One: How do college students with disabilities describe their experience accessing digital course materials?

Research Question Two: How do college students with disabilities describe the support they currently receive in their use of technology?

Research Question Three: How do college students with disabilities describe the technology they perceive as contributing to their success in their academic pursuits?

The IPA research approach was chosen for this study to understand the significance of the participants' lived experiences. Smith et al. (2022) advocate for this interpretative method, rooted in the theory of interpretation, to understand how people make sense of their experiences. By utilizing IPA, the researcher gained insight into the experiences of students with disabilities in using technology to engage with their coursework. This method allowed for the identification of the barriers and challenges faced by this population in their use of technology, helping to address the problem and purpose of the study.

The study's semi-structured interview protocol (Appendix C) focused on the lived experiences of students with disabilities in using technology to support their coursework in postsecondary education. The interview questions were created to understand students' experiences using technology for their coursework, the support they receive, and how they perceive technology as contributing to their academic success.

This chapter is divided into three sections. The first section is an overview of the data collection process and analysis method. The second section summarizes the participants and highlights the themes that emerged from the data. The third section summarizes the results and findings of this study.

### **Analysis Method**

Data collection began after receiving an exemption determination letter from the Institutional Review Board at the University of New England (Appendix D) and site approval from the member institutions of the state college system. Per the protocol, recruitment began with staff members sending the recruitment email (Appendix A) and participant information sheet (Appendix B) on behalf of the researcher to students registered with disability services

office with approved accommodations for the current term. The recruitment process took about two weeks until 12 participants were recruited for the study.

The participant inclusion criteria for the study included the following: age 18 or older, the student must have a disability as defined by ADA, be an active degree-seeking student in the state college system who is enrolled at least part-time, have completed at least one semester, must be able to participate in a Zoom interview, and have no current or previous relationship with the researcher. All communication between the researcher and participants was conducted by email, including scheduling and setting up Zoom interviews for each participant. Interviews were recorded in Zoom. Following the interview, the researcher downloaded each transcript, verified for accuracy, replaced participant names with pseudonyms, and removed any other identifiable information before sending it to the participants for member checking. Participants were given five calendar days to suggest revisions before transcripts were considered accepted.

To gain a deep understanding of the lived experience of the participants, interpretative phenomenological analysis was the method used for this study. The researcher followed the seven-step process for analyzing IPA study data outlined by Smith et al. (2022):

Step 1: Reading and re-reading

Step 2: Exploratory noting

Step 3: Constructing experiential statements

Step 4: Searching for connections across experiential statements

Step 5: Naming the personal experiential themes

Step 6: Continuing analysis of other cases

Step 7: Developing group experiential themes across cases

Following this process, group experiential themes were identified, striving to answer the research questions in alignment with the problem and purpose of the study.

After completing member checking, the researcher divided each of the 12 transcript files into three columns to begin coding the interviews by hand. After the first reading of each transcript, the researcher read through the transcripts a second time and made exploratory notes in a column on the right side of each transcript. In step 3 of the process, the researcher turned those notes into experiential statements, taking care to ground the statements in the participants' lived experiences (Smith et al., 2022). Next, the researcher reviewed each transcript again, looking for common thematic elements across the experiential statements, and noted personal experiential themes (PET) in the left column of each of the 12 transcripts. Given the large number of interviews and resulting data, and not wanting to lose track of any of the valuable experiences described by participants, the researcher moved all of the PETs from each transcript into an Excel spreadsheet file. With each personal experiential theme, the researcher noted the participant's name and the general topic(s) of the PET, including device/applications, assistive technology, disability, accommodations, faculty/staff, Canvas (the institutional learning management system), and course materials. Multiple topics were tagged when appropriate. Topical categorization enabled the researcher to efficiently sort, analyze, and track the personal themes and look across the cases to identify the group experiential themes presented here.

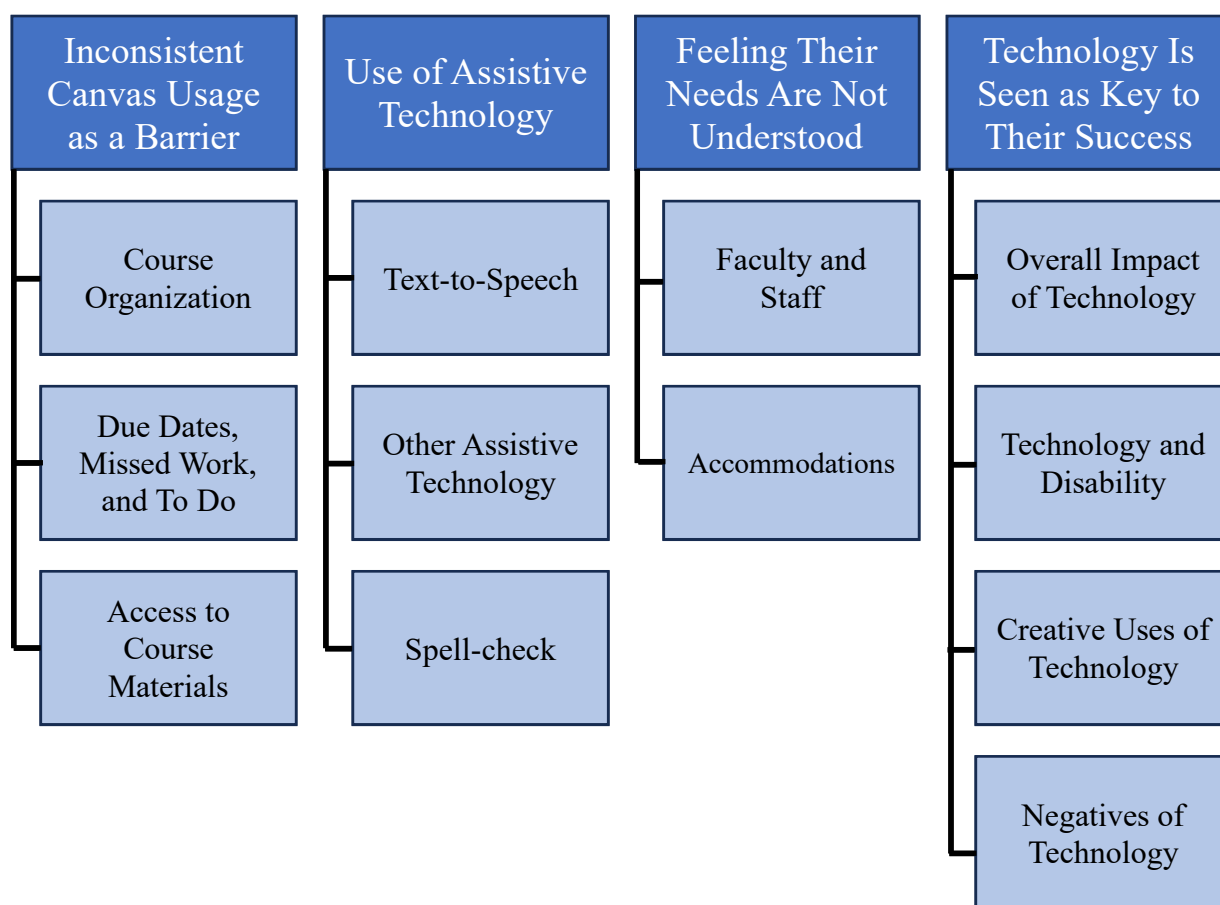
### **Presentation of Results and Findings**

Four overarching themes emerged from the interviews about the lived experiences of students with disabilities and their use of technology to support learning in higher education. While most of the themes will discuss challenges and barriers experienced by students with disabilities, the participants also acknowledged that technology was viewed as a key to their

success as a student with disabilities, which is the fourth theme. The findings of the study are explored through the following themes, shown in Figure 1 with subthemes: 1) inconsistent Canvas usage as a barrier, 2) use of assistive technology, 3) feeling their needs are not understood, and 4) technology is seen as key to their success.

**Figure 1**

*Themes and Subthemes*



### Study Participants

This study recruited 12 participants who met the criteria for inclusion and shared their experiences as a student with disabilities using technology to support their coursework. Interviews were conducted over Zoom, and the participants were asked the same set of questions, provided ahead of the interview for their review and consideration should they choose. The



researcher asked a few clarifying questions throughout the semi-structured interviews.

Participants were told they were not required to share specifics about medically- or self-diagnosed disabilities, but many volunteered that information during their interview. Table 3 represents some demographic information about the participants:

**Table 3**

*Study Participants*

Pseudonym	Primary device used	Assistive technology mentioned	Disability mentioned
Alex	Laptop	Contrast modifications, speech-to-text, spell-check, text-to-speech	Anxiety, dyslexia, migraines
Bryce	Laptop	Spell-check, text-to-speech	
Edin	Desktop	Contrast modifications, speech-to-text, text-to-speech	
Jamie	Laptop	Text-to-speech	Anxiety, hidden disabilities
Jude	Smartphone		
Nima	Tablet	Dyslexia font	ADHD, dyslexia
Peyton	Laptop	Dyslexia font, text-to-speech	Processing speed disorder
Phoenix	Tablet	Text-to-speech	Cognitive and motor disabilities
River	Laptop	Speech-to-text, text-to-speech	ADHD
Rowan	Laptop		
Tate	Laptop	Speech-to-text, spell-check, subtitles, text-to-speech	Chronic pain, dyslexia
Vale	Laptop	Spell-check, Text-to-speech	Dyslexia

Many of the participants used a laptop or desktop computer as their primary device for participating in the coursework. Two participants, Nima and Phoenix, used a tablet as their primary device, and Jude used a smartphone as their primary device. Jude spoke of the challenges of using only a smartphone, like assignment formatting and storage issues, but a long wait for the school laptop grant program delayed their laptop purchase.

## **Inconsistent Canvas Usage as a Barrier**

Each participant discussed inconsistent and ineffective use of the Canvas learning management system by faculty as a barrier to their learning experience as a student with disabilities. All participants were aligned in describing the lived experience of accessing their course materials as full of challenges because of inconsistent Canvas usage across their courses. Participants mentioned varying course organization, challenges and confusion using course materials, and missed work.

### ***Course Organization***

Participants talked about the challenges of having their courses in Canvas organized differently by each faculty member and their difficulties finding materials when the layout across their courses is inconsistent. Eleven of the participants described their experience using Canvas as difficult and confusing. Participant Rowan said of Canvas, “I can’t figure it out. It looks like a mess all over.” River described Canvas as “incredibly disorganized” and said each class “looks different just dependent on the class. Some classes will only have the modules, and some classes will only have the tab for assignments.” Participant Edin also mentioned the inconsistent usage of modules, files, and assignments. They said:

Canvas works well enough, but the way it is applied is really non-standardized between instructors, between courses, and even from the same instructors.... So it takes me some time to find the course materials. It takes me more time to figure out which course materials I’m supposed to be viewing and using.

Nima similarly described the experience of locating course materials in Canvas, saying their “biggest issue with it is oftentimes finding the relevant information for certain assignments because different instructors will place them in different locations.”

Participants Bryce and Nima discussed finding the organization of courses by week confusing because there are no dates associated with the weeks. Bryce said, “Coursework in the modules are done by week and not dates, so there’s never dates on anything. It’s really hard to figure out when that is.” Nima described their experience with the organization of courses by week:

As a student, I barely know which week it is, and some instructors will count their week slightly differently or have next week’s stuff. Everybody does it a little bit differently, so I think that maybe just having more consistency with how the dates are counted.

Nima suggested more standardization in how courses are organized in Canvas would help alleviate some of these challenges.

### ***Due Dates, Missed Work, and To Do***

Several participants discussed their experiences with due dates, the Canvas to do list, and missed work due to inconsistent course setup by faculty. Within the Canvas software, assignments or assessments that do not have a date associated with them will not appear on the student’s calendar and to do list. Peyton talked about this challenge, saying they had “some professors that would not tell us about the material on Canvas that is due. They would have no due dates.... I had one professor that we had a midterm, and nobody knew except two people.” When asked about challenges related to their coursework, Bryce said, “It seems a little silly, but the dates really. When assignments don’t have dates on them.”

Bryce also shared an experience of a professor who would change due dates verbally in video announcements but not change the dates in Canvas, so there was much confusion over when things for the course were due, resulting in missed work. Phoenix mentioned having missed deadlines a few times due to confusion around due dates, saying they didn’t always know

where they were supposed to be looking for things or where to go for what, even though they were a faithful student. Participant River also discussed missed work, saying, “There have been points where I’d missed a week’s worth of work because I was expecting it to be in the module, but it wasn’t there.”

A few participants discussed their experiences using Canvas's to do list feature. Participant Edin lamented that they like the to do list, but groups outside of academics use it to display student activities, and their list will “get flooded with stuff from residence life like a poker night,” making the feature unusable for them. Edin said, “If that actually worked, it would be amazing if the coursework that I owe, and when it’s due, and all of that was already digitized.” Participant Tate talked about liking the to do list feature but lamented that “it’s not always obvious what you have and haven’t done.” Because of this, they track their academic tasks outside of Canvas.

### *Access to Course Materials*

Participants talked about challenges they faced accessing their course materials in Canvas, including issues with broken links in their courses, problems with electronic textbooks, and confusion using materials outside of Canvas. This section focuses specifically on challenges participants had accessing course materials. Discussion of the difficulties they experienced in using course materials will come later in the section on assistive technology.

Half of the participants mentioned that they had experienced links to course materials that did not work or were broken in their courses. Participant River talked about having difficulty accessing files, saying, “Professors link to stuff, and you go to click on it, and it won’t let you open it, or you need some sort of code.” Similarly, Jamie said it was annoying that they experienced “multiple times where the link is broken. And then you have to communicate with

your professor to work through it. And then the course material ends up changing.” Participant Jude, whose primary device for coursework is a smartphone, estimated that about “25% of the coursework on the mobile version points to an incorrect address, so I get an error when trying to access it.”

A few participants discussed their experiences of having difficulty accessing digital textbooks outside of Canvas that needed a special code or password. Participant Peyton said, “There was a book for one course that was through this weird website, and everybody in the class had to wait a couple of weeks for us to get access to the book because we needed a special password.” Jamie described a “really frustrating” experience with a textbook code not working, saying:

My access code wasn’t working and I ended up spending like a month communicating with different groups of people trying to figure things out. And my professor was just like, seems like it’s working for everyone else, so I didn’t get any help from him. Yeah, that was a huge source of stress.

This student faced a serious equity issue and unnecessary stress as they struggled to gain access to their course materials while their other classmates did not face the same issue.

Participants Phoenix and Vale discussed challenges navigating to course materials outside of Canvas. Phoenix described their experience:

You go to the course, to the modules in Canvas, and then your teacher will have another thing that you have to click on to go out to a YouTube or an article, or to some materials that’s not directly in Canvas. There have been moments where navigating to that has been challenging.

Vale also talked about materials outside of Canvas, saying they wish more course materials were “downloaded from the course itself instead of going to different websites with logins and passwords because that becomes a little tedious.”

Many of the experiences the participants shared as they spoke of inconsistent Canvas usage as a barrier, like inconsistent course layouts and poor use of due dates, would be a barrier to all students, not just students with disabilities. Some participants related these challenges to their disability. Participant Nima said, “Being dyslexic, I have a lot of issues finding anything that is not on the calendar or accessible through the calendar. So everything in the week slot is usually just very hard for me to find. It feels hidden.” Vale shared that it would be better if “things could be found easier so that students with disabilities aren’t digging everywhere and trying to figure out what they are doing and what they’re doing wrong because it becomes very frustrating and triggers a lot of stuff.” Participant Alex said, “I used to only take in-person classes because I was struggling so much with trying to use all the online classes and different classes. I think it was just since there was so much to learn, it was really challenging.”

This theme of inconsistent Canvas usage as a barrier explored three subthemes. The first subtheme was inconsistent course organization across their courses, and participants described the challenges they experienced finding course materials with ineffective and inconsistent course layouts. Next, participants described negative experiences with due dates and the Canvas to do list, resulting in unintentional missed work. In the final subtheme, participants described difficulties accessing their course materials in Canvas.

### **Use of Assistive Technology**

As seen in Table 2 earlier in this chapter, most study participants use assistive technology as a part of their academic experience. This theme explores participants' lived experiences

around their use of assistive technologies. Since text-to-speech was the most used assistive technology among the participants, it is not surprising that much of the discussion centered around experiences with this technology. Other assistive technology topics were spell check, speech-to-text, dyslexia fonts, and video subtitles.

### *Text-to-Speech*

Text-to-speech technology converts digital text to audio, and the quality of that audio can vary from a robotic-sounding voice to more human-like artificial intelligence voices (Raffoul & Jaber, 2023). In their interviews, participants used the terms text-to-speech and screen reader interchangeably, even though they are slightly different technologies in terms of use case and functionality. Participants discussed their experiences using text-to-speech, some challenges they face, and their desire for a high-quality version to be provided by the institution.

A few participants discussed why they use text-to-speech software to assist with their coursework. Participant Vale said, “I tend to not fully understand what I’m reading because I also have to hear it.” Both Peyton and Tate use text-to-speech to listen and read simultaneously, with Peyton saying they “read along with the text.” Tate said, “Whenever there is a possibility for me to be able to have a voice read along with me, that has been really helpful, especially with any concentration issues or dyslexia or my fatigue. Anything that can make processing the information a little bit easier helps a lot.” The participants struggle to retain the information through reading only, so they rely on text-to-speech technology as part of their learning experience.

Many participants discussed the challenges and barriers they face when using text-to-speech with their course materials. Several participants talked about text-to-speech software voices. Jamie said:

I tried to use a function where it would read to you, but because the voice was very robotic, and the intonation was so different from how people actually speak, it made it harder to process the information than it would have been to actually read it.

Jamie acknowledged they would like to use text-to-speech more with “a more human-sounding voice that could be super helpful.” Bryce also mentioned robotic voicing, saying, “It’s a lot easier to listen to the AI voice over the, you know, general basic text-to-speech voice, which is super robotic and weird.” Participant Edin noted:

It would be really nice if I had an actual human person reading through the documents because even the AI voices, they sound human, but they don’t do a very good job of saying, okay, let’s take a look at this graphic and talk about what it’s illustrating.

Peyton discussed liking the ability to change the text-to-speech to different voices, saying, “I find that helpful, so I don’t get distracted like it keeps me in focus.... If I read for hours, changing up the accent or the voice will keep me in focus.”

Participants also described challenges using text-to-speech with their course materials. Bryce said, “The biggest barrier is that sometimes textbooks and articles, more educational stuff, it doesn’t know how to read that format. So sometimes it will go all over the place.” Peyton described a digital textbook for one of their classes that did not match the book's text, so listening while reading along was impossible, saying the audio “would be slightly different from the actual text. So I’d get lost when reading that book because there’d be a paragraph put somewhere else, or a paragraph removed, or just a line of text removed.”

Edin and River discussed instructors’ use of scanned course materials that aren’t digitized and do not work with text-to-speech software. Edin said:



As a graduate student, many of my reading assignments are from old journals that haven't been fully digitized. So I can use OCR sometimes for a few paragraphs at a time, but anything involving graphics or diagrams, I'm kind of on my own.

River said, "Sometimes teachers will scan textbooks or whatever. Sometimes it won't be able to read that – the screen reader won't." When students rely on text-to-speech, and course materials do not work with that technology, their course materials become inaccessible.

Similar to Edin's previous comment about graphics and diagrams, Participant Vale talked about their experience with text-to-speech and images. If images are not set up with proper descriptions, called alt tags, text-to-speech will not provide any detail about the image. Vale said, "A lot of the classes are very visual, but I know the audio is really weird, and it doesn't work well with the images. So when you do the audio, it doesn't tell you what the what the image is." They described their experience with barriers related to images used in Canvas quizzes in their courses, saying, "If you're doing a quiz.... Some of these quizzes have images, and they don't have the alt tags, so it doesn't matter. I know I've failed those specific questions."

Participants also discussed how Canvas does not have text-to-speech functionality in the assignment area, which has proved to be a challenge in understanding their assignment instructions. Tate said:

I don't know if Canvas has a screen reader thing in it, but if it does, I haven't found it. I think in general it would be nice if you could have the instructions to an assignment read to you as you're reading it.

Similarly, Alex said, "Including the text-to-speech icon for those descriptions, you know, when they're saying what to do on a project. The explanations can be super long, so having a text-to-speech option would be nice." Vale described a workaround they had developed to compensate

for no text-to-speech functionality in the assignment area of Canvas, saying, “I actually do a recording of the assignment. I record my voice, and I listen to it back, so that helps me understand what I’m reading.”

Finally, some participants expressed the desire for the institution to provide better text-to-speech recommendations or to pay for a high-quality text-to-speech product for student use. Peyton said, “If they could list some reliable free text-to-speech extensions or programs that’d be good. I only got given one, but I already use that one.” They also added that “it was a bit difficult to figure out.” Edin shared their experience with asking for the software, saying:

I asked about getting professional text-to-speech software provided last year and was told that the school could not afford it and had a few options suggested to me for me to pay for, but I was not able or willing to do that.

Later in the interview, Edin added:

I think that something like text-to-speech or correspondingly speech-to-text needs to be something the school is able and willing to provide. I shouldn’t have to buy that myself. I shouldn’t even have to ask about it. It really should just be available.

Participant Bryce shared they purchased a high-quality text-to-speech program with their own funds, saying, “I think it would be nice if programs like NaturalReader wasn’t something that I had to personally pay for because I can’t read. I know a lot of other people can’t read stuff that same way, either.”

Text-to-speech was the most discussed assistive technology among study participants and is important to their academic experience as students with disabilities. Several participants talked about the importance of using text-to-speech while they are reading as a way to help with their struggles with reading. Although this technology plays a prominent role in their academic

experience, the discussion of their experiences using text-to-speech also included many challenges. Some of those challenges included robotic voices, difficulty with the software reading out of order or the inability to read it at all, and the lack of text-to-speech functionality in crucial areas of Canvas. Participants also expressed a desire for the institution to provide a high-quality text-to-speech product for students to use free of charge.

### *Other Assistive Technologies*

Other less frequently mentioned assistive technologies included speech-to-text, dyslexia fonts, and subtitles. Only one participant mentioned video subtitles, but accurate subtitles are important to their experience as a student with disabilities. Tate noted that they have experienced courses that used “videos that do not have subtitles, or really poorly auto-generated subtitles.” Tate discussed the importance of subtitles to them, saying, “Subtitles are good because I also have auditory processing issues. So someone might say something, and I just won’t be able to quite understand what they’re saying if it isn’t written text as well.”

Two participants discussed using special fonts created for dyslexia. Peyton said they would like “for all digital texts to have that dyslexia font. That’d be very helpful for reading.... It just makes it easier to read, makes it faster.” Nima talked about their reliance on the dyslexia font for reading, saying, “I do use the font style OpenDyslexic. So I convert most documents that I’m reading, anything more than a paragraph I’ll try and convert to OpenDyslexic. It makes it easier for me to read.”

Speech-to-text is another assistive technology discussed by the participants. Tate described the need for speech-to-text related to their disability, saying, “If my hands aren’t feeling well or something is wrong in my upper body, so it’s harder to type, being able to speak

and then have that turn into text is really nice.” Sharing more about their experience with speech-to-text, Tate said:

Recently, I found the dictate button on Microsoft Word, which you can click and then speak, and it’ll type it out for you. Before I found that button, I’d have to speak into my phone and then send that information to my computer, which was not as good.

Participant Edin also shared their experience with speech-to-text, which was less positive. Edin said, “I had previously used some speech-to-text, but that gets worse as the jargon gets thicker so as the courses got more advanced, it became pretty useless.”

Subtitles, dyslexia fonts, and speech-to-text were mentioned less frequently than other assistive technologies like text-to-speech. Given the wide variety of disabilities represented in the pool of participants, as seen in Table 2 earlier in the chapter, it is expected that not all assistive technology would be relevant for all participants. These other technologies were important to the experience of the participants who used them.

### *Spell-check*

Spell-check is not traditionally included in the research as an assistive technology, but the participants in this study who discussed spell-check use it in a way that meets the definition of assistive technology. Participants Alex and Tate mentioned spell-check in general terms as a helpful tool. Alex talked about using the Grammarly application to “help with the spelling. I’m a notoriously bad speller, so it’s very helpful.” Two participants discussed the challenges of not having spell-check functionality built into Canvas. Bryce talked about having workarounds for discussions, like typing it up outside of Canvas, but spoke of the difficulties of being without spell-check in exams. Bryce said:

If I'm taking an exam, sometimes it's hard because it can't figure out the word I'm trying to say. I have a lot of difficulty with spelling and so I'll sit there for a long time trying to figure out how to spell a word that I have no idea how to spell.

Vale discussed their workaround for Canvas, saying, "I use Grammarly because in Canvas there's no real correction thing, and because of my dyslexia, I have to have something to show me what's going on when I'm spelling because I put letters backwards a lot." The study participants who discussed spell-check rely on it to help them complete their coursework.

Through the interviews, it became clear that the use of assistive technology is an integral part of the academic experience of the participants. Most participants in this study use text-to-speech, and many rely on more than one assistive technology, as seen in Table 2 earlier in this chapter. Participants often learned of assistive technology applications and features and how to use them independently. Several participants shared that they pay out of pocket for premium services that the institution does not provide. Two participants expressed interest in knowing more about assistive technology and accessibility features available in applications they already use, like Canvas and Microsoft Word. Alex said of accessibility tools, "having them posted in syllabuses or just online or through email, something like that. I definitely think there could be more, you know, advertisement for these helpful tools." Similarly, Tate wished there could be a page "that can help students find accessibility software" and that "shows you how to use accessible features on Canvas, but also maybe could give links to other accessible things. Like even tutorials on how to use the accessibility features on Microsoft applications." Making sure course materials meet digital accessibility standards and supporting students with disabilities better in their use of assistive technology can improve their academic experience.

This theme exploring the use of assistive technology investigated participants' experiences using assistive technology applications to help support them with challenges presented by their disabilities. The most commonly used assistive technology was text-to-speech, but participants also discussed spell-check and other assistive technologies. Participants shared challenges and barriers to using these assistive technologies, like the inaccessibility of course materials and lack of text-to-speech functionality in certain areas of Canvas, and they also expressed a desire for their institution to provide more high-quality tools and information about available features.

### **Feeling Their Needs Are Not Understood**

The next theme to explore is that of the participants feeling like their needs as students with disabilities in higher education are not very well understood. Participants shared their experiences with faculty and staff and with the accommodations they received. Participants described represented challenges they experienced related to their needs, but some participants discussed positive experiences with the accommodations or support they received.

### ***Faculty and Staff***

Many participants discussed their experiences with faculty not understanding their needs as students with disabilities. Phoenix noted that “a lot of the teachers don’t have a solid understanding of technology” and “many of the teachers are not very well-trained on how to post information knowing what’s happening when they post in a certain way.” Also, speaking of their coursework and relating it to their disability, Bryce said, “A lot of educators don’t put enough information into assignments. In person, you can ask questions, and there’s usually more detail, but when it’s written down, it’s like condensed in a way where you can’t really ask questions.”

Bryce added, “I don’t have enough information on what I’m supposed to do, that can cause panic and shut down and pain.”

Jamie shared that they don’t think faculty understand the needs of students with disabilities very well. They said:

They don’t really understand the student experience of Canvas very much, and then if you have any added barriers, everything unravels so quickly.... I don’t really feel like they even understand the needs of their students, and then the needs of their students with disabilities is just like an extra level that they have to get to.

Participant Tate shared, “I think the majority of professors and staff probably don’t understand the specific technology or the specific issues that students have, but I also think that most of the staff and professors would want to help.” Tate went on to say, “I don’t think most people are very knowledgeable about it, but I also think the majority of people are going to find you help if you need it.”

Participants Rowan and Vale discussed their experiences with tutoring. Rowan expressed a desire for more tutoring to be provided, saying, “It would be really helpful to have more tutors.” Vale described using an outside tutoring service to supplement support provided by the institution. Vale said:

I use a monthly subscription to a tutoring service for people who have like dyslexia and things of that nature. It’s a little easier to use because they understand my issues, so they work a little longer with me and have a little more patience.

Vale went on to say, “It’s helped me a lot because my grades are really good considering that it’s been a challenge.”

A few participants positively spoke of staff members. Jamie said, “I have a really great advisor, and she works really hard for me, and I appreciate her very, very much.” Alex expressed that they feel supported by staff members, saying, “I’ve connected with my advisor, and even IT, and figured out some things that were either making me super anxious or were giving me migraines beyond belief. So they help me find those options.”

### *Accommodations*

Participants discussed some of the challenges they experienced with the accommodations provided to them as students with disabilities. Unfortunately, several shared that they find the accommodations they are provided to be ineffective. When asked about the support they receive, Bryce said, “I don’t think I get anything, not from the school, at least. ... My accommodations are useless.” Similarly, Rowan said that they did not share their accommodation plan with faculty this term, saying, “I didn’t tell them this semester. ... I told them last semester, and I felt like they didn’t have the time to help.” Peyton discussed an experience of telling a faculty member about their disability and, “they didn’t know what accommodations went with it, like extended test time. They offered that, but there are no tests for that class, there were take-home quizzes.” Edin discussed how the accommodations are ineffective for their disability, saying, “Generally speaking, the accommodations that are available to students... are more, you can have an extra 30 minutes on your exam or take your exam in a quiet room. But the day-to-day stuff, that’s where I really struggle, with getting assignments done and doing readings.”

Participant Vale discussed the self-advocacy required to make sure accommodations are followed. They said:

I don’t think when you do an accommodation letter and you send it out that it does its thing. When I was in high school, totally different. You know, you have a support group.



In college, you don't have that. You kind of have to advocate for yourself. But even advocating for yourself, not every teacher is going to understand. ... Some of them will not follow the accommodations.

Vale shared that they wish accommodations, like extra time on tests, could be automatically programmed into Canvas because "they're not really there in the platform." Vale described it as "annoying and not very convenient" to advocate "over and over again" for accommodations to be applied.

Some participants shared positives about their accommodations. Tate shared the following sentiment, which aligns with the principles of Universal Design:

Having accommodations kind of built into classes already, which a lot of professors at the college do, which is really nice. So I get extended time on assignments, and this and that, but I think that everyone would benefit from that, and it wouldn't hurt anyone's ability to learn, if anything, it would do the opposite.

Jamie said they like having the accommodation plan as a "format to communicate with all my professors." Similarly, Bryce noted being able to email the accommodation plan to faculty, or 504 plan as the participant called it, "I don't have to go up in person and explain everything. I can send it through an email. ... And if they have questions, they have questions, but we don't necessarily need to go through everything in person."

This theme explored the sentiment that participants feel their needs are poorly understood. While participants generally did not feel like their needs as students with disabilities were well understood, they often shared they felt there were good intentions from faculty and staff. Several of the participants discussed finding their accommodations ineffectual, or they shared the challenges of having to advocate for themselves to receive their accommodations.

This contributes to feelings that their needs as students with disabilities are not well understood. Some participants shared positive experiences with accommodations and faculty and staff, and those were also included in the results.

### **Technology Is Seen as Key to Their Success**

The final theme seen in the interviews concerns the impact of technology on the participants' success. Participants described how technology has influenced their academic experience, in relation to their disability, and shared creative uses of technology. A few participants shared some of the downsides of technology related to their academic pursuits.

### ***Overall Impact of Technology***

Participants shared their ideas about the overall impact of technology on their academic success, with some admitting technology and online learning make higher education possible for them. Participant Vale said, “I don’t think I would have been able to go back to school,” and, “I think technology has been great, the overall impact has been great for me at this stage in the game.” Similarly, Jude shared, “I wasn’t able to be in a traditional classroom, and now I’m able to go back and have a 4.1 GPA, and that’s great. And that’s all thanks to technology.”

Participant Jamie shared more details about how their laptop and phone help with their coursework. Jamie said:

I think technology is what has really made it possible. I have a really good GPA right now because I’m able to keep my stuff organized on Canvas and in my laptop, and I can put alarms in my phone when I need to remember to do certain things or put it in my calendar. It keeps my stress low in environments that work for me. I think technology is really what has made it happen for me.

Along the same lines, Nima talked about their tablet as key to their success, saying, “I don’t think I could be here right now without a tablet. It completely changed the course of my education.”

### ***Technology and Disability***

Participants also discussed their disability and how technology helps them pursue postsecondary education, with several of them mentioning a preference for online learning over in-person classes. Tate discussed the preference for online courses over in-person because of their disability:

I wouldn’t have been able to start college if it wasn’t for the ability to have online classes. ... Just in the past few years, I started doing physical therapy that can help with my disability a little bit, so that means now I’m able to go to in-person classes more, but when I started I wasn’t able. So being able to do online classes really helped me be able to just go to college to begin with and start taking classes.

Jamie talked about anxieties that make in-person classes difficult for them, saying:

I don’t think I would be able to take courses without doing it remotely. I have a lot of social anxiety and anxiety in new places, so physically going into a space that I’m not familiar with and being around people I’m not familiar with it just stresses me out, and then I can’t really learn.

Jude shared details of the experience of pursuing higher education with chronic pain:

As someone living with day to day with severe chronic pain, sometimes I can’t get out of bed and to be able to lay in my bed and use my phone to complete my coursework is amazing. I mean life-changing. I couldn’t go to college before because of it.

Finally, Bryce described their preference for online classes, saying, “Zoom calls don’t give me like the same level of doing something and prevents a lot of my issues. My issues are directly related to my emotions, my physical body is affected by my emotions.”

Participant Nima explained how their technology device, specifically a tablet, makes their academic experience easier. Nima said:

For me, being dyslexic and having ADHD, I think there’s very clear disabilities that I have, but I also think that a lot of strengths that come with those two that are hard to see....But then when I get certain technologies, like my tablet, it suddenly feels like things that were impossible before are much more manageable.

Nima also discussed how that tablet helps them overcome challenges related to each of their disabilities, saying:

I think it’s much easier for me to take initial steps to then start working on larger projects, and that relates to the ADHD. And I think that with dyslexia, it just helps me organize my thoughts much better, and see what my work is without having spent so much time looking into it.

These discussions highlight the critical role technology plays in the academic experience of students with disabilities and how these participants see technology as a contributor to their success in postsecondary education.

### ***Creative Uses of Technology***

Some participants in the study also mentioned ways in which they use software applications or their devices creatively to support their learning and coursework. Most mentioned their smartphone as a secondary device, using it to quickly check on their courses and for alarms and notifications related to coursework and due dates. Participant River talked about a phone

application called StudyBunny, a timer they use for focused study sessions, saying, “I do classwork for like 30 minutes, and then it’ll give you a five-minute break.” Participant Peyton discussed using their phone to “use my camera and use the text scan, and it would convert what’s in like a book to text, which, if I need to take notes, that’s good.” Peyton described how they can search within those pictures, saying, “I can type in a specific word, so it will find the picture that has that word in it, which is very helpful.”

Participant Edin, a software engineering student, said they used their technical knowledge to streamline their assignments programmatically. Edin said:

I live and die by my digital to-do list. It has really made school doable for me that I have a hook attached to the item. And I say, okay, I’m starting assignment A, and it pulls up the text editor with my boilerplate with the description of the assignment in a comment at the top of the page. And that makes it just so much easier for me to get into the flow without having to worry about getting myself organized.

Edin suggested that what they have done programmatically could be provided in a template version to all students in their program, making it easier for everyone. Edin said, “That’s something that could be prepared and ready to go. Like my program’s assignments could basically be worksheets.”

Participant Nima talked about their use of color coding in their notes, as seen in Figure 2, and how much that has made it easier to understand categories of things at a glance. Nima said:

I use a tablet for almost all of my coursework, especially mathematical homework. When I first came to the college, I was really struggling with my math courses in general, with organization and planning and making sure I can actually read and understand what I did.

But when I started using a tablet, I started color coding the work... so I didn't have to read as much, I could just look and know.

Nima explained, "certain items would be black, certain items would be blue, and certain items like formulas would be red." Also, "it helped me worry less about where I put everything, and it put me in a place where I can write, and if I write in the wrong locations, I can move it later."

## Figure 2

Screenshot of Participant Nima's Color-Coded Notes

Strip spacing from Req  $\phi V_s = V_v^* - \phi V_c$

$S_{req} = \frac{\phi A_v f_y d}{Req - \phi V_s}$        $S_{req} = \frac{0.75(0.22 \text{ in}^2)(60 \text{ ksi})(24")}{82.8^k - 34.155^k} = 4.89" \approx 4" = S_{req}$       (C)

$S_{max} = 4\sqrt{f_c b d}$       or       $V_s^* = \frac{V_v^* - \phi V_c}{\phi}$

$S_{max} = 4 \cdot \sqrt{4,000 \text{ psi} \cdot 24" \cdot 15"} = 91.07$  larger       $V_s^* = \frac{82.8^k - 34.2^k}{0.75} = 64.8$

$S_{max} = \frac{d}{2}$  or  $24"$

$\frac{24"}{2} > 24" \therefore 12" = S_{max}$

$f_c < 4,444 \text{ psi}$

## Negatives of Technology

While most of the experiences with technology shared by participants were positive, a few mentioned some negatives. For example, Rowan talked about needing more support, saying they need "extra help with the use of technology. I've been out of school for many years and just need some help with that." Nima shared some of the challenges of reliance on technology:

Technology is incredible for me, helping me get through school in general, but at the same time, it's a major stressor because I don't organize well in a digital space. For me,

organization is much more difficult digitally because it involves lots of reading, which is my biggest challenge.

Participant Nima discussed the difficulties of technology being a distraction, saying, “With my ADHD, I have a really hard time focusing. If I’m on the internet, I have access to everything. So sometimes being so heavily reliant on technology can take me down a different path that goes beyond my coursework.”

This final theme of participants seeing technology as key to their success was explored through four subthemes. Participants spoke highly of the overall impact of technology on their experience as students with disabilities, with several sharing that technology has made postsecondary education possible for them. Some discussed how technology helps support them with challenges presented by their disabilities. The third subtheme was around the creative uses of applications and devices supporting participants’ academic experience. Finally, participants shared some of the negatives they experienced while relying on technology, like challenges with distraction and digital organization.

### **Summary**

This chapter presented the data collected to understand the lived experiences of students with disabilities while they used technology to pursue postsecondary education. The analysis of the study’s data revealed four themes of shared lived experiences among the participants, identifying their experiences as students with disabilities using technology for their coursework. The four themes were 1) inconsistent Canvas usage as a barrier, 2) use of assistive technology, 3) feeling their needs are not understood, and 4) technology is seen as key to their success.

The problem addressed in this study was the technology barriers students with disabilities might face while participating in their courses due to the inaccessibility of learning materials,

which can negatively impact course participation and academic outcomes (Seale et al., 2021). Within the results of the first theme, study participants described experiences where course materials were inaccessible or difficult or confusing to access and the negative impacts of those experiences on their course participation and academic outcomes. The second theme on the use of assistive technology revealed more challenges and barriers related to digital accessibility and limitations associated with using assistive technology in Canvas, again negatively impacting participants' course participation and academic outcomes. Within the third theme, participants shared their experiences with faculty and accommodations, some of which also negatively impacted their course participation.

The purpose of this qualitative IPA study was to explore the lived experiences and perceptions of college students with disabilities while using technology to pursue postsecondary education. All four themes are directly related to the purpose of the study, and the researcher was able to learn much about the participants' lived experiences as they used technology for their coursework. Within the results of the fourth theme, participants presented a mostly positive view of the overall experience of using technology and its positive impact on their experience as students with disabilities. Participants shared that technology has made postsecondary education possible for them, and a few attributed technology to their success and positive academic outcomes. The importance and implications of these findings and further recommendations will be explored in the next chapter.



## CHAPTER 5: CONCLUSION

The purpose of this qualitative interpretative phenomenological analysis study was to explore the lived experiences and perceptions of college students with disabilities while using technology to pursue postsecondary education. For students with disabilities, using technology can create challenges in accessing digital course content and services (Burgstahler, 2021). Students with disabilities have higher dropout rates, experience longer degree completion times, and have lower retention rates, as found by De Los Santos et al. (2019). The problem addressed in this study was the technology barriers students with disabilities might face while participating in their courses due to the inaccessibility of learning materials, which can negatively impact course participation and academic outcomes (Seale et al., 2021).

Interpretative phenomenological analysis methodology was chosen for this study to emphasize the participants' voices. Focusing on the experiences of students with disabilities using technology in pursuit of higher education, the study's research questions were:

Research Question One: How do college students with disabilities describe their experience accessing digital course materials?

Research Question Two: How do college students with disabilities describe the support they currently receive in their use of technology?

Research Question Three: How do college students with disabilities describe the technology they perceive as contributing to their success in their academic pursuits?

Participants in the study shared their lived experiences as students with disabilities using technology for their academic pursuits. The data analysis revealed four themes of shared lived experiences among the participants, which were 1) inconsistent Canvas usage as a barrier, 2) use of assistive technology, 3) feeling their needs are not understood, and 4) technology is seen as

key to their success. The results presented in Chapter 4 align with the problem and purpose of the study. The findings relative to the research questions will be explored further throughout this chapter. The researcher will also present implications and recommendations for action and further study.

### **Interpretation and Importance of Findings**

According to Bloomberg (2022), findings and interpretations are the foundation for making conclusions. The findings of this study supported the research questions and conceptual framework. This section will highlight the study's interpretations and important findings relative to the research questions.

#### **Research Question 1**

Research Question One asked, “How do college students with disabilities describe their experience accessing digital course materials?” and was created to explore and understand the lived experiences of students with disabilities as they access their course materials. The experiences participants shared for this research question related to the first two themes presented in the results: inconsistent Canvas usage as a barrier and use of assistive technology. The study participants shared the difficulties they experienced navigating to, finding, and using their digital course materials.

#### ***Course Organization***

Participants shared the challenges they experienced finding and accessing course materials in Canvas as barriers to their academic experience. Study participants universally discussed difficulty and confusion with inconsistent course organization across their courses. They mentioned inconsistent usage of modules, files, and assignments within each course in Canvas, leading to uncertainty about where to find course materials. This finding is consistent

with the literature, with Munguia et al. (2020) reporting that course organization is essential to the student experience, and when each course is organized differently, students have the frustrating experience of having to relearn how to find the information they need. Similarly, Liu et al. (2022) reported that students with disabilities stressed the importance of the organization of course materials and easy navigation.

One participant shared that due to their dyslexia and inconsistent Canvas usage by faculty, course materials can feel hidden from them. The lack of equity with their peers because of disability desperately needs to be addressed. As an idea for more consistency in course layout, Lewis (2021) advocated for using course templates to provide a more standardized student experience, which was also a suggestion shared by one of the study participants. This idea will be explored further in the recommendations section below.

### ***Assistive Technology***

Participants also shared the accessibility issues they faced when using digital course materials with assistive technology. The primary issue participants faced was that text-to-speech software did not work well with the course materials due to format, lack of digitization, and unlabeled images and figures. Given the breadth and depth of its use, text-to-speech software plays a vital role in the participants' academic experience, so issues with using it are a barrier to their learning. McNicholl et al. (2021) found that barriers to effective use of assistive technology can hinder academic engagement. Additional accessibility issues participants faced with their course materials were missing video subtitles and materials that lacked dyslexia fonts. Lazar (2022) noted that accessibility barriers can lead to the exclusion of students with disabilities from the university experience. Bong and Chen (2021) recommended that faculty and staff who work

with students with disabilities receive hands-on training with assistive technology so they understand how those technologies work with their own course content.

The study participants compensated for challenges experienced while using assistive technology with workarounds and creative uses of technology, but they should not have to do so. Moon and Park (2021) noted students with disabilities tend to experience technical difficulties with their use of assistive technology. How to work through some of these digital accessibility issues, whether they be limitations of the technology or training issues with faculty, is discussed in more detail in the recommendations section.

In sharing their experiences, the study participants described an alarming number of barriers they experienced both finding and using their course materials, such that they are not on equal footing with their peers without disabilities. Each participant discussed struggles related to course organization, and many were not able to effectively use the assistive technologies needed to succeed. This is a similar finding to Liu et al. (2022), who reported that “the means by which content is being delivered to students is not adequately serving the SWD population” (p. 16). As they continue to experience barriers in their access to education, one must wonder if we are meeting the legal obligations to provide students with disabilities equal access to education. The recommendations section below offers ideas for how we can improve the experience of students with disabilities in the way they deserve.

## **Research Question 2**

Research Question Two asked, “How do college students with disabilities describe the support they currently receive in their use of technology?” and was created to understand whether students feel they have adequate support in using technology for their coursework. Study participants shared that they generally did not feel like the faculty had a good

understanding of their needs as students with disabilities, which affected their experience of feeling supported. As part of their lived experience, participants shared that they feel many faculty do not have a good understanding of technology or what the student experience is like in Canvas, and the needs of students with disabilities are an extra level to get to beyond that. A review of the literature revealed that institutional adoption of Universal Design for Learning (UDL) frameworks has been shown to benefit students with disabilities (Fleet & Kondrashov, 2019), and UDL is increasingly being recommended as an accommodation by disability services offices (Edwards et al., 2022).

Participants also felt the institution could improve in their support of assistive technology. Many participants lamented that a high-quality text-to-speech product was not provided to them. Several said the disability services office recommended they purchase it themselves, and one participant said they did so, but that option was cost-prohibitive for other participants. Bruno et al. (2021) reported that text-to-speech is one of the most common accommodations used to support students with disabilities. Participants also recommended the institution provide them with more information on available assistive technologies and training materials on the accessibility features available in software applications they use to support their learning.

Study participants do not feel supported as they use technology for their coursework. Critical disability theory views institutional barriers as discriminatory and advocates for a society free of barriers for people with disabilities (Procknow et al., 2017). Given the barriers participants experience, especially with the use of assistive technology, the researcher again wonders if legal obligations to provide equal access to education are being met. Later in this

chapter, suggestions will be made for how postsecondary institutions can better support students with disabilities in their use of technology.

### **Research Question 3**

Research Question Three asked, “How do college students with disabilities describe the technology they perceive as contributing to their success in their academic pursuits?” and was created to try to understand students with disabilities’ perceptions of the contribution of technology to their learning experience. Participants shared that they felt technology made postsecondary education possible for them as students with disabilities, and they shared specifics of how technology supports them with challenges presented by their disabilities. In the literature, Armstrong and Gutica (2020) reported that the use of technology helps students with disabilities access, capture, and process the content in their courses, and technologies were found to help students maintain focus and reduce the energy needed to complete coursework. One participant mentioned increased distractibility while using technology, but most others shared positive experiences of improved ability to focus and process information, especially when using text-to-speech.

Participants who struggle to attend in-person classes due to their disability discussed the benefits of online education. They mentioned chronic pain and anxiety as reasons that synchronous and asynchronous online courses are better for them as students with disabilities. Several participants discussed postsecondary education being out of reach for them before online classes were available. Critical disability theory advocates for a society free of barriers for students with disabilities (Procknow et al., 2017), and online postsecondary education has removed many of those barriers for students with disabilities. The heavy reliance on technology, though, has presented a new challenge, as shared by participants in this study.

## **Implications**

Students with disabilities make up 19% of the undergraduate population in the United States (National Center for Education Statistics, 2018). It is important to understand the specific needs and barriers of students with disabilities because they have lower success rates in course completion and retention (De Los Santos et al., 2019). Students with disabilities are offered civil rights protections under United States law, requiring postsecondary legal institutions to provide equal access to education (Newman et al., 2021). Newman et al. (2021) reported that only one-third of students who received special education in high school disclosed their disability in college, leaving faculty and staff unaware of a large population of unsupported students with disabilities. When institutions implement UDL frameworks, which have been shown to benefit students with disabilities, they can remove some of the learning barriers of students with disabilities without the need for disclosure of their disability (Fleet & Kondrashov, 2019). Digital accessibility is equally as important for higher education institutions, and staff and faculty need to understand the interaction between the assistive technology on which students rely and digital course materials (Bong & Chen, 2021). The researcher hopes that understanding the challenges and barriers students with disabilities experience with their coursework and working to improve those aspects of the student experience could improve student persistence and graduation rates.

## **Recommendations for Action**

This study of the lived experiences of students with disabilities as they use technology in pursuit of higher education revealed several challenges and barriers in their academic experience. Some ideas come directly from the study participants in the form of suggestions they made in their interviews. The recommendations shared here have varying degrees of difficulty, but all could positively impact the student experience for this population of students.

### **Text-to-speech Software**

The first recommendation is to budget for and provide high-quality, feature-rich assistive technology applications that students rely on and find beneficial. In this study, a large majority of participants reported using text-to-speech software, but they lamented that the institution only provided recommendations for free software or premium versions they had to pay out-of-pocket for themselves. The use of assistive technology has been shown to have a significant positive impact on the academic engagement of students with disabilities (Fernández-Batanero et al., 2022), so it is important to align technology and disability services office budgeting with the assistive technology needs of students with disabilities and provide them high-quality assistive technology tools.

### **Assistive Technology Training**

As study participants recommended, institutions must provide resources and training materials for students so they know what assistive technology and accessibility features are available to them. McNicholl et al. (2021) reported on the importance of training and support for students using assistive technology and that inadequate support can be a significant barrier for students. In this study, participants recommended creating a webpage that lists available assistive technology software and any training materials associated with those products. Additionally, they suggested providing more information on what accessibility features are available and how to use them within institution-provided tools like the learning management system, Canvas, and Microsoft products like Word, PowerPoint, and email.

### **Canvas**

Study participants described many barriers related to the use of the Canvas LMS that need to be untangled and addressed. Some of these issues are related to the software itself, and



others are due to poor faculty usage and training. Several participants discussed the lack of text-to-speech functionality in the assignment area and their struggles with this issue. Assignment instructions can be long and detailed, so barriers to students' understanding of their assignments must be reduced. Additional discovery needs to be done within the institution to understand this issue better and work toward an appropriate solution, whether that be working with the vendor to improve the accessibility of their system or purchasing any necessary add-in programs. Text-to-speech was revealed to be a critical tool to the experience of many study participants, and should be available in all areas of Canvas.

To improve the overall accessibility of course materials, the purchase of the Blackboard Ally software for use within the institutional Canvas LMS is recommended. The software provides alternative formats of course materials that students can download and can be used with assistive technology, like audio versions, ePub, mobile-friendly, electronic Braille, and more (Almufarreh et al., 2021). Additionally, the instructor view provides tips on improvement, reviews the usability, and gives insight into the accessibility of course materials (Almufarreh et al., 2021). Lastly, Ally's administrator view enables tracking and reporting on usability and accessibility across the institution. Institutional adoption of this software would provide instructors with additional tools to understand and improve the academic experience for students with disabilities.

Finally, faculty training on Canvas is recommended based on participant experiences with barriers related to course organization and the feeling that faculty do not understand the experience of students with disabilities. Increasing faculty awareness of how students find, access, and use course materials within Canvas is imperative to improving the student experience. Participants mentioned broken links, issues with digital textbook access, confusion

over assignment due dates leading to missed work, inability to use the to do list due to improper setup of their courses, inconsistent usage of modules and assignments, and more challenges and barriers that could be addressed with additional training for faculty on the use of Canvas.

### **Course Templates and UDL**

Study participants universally struggled with confusion and frustration over inconsistent course organization by faculty, and course templates have been shown to standardize the student experience across courses and create a more accessible learning environment (Lewis, 2021). Due to faculty contracts, course templates cannot be required, and the student experience suffers, as evidenced by the barriers experienced by the participants in this study. Course templates are in use in small pockets, by specific programs, and a template produced by the Center for Teaching and Learning Innovation at the university is available. Even if the requirement of a template is not possible, awareness of the benefits and strong encouragement of use could help.

The application of UDL frameworks has proven to benefit students with disabilities (Fleet & Kondrashov, 2019), and UDL is increasingly being recommended as an accommodation by disability services offices (Edwards et al., 2022). Rogers-Shaw et al. (2023) noted that UDL reduces barriers for students with disabilities through its flexibility and individualization. The cultural change and institutional buy-in required for these two suggestions are immense, but given the potential positive impact on the experience of students with disabilities, these must be mentioned.

### **Open Educational Resources**

The use of open educational resources (OER) presents an opportunity to address equity issues for students with disabilities. OER course materials are often designed with accessibility and usability in mind (Moon & Park, 2021), and UDL principles are often used in the design,

further supporting the participation of students with disabilities (Ingavélez-Guerra et al., 2022). Expanded use of OER materials would help with the barriers the study participants described in accessing their course materials. An institution-wide increase in the use of OER materials would also align with strategic initiatives around affordability.

### **Digital Accessibility**

Institutional digital accessibility policy can help institutions address pervasive problems with inaccessible digital content (Lazar, 2022). Participants in this study discussed barriers they experienced using inaccessible content, like scanned documents that weren't digitized and videos without captions. A noted barrier to digital accessibility in higher education is the faculty's understanding of the inaccessibility of learning materials and how assistive technology works with digital course materials (Bong & Chen, 2021).

### **Recommendations for Further Study**

Exploring the lived experiences of students with disabilities provided revealing insights into their perceptions of using technology for postsecondary coursework and the barriers they experience. Opportunities exist to further examine:

- Text-to-speech use was high and valued among participants of the study. There is very little literature available about the use of test-to-speech software by students with disabilities in higher education. It would be interesting to know which types of disabilities benefit most from the use of text-to-speech software and how it impacts their student experience.
- Two participants in this study attributed their high GPAs and overall success to their use of technology, so it would be interesting to explore this topic further.

- Although they were not specifically asked about their academic accommodations, many of the participants discussed their experiences with the accommodations they received. While many of these comments were shared in Chapter 4, the discussion of accommodations in this chapter was limited based on relevance to the research questions. It would be interesting to further explore perceptions and effectiveness of accommodations that rely on technology.
- Artificial intelligence has quickly risen into a disruptive force in higher education (Farrelly & Baker, 2023), so further study on the benefits of artificial intelligence for students with disabilities in higher education would be interesting to explore.

The pace of change with technology is very fast, so higher education technology leadership needs to stay up-to-date with current and emerging trends in technology. Students are often curious enough to be at the forefront of adopting new technologies. Study participant Nima discussed their excitement for the new Apple headset, saying:

It's supposed to be augmented and virtual reality, and I think that would be important to me because I think that the biggest limiting factor of current technologies is they're all two-dimensional. I think that it forces people like me to think two-dimensionally when we don't.... Just to allow people with dyslexia who already think three-dimensionally to express themselves more fully instead of being forced to kind of present their information linearly.

The benefits of emerging technologies like augmented reality and artificial intelligence are still revealing themselves, especially for students with disabilities. However, they are most certainly on the list as future areas of study as they continue to develop.

## Conclusion

Technology barriers students with disabilities might face due to the inaccessibility of learning materials can negatively impact their course participation and academic outcomes (Seale et al., 2021). This interpretative phenomenological analysis study sought to understand the lived experiences and perceptions of college students with disabilities while using technology to pursue postsecondary education. Focusing on the experiences of students with disabilities using technology in pursuit of higher education, the study's research questions were:

Research Question One: How do college students with disabilities describe their experience accessing digital course materials?

Research Question Two: How do college students with disabilities describe the support they currently receive in their use of technology?

Research Question Three: How do college students with disabilities describe the technology they perceive as contributing to their success in their academic pursuits?

The analysis of the study's data revealed four themes of shared lived experiences among the 12 participants. The four themes were 1) inconsistent Canvas usage as a barrier, 2) use of assistive technology, 3) feeling their needs are not understood, and 4) technology is seen as key to their success. Findings related to Research Question 1 were that study participants experienced difficulties navigating to, finding, and using digital course materials, and they shared accessibility issues they faced when using digital course materials with assistive technology. Findings related to Research Question 2 were that participants felt like faculty do not generally understand their needs as students with disabilities, and they felt the institution could improve their support of assistive technology. Related to Research Question 3, participants shared that

they felt technology has removed many barriers they experienced as students with disabilities and has made postsecondary education possible for them.

Recommendations for action included the institutional provision of high-quality assistive technology and training on using assistive technology and accessibility features, both of which are recommendations to support access to course materials for students with disabilities.

Additional recommendations include implementing course templates, use of UDL frameworks in course design, Canvas recommendations, increased OER use, and a digital accessibility policy.

The recommendations could positively impact the academic experience and outcomes of students with disabilities.

## REFERENCES

- ADA. (2020, February 28). *Guide to Disability Rights Laws*. ADA.gov.  
<https://www.ada.gov/resources/disability-rights-guide/>
- Alase, A. (2017). The interpretative phenomenological analysis (IPA): A guide to a good qualitative research approach. *International Journal of Education and Literacy Studies*, 5(2), 5-19. <https://doi.org/10.7575/aiac.ijels.v.5n.2p.9>
- Almufarreh, A., Arshad, M., & Mohammed, H. (2021). An efficient utilization of Blackboard Ally in higher education institutions. *Intelligent Automation and Soft Computing*, 29, 73–87. <https://doi.org/10.32604/iasc.2021.017803>
- Andersen, H. V., & Jensen, R. H. S. (2018). Assistive learning technologies for learners with ADHD and ASD: A review 2006-2016. *Læring Og Medier*, 11(19).  
<https://doi.org/10.7146/lom.v11i19.109755>
- Aquino, K. C. (2016). A new theoretical approach to postsecondary student disability: Disability-Diversity (Dis)Connect model. *Journal of Postsecondary Education and Disability*, 29(4), 317–330.
- Armstrong, A., & Gutica, M. (2020). Bootstrapping: The emergent technological practices of post-secondary students with mathematic learning disabilities. *Exceptionality Education International*, 30(1), Article 1. <https://doi.org/10.5206/eei.v30i1.10912>
- Assistive Technology Industry Association. (n.d.). *What is AT?*. Retrieved February 20, 2022, from <https://www.atia.org/home/at-resources/what-is-at/>
- Avila-Garzon, C., Bacca-Acosta, J., Kinshuk, J. D., & Betancourt, J. (2021). Augmented reality in education: An overview of twenty-five years of research. *Contemporary Educational Technology*, 13(3), ep302. <https://doi.org/10.30935/cedtech/10865>

- Bastedo, K., & Swenson, N. (2019). General accessibility guidelines for online course content creation. In *Universal Access Through Inclusive Instructional Design* (pp. 208–217). Routledge.
- Berghs, M., Atkin, K., Hatton, C., & Thomas, C. (2019). Do disabled people need a stronger social model: A social model of human rights? *Disability & Society*, *34*(7–8), 1034–1039. <https://doi.org/10.1080/09687599.2019.1619239>
- Bloomberg, L. D. (2022). *Completing your qualitative dissertation: A roadmap from beginning to end* (5th ed.). SAGE Publications.
- Bong, W. K., & Chen, W. (2021). Increasing faculty's competence in digital accessibility for inclusive education: A systematic literature review. *International Journal of Inclusive Education*, *0*(0), 1–17. <https://doi.org/10.1080/13603116.2021.1937344>
- Bright, D. (2021). An integrative review of the potential of wireless assistive technologies and internet of things (IoT) to improve accessibility to education for students with disabilities. *Assistive Technology*, *0*(0), 1–8. <https://doi.org/10.1080/10400435.2021.1956639>
- Brown, K., Pena, E., Broido, E., Stapleton, L., & Evans, N. (2019). Understanding disability frameworks in higher education research. In *Theory and Method in Higher Education Research* (Vol. 5, pp. 19–36). Emerald Publishing Limited.
- Bruno, L., Ball, M., Kaldenberg, E., Bahr, P., & Willits, J. (2021). Direct instructions to teach students in a comprehensive transition program how to utilize text-to-speech software effectively. *Journal of Inclusive Postsecondary Education*, *3*(1), Article 1. <https://doi.org/10.13021/jipe.2021.2871>



- Bunbury, S. (2020). Disability in higher education – do reasonable adjustments contribute to an inclusive curriculum? *International Journal of Inclusive Education*, 24(9), 964–979.  
<https://doi.org/10.1080/13603116.2018.1503347>
- Burgstahler, S. (2021). What higher education learned about the accessibility of online opportunities during a pandemic. *Journal of Higher Education Theory and Practice*, 21(7), 160–170.
- Burgstahler, S., & Russo-Gleicher, R. J. (2015). Applying Universal Design to address the needs of postsecondary students on the autism spectrum. *Journal of Postsecondary Education and Disability*, 28(2), 199–212.
- Centers for Disease Control. (n.d.). *Disability and health inclusion strategies*. Retrieved February 20, 2023, from <https://www.cdc.gov/ncbddd/disabilityandhealth/disability-strategies.html>
- Chatterjee, L., & Mitra, M. (1998). Evolution of federal and state policies for persons with disability in the United States: Efficiency and welfare impacts. *The Annals of Regional Science*, 32(3), 347–365. <https://doi.org/10.1007/s001680050078>
- Chiu, Y.-C. J., Chang, H.-Y. V., Johnston, A., Nascimento, M., Herbert, J. T., & Niu, X. M. (2019). Impact of disability services on academic achievement among college students with disabilities. *Journal of Postsecondary Education and Disability*, 32(3), 227–245.
- Cibrian, F. L., Monteiro, E., Ankrah, E., Beltran, J. A., Tavakoulnia, A., Schuck, S. E. B., Hayes, G. R., & Lakes, K. D. (2021). Parents’ perspectives on a smartwatch intervention for children with ADHD: Rapid deployment and feasibility evaluation of a pilot intervention to support distance learning during COVID-19. *PLOS ONE*, 16(10), e0258959.  
<https://doi.org/10.1371/journal.pone.0258959>

- Cilesiz, S. (2011). A phenomenological approach to experiences with technology: Current state, promise, and future directions for research. *Educational Technology Research and Development*, 59(4), 487–510.
- Clouder, L., Karakus, M., Cinotti, A., Ferreyra, M. V., Fierros, G. A., & Rojo, P. (2020). Neurodiversity in higher education: A narrative synthesis. *Higher Education*, 80(4), 757–778. <https://doi.org/10.1007/s10734-020-00513-6>
- Couzens, D., Poed, S., Kataoka, M., Brandon, A., Hartley, J., & Keen, D. (2015). Support for students with hidden disabilities in universities: A case study. *International Journal of Disability, Development and Education*, 62(1), 24–41. <https://doi.org/10.1080/1034912X.2014.984592>
- Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). SAGE Publications.
- Cumming, T. M., & Rose, M. C. (2022). Exploring universal design for learning as an accessibility tool in higher education: A review of the current literature. *The Australian Educational Researcher*, 49(5), 1025–1043. <https://doi.org/10.1007/s13384-021-00471-7>
- De Los Santos, S. B., Kupczynski, L., & Mundy, M.-A. (2019). Determining academic success in students with disabilities in higher education. *International Journal of Higher Education*, 8(2), 16–38.
- Edwards, M., Poed, S., Al-Nawab, H., & Penna, O. (2022). Academic accommodations for university students living with disability and the potential of universal design to address their needs. *Higher Education*. <https://doi.org/10.1007/s10734-021-00800-w>

- Farrelly, T., & Baker, N. (2023). Generative Artificial Intelligence: Implications and considerations for higher education practice. *Education Sciences*, 13(11), Article 11. <https://doi.org/10.3390/educsci13111109>
- Fernández-Batanero, J. M., Montenegro-Rueda, M., Fernández-Cerero, J., & García-Martínez, I. (2022). Assistive technology for the inclusion of students with disabilities: A systematic review. *Educational Technology Research and Development*, 70(5), 1911–1930. <https://doi.org/10.1007/s11423-022-10127-7>
- Fingal, D. (2021, October 4). *6 things every educator should know about digital equity*. ISTE. <https://www.iste.org/explore/Lead-the-way/5-things-every-educator-should-know-about-digital-equity>
- Fleet, C., & Kondrashov, O. (2019). Universal design on university campuses: A literature review. *Exceptionality Education International*, 29(1), Article 1.
- Fornauf, B. S., & Erickson, J. D. (2020). Toward an inclusive pedagogy through Universal Design for Learning in higher education: A review of the literature. *Journal of Postsecondary Education and Disability*, 33(2), 183–199.
- Francis, G. L., Duke, J. M., Fujita, M., & Sutton, J. C. (2019). “It’s a constant fight:” Experiences of college students with disabilities. *Journal of Postsecondary Education and Disability*, 32(3), 247–262.
- Friedensen, R., Lauterbach, A., Kimball, E., & Mwangi, C. G. (2021). Students with high-incidence disabilities in STEM: Barriers encountered in postsecondary learning environments. *Journal of Postsecondary Education and Disability*, 34(1), 77–90.
- Gabel, S. L. (2010). A disability studies framework for policy activism in postsecondary education. *Journal of Postsecondary Education and Disability*, 23(1), 63–71.

- Ghanouni, P., Jarus, T., Zwicker, J. G., & Lucyshyn, J. (2020). The use of technologies among individuals with autism spectrum disorders: Barriers and challenges. *Journal of Special Education Technology*, 35(4), 286–294. <https://doi.org/10.1177/0162643419888765>
- Griful-Freixenet, J., Struyven, K., Verstichele, M., & Andries, C. (2017). Higher education students with disabilities speaking out: Perceived barriers and opportunities of the Universal Design for Learning framework. *Disability & Society*, 32(10), 1627–1649. <https://doi.org/10.1080/09687599.2017.1365695>
- Hosking, D. L. (2008). *Critical disability theory* [Paper presentation]. 4th Biennial Disability Studies Conference, Lancaster, England, United Kingdom. [https://www.lancaster.ac.uk/fass/events/disabilityconference\\_archive/2008/papers/hosking2008.pdf](https://www.lancaster.ac.uk/fass/events/disabilityconference_archive/2008/papers/hosking2008.pdf)
- Hutcheon, E. J., & Wolbring, G. (2012). Voices of “disabled” post secondary students: Examining higher education “disability” policy using an ableism lens. *Journal of Diversity in Higher Education*, 5(1), 39–49. <https://doi.org/10.1037/a0027002>
- Ingavélez-Guerra, P., Robles-Bykbaev, V., Teixeira, A., Otón-Tortosa, S., & Hilera, J. R. (2022). Accessibility challenges in OER and MOOC: MLR analysis considering the pandemic years. *Sustainability*, 14(6), Article 6. <https://doi.org/10.3390/su14063340>
- Jdaitawi, M. T., & Kan'an, A. F. (2022). A decade of research on the effectiveness of augmented reality on students with special disability in higher education. *Contemporary Educational Technology*, 14(1), ep332. <https://doi.org/10.30935/cedtech/11369>
- Johnson, M. W., & Abumeeiz, S. (2023). The limits of inclusion in open access: Accessible access, Universal Design, and open educational resources. *Journal of Librarianship and Scholarly Communication*, 11(1). <https://doi.org/10.31274/jlsc.14399>

- Kim, M. M., & Kutscher, E. L. (2021). College students with disabilities: Factors influencing growth in academic ability and confidence. *Research in Higher Education*, 62(3), 309–331. <https://doi.org/10.1007/s11162-020-09595-8>
- Ko, S., & Petty, L. S. (2022). Assistive technology accommodations for post-secondary students with mental health disabilities: A scoping review. *Disability & Rehabilitation: Assistive Technology*, 17(7), 760–766. <https://doi.org/10.1080/17483107.2020.1815087>
- Koh, J. H. L., & Kan, R. Y. P. (2021). Students' use of learning management systems and desired e-learning experiences: Are they ready for next generation digital learning environments? *Higher Education Research & Development*, 40(5), 995–1010. <https://doi.org/10.1080/07294360.2020.1799949>
- Kuder, S. J., & Accardo, A. (2018). What works for college students with autism spectrum disorder. *Journal of Autism and Developmental Disorders*, 48(3), 722–731. <https://doi.org/10.1007/s10803-017-3434-4>
- Kutscher, E. L., & Tuckwiller, E. D. (2019). Persistence in higher education for students with disabilities: A mixed systematic review. *Journal of Diversity in Higher Education*, 12(2), 136–155. <https://doi.org/10.1037/dhe0000088>
- Lazar, J. (2022). Managing digital accessibility at universities during the COVID-19 pandemic. *Universal Access in the Information Society*, 21(3), 749–765. <https://doi.org/10.1007/s10209-021-00792-5>
- Lee, O. E., Kim, S. Y., & Gezer, T. (2021). Factors associated with online learning self-efficacy among students with disabilities in higher education. *American Journal of Distance Education*, 35(4), 293–306. <https://doi.org/10.1080/08923647.2021.1979344>

- Lewis, E. (2021). Best practices for improving the quality of the online course design and learners experience. *Journal of Continuing Higher Education*, 69(1), 61–70.  
<https://doi.org/10.1080/07377363.2020.1776558>
- Liasidou, A. (2014). Critical disability studies and socially just change in higher education. *British Journal of Special Education*, 41(2), 120–135.
- Lindsay, S., Cagliostro, E., & Carafa, G. (2018). A systematic review of barriers and facilitators of disability disclosure and accommodations for youth in post-secondary education. *International Journal of Disability, Development and Education*, 65(5), 526–556.  
<https://doi.org/10.1080/1034912X.2018.1430352>
- Liu, H., Moparthy, D., Angrave, L., Amos, J. R., Dalpiaz, D., Vogiatzis, C., Varadhan, S., Huang, Y., & Reck, R. M. (2022). Understanding the needs of students with and without disabilities for inclusive UDL-based design of Engineering courses through learning management systems. *ASEE Annual Conference and Exposition, Conference Proceedings*.  
<http://www.scopus.com/inward/record.url?scp=85138294351&partnerID=8YFLogxK>
- Lopez-Gavira, R., Moriña, A., & Morgado, B. (2021). Challenges to inclusive education at the university: The perspective of students and disability support service staff. *Innovation: The European Journal of Social Sciences*, 34(3), 292–304.  
<https://doi.org/10.1080/13511610.2019.1578198>
- Madaus, J. W. (2011). The History of Disability Services in higher education. *New Directions for Higher Education*, 2011(154), 5–15. <https://doi.org/10.1002/he.429>
- Malcolm, M. P., & Roll, M. C. (2017a). Assistive technology outcomes in post-secondary students with disabilities: The influence of diagnosis, gender, and class-level. *Disability*

& *Rehabilitation: Assistive Technology*, 12(8), 857–867.

<https://doi.org/10.1080/17483107.2016.1277794>

Malcolm, M. P., & Roll, M. C. (2017b). The impact of assistive technology services in post-secondary education for students with disabilities: Intervention outcomes, use-profiles, and user-experiences. *Assistive Technology*, 29(2), 91–98.

<https://doi.org/10.1080/10400435.2016.1214932>

Martiniello, N., Asuncion, J., Fichten, C., Jorgensen, M., Havel, A., Harvison, M., Legault, A., Lussier, A., & Vo, C. (2020). Artificial intelligence for students in postsecondary education: A world of opportunity. *AI Matters*, 6(3), 17–29.

<https://doi.org/10.1145/3446243.3446250>

McNicholl, A., Casey, H., Desmond, D., & Gallagher, P. (2021). The impact of assistive technology use for students with disabilities in higher education: A systematic review. *Disability and Rehabilitation: Assistive Technology*, 16(2), 130–143.

<https://doi.org/10.1080/17483107.2019.1642395>

McNicholl, A., Desmond, D., & Gallagher, P. (2023). Assistive technologies, educational engagement and psychosocial outcomes among students with disabilities in higher education. *Disability and Rehabilitation: Assistive Technology*, 18(1), 50–58.

<https://doi.org/10.1080/17483107.2020.1854874>

Meekosha, H., & Shuttleworth, R. (2009). What's so 'critical' about critical disability studies? *Australian Journal of Human Rights*, 15(1), 47–75.

<https://doi.org/10.1080/1323238X.2009.11910861>

Merriam, S. B., & Tisdell, E. J. (2015). *Qualitative research: A guide to design and implementation* (Fourth edition.). John Wiley & Sons.

- Miskovic, M., & Gabel, S. L. (2012). When numbers don't add up and words can't explain: Challenges in defining disability in higher education. *International Journal of Multiple Research Approaches*, 6(3), 233–244.
- Mole, H. (2013). A US model for inclusion of disabled students in higher education settings: The social model of disability and Universal Design. *Widening Participation and Lifelong Learning*, 14(3), 62–86. <https://doi.org/10.5456/WPLL.14.3.62>
- Moon, J., & Park, Y. (2021). A scoping review on open educational resources to support interactions of learners with disabilities. *International Review of Research in Open and Distributed Learning*, 22(2), 314–341. <https://doi.org/10.19173/irrodl.v22i1.5110>
- Moriña, A., & Biagiotti, G. (2022). Academic success factors in university students with disabilities: A systematic review. *European Journal of Special Needs Education*, 37(5), 729–746. <https://doi.org/10.1080/08856257.2021.1940007>
- Moustakas, C. (1994). *Phenomenological Research Methods* (1st ed.). SAGE Publications, Incorporated.
- Munguia, P., Cheong, C., Cheong, F., & Gharaie, E. (2020). Exploratory variations in course structure consistency within the learning management system. In *Tertiary Education in a Time of Change: Disruptions, Challenges and Strategies* (p. 111). Springer Singapore. [https://doi.org/10.1007/978-981-15-5883-2\\_8](https://doi.org/10.1007/978-981-15-5883-2_8)
- National Center for Education Statistics. (2018). *Fast facts: Students with disabilities*. National Center for Education Statistics. Retrieved November 16, 2022, from <https://nces.ed.gov/fastfacts/display.asp?id=60>
- National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research. (1979). *The Belmont report: Ethical principles and guidelines for the*



*protection of human subjects of research*. U.S. Department of Health and Human Services. <https://www.hhs.gov/ohrp/regulations-and-policy/belmont-report/read-the-belmont-report/index.html>

- Newman, L. A., Madaus, J. W., Lalor, A. R., & Javitz, H. S. (2021). Effect of accessing supports on higher education persistence of students with disabilities. *Journal of Diversity in Higher Education*, 14(3), 353–363. <https://doi.org/10.1037/dhe0000170>
- Oliver, M. (1986). Social Policy and Disability: Some theoretical issues. *Disability, Handicap & Society*, 1(1), 5–17. <https://doi.org/10.1080/02674648666780021>
- Pearson, V., Lister, K., McPherson, E., Gallen, A.-M., Davies, G., Colwell, C., Bradshaw, K., Braithwaite, N., & Collins, T. (2019). Embedding and sustaining inclusive practice to support disabled students in online and blended learning. *Journal of Interactive Media in Education*, 2019(1).
- Perera-Rodríguez, V. H., & Moriña Díez, A. (2019). Technological challenges and students with disabilities in higher education. *Exceptionality*, 27(1), 65–76. <https://doi.org/10.1080/09362835.2017.1409117>
- Perifanou, M., & Economides, A. A. (2023). Analyzing repositories of OER using web analytics and accessibility tools. *Universal Access in the Information Society*, 22(4), 1243–1257. <https://doi.org/10.1007/s10209-022-00907-6>
- Pontikas, C. M., Tsoukalas, E., & Serdari, A. (2020). A map of assistive technology educative instruments in neurodevelopmental disorders. *Disability and Rehabilitation: Assistive Technology*, 0(0), 1–9. <https://doi.org/10.1080/17483107.2020.1839580>

- Procknow, G., Rocco, T. S., & Munn, S. L. (2017). (Dis)ableing notions of authentic leadership through the lens of critical disability theory. *Advances in Developing Human Resources*, 19(4), 362–377. <https://doi.org/10.1177/1523422317728732>
- Raffoul, S., & Jaber, L. (2023). Text-to-speech software and reading comprehension: The impact for students with learning disabilities. *Canadian Journal of Learning and Technology / Revue Canadienne de l'apprentissage et de La Technologie*, 49(2), 1–18. <https://doi.org/10.21432/cjlt28296>
- Ravitch, S. M., & Riggan, M. (2017). *Reason & rigor: How conceptual frameworks guide research*. SAGE Publications.
- Reardon, K., Bromley, K. W., & Unruh, D. (2021). The promise of Universal Design in postsecondary education: A literature review. *Journal of Postsecondary Education and Disability*, 34(3), 209–221.
- Rocco, T. S. (2005). *From disability studies to critical race theory: Working towards critical disability theory* [Paper presentation]. Adult Education Research Conference, Athens, Georgia, United States. <https://newprairiepress.org/cgi/viewcontent.cgi?article=2685&context=aerc>
- Rocco, T. S., & Delgado, A. (2011). Shifting lenses: A critical examination of disability in adult education. *New Directions for Adult and Continuing Education*. <https://doi.org/10.1002/ace.426>
- Rogers-Shaw, C., Park, T. W., & Mohny, K. D. (2023). Strategies for supporting learners with disabilities in postsecondary education. *New Horizons in Adult Education and Human Resource Development*, 35(4), 199–207. <https://doi.org/10.1177/19394225231189136>

Römhild, A., & Holleder, A. (2023). Effects of disability-related services, accommodations, and integration on academic success of students with disabilities in higher education. A scoping review. *European Journal of Special Needs Education*.

<https://doi.org/10.1080/08856257.2023.2195074>

Seale, J., Colwell, C., Coughlan, T., Heiman, T., Kaspi-Tsahor, D., & Olenik-Shemesh, D. (2021). ‘Dreaming in colour’: Disabled higher education students’ perspectives on improving design practices that would enable them to benefit from their use of technologies. *Education and Information Technologies*, 26(2), 1687–1719.

<https://doi.org/10.1007/s10639-020-10329-7>

Shakespeare, T. (2006). The social model of disability. In *The Disability Studies Reader* (2nd ed., pp. 197–204).

Shpigelman, C. N., Mor, S., Sachs, D., & Schreuer, N. (2022). Supporting the development of students with disabilities in higher education: Access, stigma, identity, and power. *Studies in Higher Education*, 47(9), 1776–1791.

<https://doi.org/10.1080/03075079.2021.1960303>

Smith, J. A., Flowers, P., & Larkin, M. (2022). *Interpretative phenomenological analysis: Theory, method and research* (Second edition.). Sage Publications Ltd.

Smith, S. A., Woodhead, E., & Chin-Newman, C. (2021). Disclosing accommodation needs: Exploring experiences of higher education students with disabilities. *International Journal of Inclusive Education*, 25(12), 1358–1374.

<https://doi.org/10.1080/13603116.2019.1610087>

Stentiford, L., & Koutsouris, G. (2021). What are inclusive pedagogies in higher education? A systematic scoping rev... *Studies in Higher Education*, 46(11), 2245–2261.

- Turnbull, D., Chugh, R., & Luck, J. (2020). Learning management systems, an overview. In A. Tatnall (Ed.), *Encyclopedia of Education and Information Technologies* (pp. 1052–1058). Springer International Publishing. [https://doi.org/10.1007/978-3-030-10576-1\\_248](https://doi.org/10.1007/978-3-030-10576-1_248)
- Zdravkova, K., Dalipi, F., & Krasniqi, V. (2022). Remote education trajectories for learners with special needs during the Covid-19 outbreak: An accessibility analysis of the learning platforms. *International Journal: Emerging Technologies in Learning*, 17(21), 89–122.
- Zhang, X., Tlili, A., Nascimbeni, F., Burgos, D., Huang, R., Ting-Wen, C., Jemni, M., & Khribi, M. K. (2020). Accessibility within open educational resources and practices for disabled learners: A systematic literature review. *Smart Learning Environments*, 7(1), 1–19. <https://doi.org/10.1186/s40561-019-0113-2>

APPENDIX A  
RECRUITMENT EMAIL

Dear XX,

I am currently a doctoral student at the University of New England. I am conducting a study titled *Technology Barriers Experienced by Students with Disabilities in Higher Education* and am seeking participants for my dissertation. The purpose of this research study is to explore the lived experiences and perceptions of college students with disabilities related to the use of technology to pursue post-secondary education. I am seeking 10 participants to participate in my doctoral research study.

You are eligible to participate in this study if you are:

- Age 18 or over
- Currently enrolled, at least part-time, as an active degree-seeking student at [Community College of Vermont OR Vermont State University].
- Have completed at least one semester
- Have at least one disability, with either official medical diagnosis or self-diagnosis
- Have no current or previous relationship with the researcher

Participation in this research is voluntary. Participation will consist of one recorded interview of approximately 60 minutes. The interview will be conducted on Zoom at a time of your convenience. If there are more than 10 people who express interest, only the first 10 will be selected to interview. All data will be kept confidential, and pseudonyms will be used to protect the identities of respondents. All identifying information, including school names, students, staff, and locations will be deidentified

Please review the attached Participant Information Sheet which outlines the specific details of this study including confidentiality and privacy measures.

If you are interested in sharing your experience with the lived experiences and perceptions of college students with disabilities related to the use of technology to pursue post-secondary education, please contact me via email at [mwalz1@une.edu](mailto:mwalz1@une.edu) and we can set up a time for an interview over Zoom.

In appreciation for your time and contribution, compensation of a \$25 VISA gift card will be offered to those who complete the interview.

If you would like additional information or have any questions, please reach out to me at the above-listed email.

Thank you for your consideration of participation in this study.

Sincerely,

Meg Walz  
Doctoral Student  
University of New England  
mwalz1@une.edu

## APPENDIX B

## PARTICIPANT INFORMATION SHEET



INNOVATION FOR A HEALTHIER PLANET

Office of Research Integrity  
Institutional Review Board

### Participant Information Sheet

Version Date:	11/30/2023
IRB Project #:	0923-19
Title of Project:	Understanding the Technology Barriers Experienced by Students with Disabilities in Higher Education
Principal Investigator (PI):	Meg Walz
PI Contact Information:	mwalz1@une.edu

#### INTRODUCTION

- This is a project being conducted for research purposes. Your participation is completely voluntary.
- The intent of the Participant Information Sheet is to provide you with important details about this research project.
- You are encouraged to ask any questions about this research project, now, during or after the project is complete.
- The use of the word 'we' in the Information Sheet refers to the Principal Investigator and/or other research staff.

#### WHAT IS THE PURPOSE OF THIS PROJECT?

The purpose of this research study is to explore the lived experiences and perceptions of college students with disabilities related to the use of technology to pursue postsecondary education. This study is being conducted as research for a doctoral dissertation, and 15 participants will take part in the project.

#### WHY ARE YOU BEING ASKED TO PARTICIPATE IN THIS PROJECT?

You are being asked to participate in this research project because:

- Age 18 or older
- Currently enrolled, at least part-time, as an active degree-seeking student at [Community College of Vermont OR Vermont State University].
- Have completed at least one semester
- Have at least one disability, with either official medical diagnosis or self-diagnosis
- Have no current or previous relationship with the researcher

#### WHAT IS INVOLVED IN THIS PROJECT?

To participate in this research, you will be asked to do the following things:

- You will be asked to participate in one semi structured interview with the principal investigator that will last approximately 60 minutes over Zoom.
- You can choose a pseudonym to be used in place of your name for the study.
- You will be given the opportunity to leave your camera on or off during the interview, and your interview will be recorded using Zoom.

For IRB Office Use Only – Do Not Alter or Delete  
RES-T-001; Rev 1; Effective Date: 11/14/2022



INNOVATION FOR A HEALTHIER PLANET

Office of Research Integrity  
Institutional Review Board

- You will be emailed a copy of your interview transcript to review for accuracy. You will have five calendar days to respond or the PI will assume that you have no comments and the transcript will assumed to be accurate.

**WHAT ARE THE POSSIBLE RISKS OR DISCOMFORTS INVOLVED FROM BEING IN THIS PROJECT?**

The risks involved with participation in this research project are minimal and may include invasion of privacy or breach of confidentiality. We will use pseudonyms for each participant and eliminate any identifying information from the study. You will have the opportunity to review your transcript for accuracy and will be given the choice to have your camera off during the interview. You will have the right to skip or not answer any question, for any reason.

Your decision to engage/not engage in this research project will have no effect on your academic status, class grade(s), or relationship with any instructor(s).

Please see the "WHAT ABOUT PRIVACY & CONFIDENTIALITY?" section below for steps we will take to minimize an invasion of privacy or breach of confidentiality from occurring.

**WHAT ARE THE POSSIBLE BENEFITS FROM BEING IN THIS PROJECT?**

There are no likely benefits to you by being in this research project; however, the information we collect may help us understand technology use by students with disabilities in pursuit of their college education.

**WILL YOU BE COMPENSATED FOR BEING IN THIS PROJECT?**

Compensation of \$25 VISA gift card will be emailed to those who complete the interview.

**WHAT ABOUT PRIVACY AND CONFIDENTIALITY?**

We will do our best to keep your personal information private and confidential. However, we cannot guarantee absolute confidentiality. Your personal information may be disclosed if required by law. Additionally, your information in this research project could be reviewed by representatives of the University, such as the Office of Research Integrity and/or the Institutional Review Board.

The results of this research project may be shown at meetings or published in journals to inform other professionals. If any papers or talks are given about this research, your name will not be used. We may use data from this research project that has been permanently stripped of personal identifiers in future research without obtaining your consent.

The following additional measures will be taken to protect your privacy and confidentiality:

- Data will only be collected during one on one participant interviews using Zoom, no information will be taken without your consent, and transcribed interviews will be checked by you for accuracy before they are added to the study.
- Pseudonyms will be used for all participants and any personally identifying information will be stripped from the interview transcript.
- All names and e-mails gathered during recruitment will be recorded and linked to a uniquely assigned pseudonym within a master list.

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RES-T-001; Rev 1; Effective Date: 11/14/2022





INNOVATION FOR A HEALTHIER PLANET

- The master list will be kept securely and separately from the study data and accessible only to the principal investigator.
- The interview will be conducted in a private setting to ensure others cannot hear your conversation.
- You will be given the option to turn off your camera during Zoom interview.
- After you have verified the accuracy of your transcribed interview the recorded Zoom interview will be destroyed. Once all transcripts have been verified by the participants of this project, the master list of personal information will be destroyed.
- All other study data will be retained on record for 3 years after the completion of the project and then destroyed. The study data may be accessed upon request by representatives of the University (e.g., faculty advisors, Office of Research Integrity, etc.) when necessary.
- All data collected will be stored on a password protected personal laptop computer accessible only by the principal investigator.

#### WHAT IF YOU WANT TO WITHDRAW FROM THIS PROJECT?

You have the right to choose not to participate, or to withdraw your participation at any time until the Master List is destroyed without penalty or loss of benefits. You will not be treated differently if you decide to stop taking part in this project.

If you request to withdraw from this project, the data collected about you will be deleted when the master list is in existence, but the researcher may not be able to do so after the master list is destroyed.

#### WHAT IF YOU HAVE QUESTIONS ABOUT THIS PROJECT?

You have the right to ask, and have answered, any questions you may have about this research project. If you have questions about this project, complaints or concerns, you should contact the Principal Investigator listed on the first page of this document.

#### WHAT IF YOU HAVE QUESTIONS ABOUT YOUR RIGHTS AS A RESEARCH PARTICIPANT?

If you have questions or concerns about your rights as a research participant, or if you would like to obtain information or offer input, you may contact the Office of Research Integrity at (207) 602-2244 or via e-mail at [irb@une.edu](mailto:irb@une.edu).

## APPENDIX C

## INTERVIEW PROTOCOL

## Interview Questions

1. Can you tell me about any devices, like a laptop, tablet or smartphone, that you use to participate in your courses and complete your coursework?
2. Can you tell me about any accessibility features you use on those devices, if any? These include text-to-speech, keyboard shortcuts, contrast modifications, or alternate input methods.
3. Can you tell me about your experience accessing your digital course materials from Canvas?
4. What challenges have you encountered when trying to access digital course materials?
5. How would you describe the overall accessibility of digital course materials provided by your instructors?
6. Have you encountered any specific barriers or limitations while accessing digital course materials? If so, can you provide some examples?
7. In what ways do you feel the accessibility of digital course materials could be improved for students with disabilities?
8. Have you found any strategies or tools that have helped you overcome challenges in accessing digital course materials?
9. What types of support do you currently receive in using technology for your courses and coursework?
10. How well do you think the faculty and staff understand the specific technology and accessibility needs of students with disabilities?
11. Are there any specific technologies or assistive devices that have been particularly helpful for you in your coursework?
12. Can you share any examples of technologies or digital tools that have contributed to your success in your academic pursuits as a student with disabilities?
13. How have these technologies specifically helped you in your studies?
14. Have you encountered any barriers or challenges while using technology in your academic pursuits? If so, can you provide some examples?
15. How would you describe the overall impact of technology on your academic achievements as a student with disabilities?
16. Are there any specific technologies that you believe would further enhance your success in your academic pursuits?

Version date 10/16/23

IRB # 0923-19

## APPENDIX D

## IRB EXEMPTION LETTER AND AMENDMENT



Office of Research Integrity  
Institutional Review Board

Biddeford Campus  
11 Hills Beach Road  
Biddeford, ME 04005  
(207) 602-2244 T  
(207) 602-5905 F

Portland Campus  
716 Stevens Avenue  
Portland, ME 04103

**DATE OF LETTER:** October 16, 2023

**PRINCIPAL INVESTIGATOR:** Meg Walz  
**FACULTY ADVISOR:** Megan Williams, EdD, CIP

**PROJECT NUMBER:** 0923-19  
**RECORD NUMBER:** 0923-19-01

**PROJECT TITLE:** Understanding the Technology Barriers Experienced by Students with Disabilities in Higher Education

**SUBMISSION TYPE:** New Project  
**SUBMISSION DATE:** September 28, 2023

**ACTION:** Determination of Exempt Status  
**DECISION DATE:** October 16, 2023

**REVIEW CATEGORY:** Exemption Category # 2(ii)

The Office of Research Integrity has reviewed the materials submitted in connection with the above-referenced project and has determined that the proposed work is exempt from IRB review and oversight as defined by 45 CFR 46.104.

You are responsible for conducting this project in accordance with the approved study documents, and all applicable UNE policies and procedures.

**If any changes to the design of the study are contemplated (e.g., revision to the research proposal summary, data collection instruments, and/or other approved study documents), the Principal Investigator must submit an amendment for review to ensure the requested change(s) will not alter the exempt status of the project.**

If you have any questions, please send an e-mail to [irb@une.edu](mailto:irb@une.edu) and reference the project number as specified above within the correspondence.

Best Regards,

Bob Kennedy, MS  
Director of Research Integrity



Office of Research Integrity  
Institutional Review Board

Biddeford Campus  
11 Hills Beach Road  
Biddeford, ME 04005  
(207) 602-2244 T  
(207) 602-5905 F

Portland Campus  
716 Stevens Avenue  
Portland, ME 04103

**DATE OF LETTER:** November 30, 2023

**PRINCIPAL INVESTIGATOR:** Meg Walz  
**FACULTY ADVISOR:** Megan Williams, EdD, CIP

**PROJECT NUMBER:** 0923-19  
**RECORD NUMBER:** 0923-19-02  
**REVIEW TYPE:** Administrative

**PROJECT TITLE:** Understanding the Technology Barriers Experienced by Students with Disabilities in Higher Education

**SUBMISSION TYPE:** Amendment  
**SUBMISSION DATE:** November 30, 2023

**DECISION:** Acknowledged  
**DECISION DATE:** November 30, 2023

The Office of Research Integrity has reviewed the materials submitted in connection with the above-referenced amendment and has acknowledged this submission. No further action is required at this time.

The changes requested as part of this amendment include the following:

- The study team has increased enrollment target # from 10 to 15. Study documents have been updated accordingly.

If you have any questions, please send an e-mail to [irb@une.edu](mailto:irb@une.edu) and reference the project number specified above within the correspondence.

Best Regards,

Bob Kennedy, MS  
Director of Research Integrity