

The Blind Leading the Blind: Increasing Blind & Low-Vision Participation in Interactive Design

by **Adam Rallo** RGD

Submitted to OCAD University in partial fulfillment of the requirements
for the degree of Master of Design in Inclusive Design.

Toronto, Ontario, Canada, December 2023

© Adam Rallo, 2023

Author's Declaration

I hereby declare that I am the sole author of this MRP. This is a true copy of the MRP, including any required final revisions, as accepted by my examiners.

I authorize OCAD University to lend this MRP to other institutions or individuals for the purpose of scholarly research.

I understand that my MRP may be made electronically available to the public.

I further authorize OCAD University to reproduce this MRP by photocopying or by other means, in total or in part, at the request of other institutions or individuals for the purpose of scholarly research.

A handwritten signature in black ink, appearing to read 'AR', with a stylized flourish at the end.

Adam Rallo RGD

Abstract

There is global concern that the migration of commerce, communications, and other services to the Internet may be marginalizing blind & low-vision individuals. Current efforts to ensure interactive accessibility are commonly based in legislating WCAG 2.0 compliance, yet there is growing evidence that this approach has limited effectiveness. Research with disabled designers has asserted that better solutions to accessibility problems will come from disabled designers themselves. There is little research on blind & low-vision individuals studying or working as Interactive Designers, and the available research is mostly through related fields such as the Computer Sciences and Web Development. In order to build on this research, an exploratory study was undertaken with blind & low-vision adults who had experience and/or interest in Interactive Design education & training. Eight individuals were interviewed and asked about the barriers they had faced, and how they would envision an ideal Interactive Design education. Reported barriers included finances & funding, finding suitable training programs, post-secondary pre-requisites, institutional readiness, hardware & software tools, teacher competence, attitudes & ideology, and 'the burden' of needing to constantly act as advocates for themselves, and the emotional, mental, and physical toll this takes. Participants' input was synthesized into a series of considerations aimed at Interactive Design training program administrators, teachers, and other personnel. Further research will be necessary to test the efficacy of these considerations, as well as to better discern the degree to which the reported barriers and recommendations are exclusive to or disproportionate to Interactive Design education & training.

Acknowledgements

Thank-you to *Jutta Treviranus* for her open-minded encouragement, to *Dr. Peter Coppin* for practical advice and going above and beyond, to *Richard Hunt* for his endless faith and insightful edits, and to *Grazyna Antoszek*, for her panoptic proof-reading.

Dedication

To *Ena*.

Table of Contents

I.	Introduction	1
I.0	Definitions	1
I.0.1	Interactive Design	1
I.0.2	Blind & low-vision	1
I.1	Background	2
I.1.0	Legislating Accessible Design	2
I.1.1	Design Schools & Training	3
I.1.2	Interactive Design Literature	4
2.	Related Work	7
2.0	Computers, Design, Blind & Low-Vision Individuals	7
2.0.0	Affordance	7
2.0.1	Ability	7
2.0.2	Desire	9
2.0.3	Direct Effects	10
2.0.4	Indirect Effect	11
2.0.5	Under-representation	12
2.1	Barriers	12
2.1.1	The Elephant in the Room	13
2.1.2	Attitudes & Assumptions	14
2.1.3	Teacher Competence	15
2.1.4	Curriculum & Learning Materials	16

2.1.5	Inadequate Tools	17
2.1.6	A Lack of Information	19
2.1.7	Being Setup to Fail	20
2.1.8	Summation	20

3.	Methods	22
----	----------------	----

3.0	Theoretical Positioning	22
-----	-------------------------	----

3.1	Interview Question Development	23
-----	--------------------------------	----

3.2	Participants	23
-----	---------------------	----

3.2.0	Participant Selection Criteria	23
-------	--------------------------------	----

3.2.1	Recruitment	24
-------	-------------	----

3.2.2	Participant Selection	25
-------	-----------------------	----

3.3	Interview Process	25
-----	-------------------	----

4.	Findings	28
----	-----------------	----

4.0	Participant Backgrounds	28
-----	--------------------------------	----

4.0.1	Design, Technology, & Certification	29
-------	-------------------------------------	----

4.0.2	Motivations & Goals	33
-------	---------------------	----

4.1	Design has a Public Relations problem	38
-----	---------------------------------------	----

4.2	Finances & Funding	41
-----	-------------------------------	----

4.2.1	Higher Financial Burdens	42
-------	--------------------------	----

4.2.2	Higher Financial Risk	44
-------	-----------------------	----

4.2.3	Lack of Relevant Supports	45
-------	---------------------------	----

4.3	Finding a Suitable Education or Training Program	46
4.3.1	Location	48
4.3.2	Lack of Clarity & Certainty of Accommodations	49
4.3.4	One Theory of the Problem	51
4.4	Post-Secondary Pre-Requisites	52
4.4.1	Lack of Recognition of the Value of Lived Experience	54
4.5	Institutional Readiness	55
4.4.1	Problem-a-thons & Intensive Suffering	57
4.4.2	Lack of Physical Functional Diversity	60
4.4.3	Words Versus Actions	61
4.6	Hardware & Software	61
4.6.1	Technology Platform Diversity	63
4.6.2	Text-Based Workflows	65
4.6.3	Industry-Standard Inaccessibility	65
4.6.4	Individual Diversity	66
4.7	Teacher Competence	69
4.7.1	Orthodox Inflexibility	70
4.7.2	Learning Materials & Lesson Plans	71
4.7.3	Tasks & Timing	73
4.8	Attitudes & Ideology	74
4.8.1	Underlying Biases	75
4.8.2	Self-Attitudes	76
4.8.3	Social Service Ideology	77
4.8.4	The Soft Bigotry of Low Expectations	77

4.9	The Burden	79
4.9.1	The Toll of Constant Advocacy	81
4.9.2	Feeling Like an Inconvenience	81
4.9.3	Denied & Discarded	83
4.9.4	Hiding Disability or Health	84
4.9.5	A Lack of Compliance & Enforcement	86
4.10	Ideal Interactive Design Education & Training	87
4.10.1	Design Education & Industry Messaging	87
4.10.2	Financing	88
4.10.3	Integration & Group work	88
4.10.4	Training People	90
4.10.5	Preparing Learning Materials	96
4.10.6	In the Classroom	99
4.10.7	Technology, Innovation & Invention	102
5.	Discussion	106
<hr/>		
5.0	Analysis	106
5.0.1	Insidious Effect	107
5.0.2	Moving Ahead	108
5.1	Considerations	110
5.1.0	Recruitment Considerations	110
5.1.1	Financial Considerations	110
5.1.2	Program Delivery & Scheduling Considerations	111
5.1.3	Program Desirability	112
5.1.4	Admissions & Pre-Enrolment	112

5.2	Facilities Considerations	114
5.2.1	Campus Considerations	114
5.2.2	Classroom Considerations	114
5.3	Technology Considerations	115
5.3.1	Procurement Considerations	115
5.3.2	Technology Deployment Considerations	116
5.4	Teaching Considerations	117
5.4.1	Mindset	118
5.4.2	Processes, Tools, & Limitations	118
5.4.3	Professional Development	119
5.4.4	Pre-emptive Adaptation	119
5.4.5	Accessible Learning Materials	120
5.4.6	Reliable Consistency	120
5.4.7	Supporting Self-Reliance	121
5.5	<i>Interactive Design</i> Teaching Considerations	121
5.6	Public Relations	123
5.6.1	Communicating Change	123
5.7	Interactive Design	124
6.	Conclusion	126
<hr/>		
7.	Bibliography	128
<hr/>		

8.	Appendices	134
<hr/>		
	Appendix A: Interview Questions	135
	Appendix B: Organizations Contacted for Participant Recruitment	137
	Appendix C: Recruitment Invitation	140
	Appendix D: Screening Questionnaire	142

1. Introduction

1.0 Definitions

1.0.1 **Interactive Design**

The term *Interactive Design* is used throughout this study. This term is used as a catch-all for any discipline that is primarily concerned with the design of Interactive Systems, including but not limited to Graphic Design, Human Computer Interaction (HCI), Interaction Design, Software Development, User-Interface Design, Web Design & Development.

1.0.2 **Blind & low-vision**

The term *blind & low-vision* is used throughout this study, as an umbrella term for any individual who would consider themselves blind. There is no universal definition for the term *blind* or for the term *low-vision*. (Stone & Brown, 2023, p. 65) Most individuals who are blind have some degree of eyesight, with absolute blindness being relatively rare. It may be tempting to think that blindness exists on a spectrum of visual acuity, but that would be misleading. There are many diverse qualitative ways of seeing that make up blindness and low-vision, and individual experiences are often unique. These terms are not being used herein to reference a biological state, but instead a sociological state as defined by Dr. Kenneth Jernigan, president of the National Federation of the Blind (NFB) from 1968 to 1986.

“One is blind to the extent that the individual must devise alternative techniques to do efficiently those things which he would do if he had normal vision. An individual may properly be said to be ‘blind’ or a ‘blind person’ when he has to devise so many alternative techniques—that is, if he is to function efficiently—that his pattern of daily living is substantially altered.”
(Jernigan, 2005)

This definition is consistent with the assessment criteria used by the Canadian National Institute of the Blind (CNIB), who succinctly state:

“You do not need to be legally blind to access services from the CNIB Foundation, Vision Loss Rehabilitation Canada or other CNIB organizations. As soon as your eyesight begins to affect your daily life, you’re eligible.” (CNIB, 2022)

1.1 Background

1.1.0 Legislating Accessible Design

As the world’s commerce, communications, and services increasingly move online, there is growing concern that this migration may be disproportionately marginalizing certain individuals. In recent years, this concern has focused on providing accessibility to individuals with a disability, in particular, blind & low-vision individuals. While the principle of accessibility has been enshrined into laws and human rights codes across many countries and governing bodies, the mechanisms for achieving this goal are limited. (Persson et al., 2015, p. 506)

For jurisdictions that mandate Web or other interactive digital accessibility, the World Wide Web Consortium’s *Web Content Accessibility Guidelines (WCAG) 2.0* are commonly used as the basis for achieving and assessing accessibility. (Persson et al., 2015, p. 517) Argentina, Australia, Canada, China, Denmark, European Union, France, Germany, Hong Kong, India, Ireland, Israel, Italy, Netherlands, New Zealand, Norway, Republic of Korea, Switzerland, Taiwan, United Kingdom, and the United States have all enacted legislation that either explicitly references or is based on the WCAG 2.0 guidelines. (2018)

In the province of Ontario, Canada, the *Accessibility for Ontarians with Disabilities Act (AODA)* includes legislation requiring websites to meet accessibility standards as defined by WCAG 2.0. This goes into full effect in 2024, at which point the WCAG 2.0 will be sixteen years old, having been published as a recommended draft in 2008. The government of Ontario website’s AODA resource titled “Learn how to make new and existing websites accessible for people with disabilities” consists entirely of advice on how to reach WCAG 2.0 compliance. (King’s Printer for Ontario, 2012, p. 1)

There is growing research that indicates that this approach of legislating web and interactive accessibility guidelines compliance falls short of its stated goals.

“The results showed that only 50.4% of the problems encountered by users were covered by Success Criteria in the *Web Content Accessibility Guidelines 2.0* (WCAG 2.0). For user problems that were covered by WCAG 2.0, 16.7% of websites implemented techniques recommended in WCAG 2.0 but the techniques did not solve the problems.” (Power et al., 2012, p. 1)

“...standard-based assessments do not account for the impact of noncompliance on user experience, or on the completeness of the standard in terms of coverage of issues likely to be experienced by people with disabilities. Both these factors may lead to a standards-conformant website that contains significant barriers for people with disabilities.”
(Horton et al., 2015, p. 3)

“Websites complying with accessibility guidelines can be ineffective, inefficient, and unpleasant for blind users.” (Nogueira et al., 2017, p. 86)

“In addition to technical accessibility, there can also be usability issues even when these guidelines are followed. For example, a web page might be WCAG compliant, but still difficult to use through a screen reader.”
(Stefik et al., 2019, p. 768)

More recent research indicates that there is a substantial gap between guidelines conformance, and practical accessibility. While the standards serve as a solid foundation, recommendations are being made for more user-centred participatory design with blind & low-vision individuals. (Vollenwyder et al., 2023, p. 11)

“Knowledge about the needs of people with disabilities comes much more reliably from people with disabilities themselves.” (Ostroff et al., 2002, p. 7)

1.1.1 Design Schools & Training

It is increasingly common for Interactive Design schools and training programs to teach a more accessible and inclusive user-centric design. (Bernardi & Kowaltowski, 2010, p. 382) More recently this includes consideration of users with disabilities. Most students

entering design courses have only minor knowledge of the capabilities of blind & low-vision individuals, but are encouraged to give them consideration in their work. (Bernardi & Kowaltowski, 2010, p. 380) Methods such as *Empathy Exercises* and *Personas* or are sometimes used to help address this lack of knowledge. These role-playing based methods have been found to be inadequate in building a student's sensitivity and ability to create effectively accessible work. (Bernardi & Kowaltowski, 2010, p. 377)

While it is increasingly common for researchers to conclude that the accessibility of Interactive Design must ultimately be evaluated by disabled users, designers with disabilities assert that the best solutions to accessibility problems will only come from including disabled designers themselves. (Power et al., 2012, p. 8) This sentiment is echoed by all twenty designers with a disability who were interviewed by Ostroff, Limont & Hunter. (Ostroff et al., 2002)

“These solutions to accommodate diversity might possibly come slowly from educated non-disabled designers, but the process will be more elegant and coherent when designers with disabilities are involved from the start.”
(Ostroff et al., 2002, p. 7)

1.1.2 Interactive Design Literature

Daniel G. Hunter asserts that, “teaching the techniques and goals of universal or inclusive design in design school programs is an ironic endeavour when design schools themselves are inaccessible, and design professionals see people with disabilities as a user group, rather than as potential peers and colleagues.” (Ostroff et al., 2002, p. 90) A survey of some of the most comprehensive and commonly prescribed books in Interactive Design seem to confirm this assertion. (Cooper et al., 2014) (Goodwin, 2009) (Krug, 2014) (Norman, 2013) (Sharp et al., 2019) While many of these texts advocate the consideration of designing for disability, not one of them advocates for individuals with disabilities becoming designers themselves. Blind & low-vision individuals are most often recognized as special-needs users, if they are recognized at all.

For instance, in the 636-page textbook *Interaction Design: Beyond Human-Computer Interaction* (2019), the authors offer a robust definition of the term “Interaction Design”. (Sharp et al., 2019, pp. 18, 30) A similarly thorough definition is offered in Cooper's

690-page *About Face 4* (2014) (Cooper et al., 2014, p. 21) When reading through these robust definitions, there is very little, if anything in the definition of an Interaction Designer that would necessitate eyesight. Furthermore, Sharp et al. specifically extol the benefits of bringing together multi-disciplined teams of diverse individuals. (Sharp et al., 2019, p. 33)

In *Interaction Design: Beyond Human-Computer Interaction* the authors later offer a definition of Inclusive Design, as well as two methods for achieving accessibility.

“Inclusive design is an over-arching approach where designers strive to make their products and services accommodate the widest possible number of people. An example is ensuring that smartphones are being designed for all and made available to everyone—regardless of their disability, education, age, or income.” (Sharp et al., 2019, p. 38)

“Accessibility can be achieved in two ways: first, through the inclusive design of technology, and second, through the design of assistive technology.” (Sharp et al., 2019, p. 38)

“The Web Content Accessibility Guidelines (WCAG) 1.1 describe how to design websites so that they are accessible.” (Sharp et al., 2019, p. 521)

In Cooper’s *About Face 4* the authors describe a typical accessibility strategy as the “design [of] a separate accessibility mode or set of accessibility options”. (Cooper et al., 2014, pp. 430–432) The text then goes on to describe the use of Accessibility Personas as a method to help achieve this accessible design.

“During the research and modelling phase of your design, as part of your accessibility strategy, you might want to consider creating an accessibility persona to add to your persona set. Naturally, the ideal method of creating this persona would be to interview users or potential users of your product who have disabilities that would affect their use of the product. If this isn’t possible, you can still create a provisional persona to help focus on accessibility issues in a somewhat less targeted way. Typically, an accessibility persona would be considered a secondary persona—someone with needs similar to your primary personas, but with some special needs that must be addressed without compromising their experience.” (Cooper et al., 2014, p. 430)

These texts define “Interaction Design” in such a way as to not necessitate eyesight, and they extol the virtues of diverse teams of designers. Yet they suggest the inclusion of secondary accessibility personas, instead of the inclusion of blind & low-vision designers as a method to achieve inclusive or accessible design. In fact, throughout the 1326 textbook pages there is not even a single allusion to the possibility of designers with a physical disability themselves.

In Krug’s *Don’t Make Me Think, Revisited: A Common Sense Approach to Web Usability* (2014) he emphasizes how important Web Accessibility is to him, and pleads with the reader to take it just as seriously. (Krug, 2014)

“It’s the right thing to do. And not just the right thing; it’s profoundly the right thing to do, because the one argument for accessibility that doesn’t get made nearly often enough is how extraordinarily better it makes some people’s lives.” (Krug, 2014)

He finishes this section on accessibility with the following lament.

“When I wrote this chapter seven years ago (2007), it ended with this:

Hopefully in five years I’ll be able to just remove this chapter and use the space for something else because the developer tools, browsers, screen readers, and guidelines will all have matured and will be integrated to the point where people can build accessible sites without thinking about it.

Sigh.

Hopefully we’ll have better luck this time.” (Krug, 2014)

There seems to be a blind spot where it is argued that blind & low-vision user consideration is essential in Interactive Design, but blind & low-vision designers may as well not exist.

2. Related Work

2.0 Computers, Design, Blind & Low-Vision Individuals

2.0.0 **Affordance**

There is very little published research on blind & low-vision Interactive Designers. The most related research on this subject seems to originate in the Computer Sciences. Emerging opportunities for blind & low-vision individuals working with computer programming was identified in studies as early as 1964. It was hypothesized that computer technology would enable blind & low-vision individuals to work in related fields without handicap. (Sterling et al., 1964, p. 228) As computing changed with the popularization of the Graphical User Interface (GUI) in the 1980s, it was again hypothesized that blind & low-vision individuals may work in related fields without handicap—provided that adequate tools were developed for them. Elkes observed that programmers were constantly developing new tools out of necessity to meet the demands put upon them. These tools were naturally conceived to serve themselves, and as sighted developers they were recursively creating a body of software tools that were inaccessible to blind & low-vision individuals. (Elkes, 1982, p. 15)

2.0.1 **Ability**

In 2004 there was barely any research literature focusing on teaching HCI to blind students, and teachers engaged in the practice had little support. (Chambel et al., 2007, p. 2) Chambel et al. report on their experiences teaching HCI to a classroom of almost two hundred students, including two blind students. While they had been teaching accessibility for many years, they had never before had to consider the accessibility of their teachings.

Most of the topics covered in the course, including those that were much more visually-oriented, were considered understandable by the blind students. Dr. Tony Stockman, a

visually-disabled senior lecturer in the Computer Sciences at Queen Mary University of London, has echoed this sentiment. In his work he “has not found any aspects of HCI that with some effort, and occasional assistance from a sighted person, that he was unable to internally visualize and appreciate.” (Chambel et al., 2007, p. 6) Furthermore, Dr. Stockman asserts:

“I also have not found my blindness has stopped me from being able to make suggestions about how to improve the visual layout or design of things in some cases, providing of course I have a clear understanding of the task and the interface.” (Chambel et al., 2007, p. 7)

McDonald et al. indicated similar findings when running a workshop that included blind & low-vision individuals learning Graphic Design with tactile aids.

“By the end of evaluations, our participant noticed an increased real time understanding of class material and increased emotional satisfaction in the material taught. The participant could follow along with the rest of the class on certain material without feeling behind or lost.”

(McDonald et al., 2014, p. 276)

In a preliminary pilot study, Venkatesh Potluri et al. found that with “minimal training”, blind & low-vision individuals could effectively make meaningful visual edits to webpages, when assisted with a real-time validation system. (Potluri et al., 2019, p. 612) Jiasheng Li et al. had similar findings, when prototyping their TangibleGrid product. Utilizing this tactile Web Design tool, blind & low-vision participants “were also able to design a new web layout from scratch without the help of sighted people.”

(Li et al., 2022, p. 1)

Some blind & low-vision individuals have found that they might have minor advantages in some aspects of Interactive Design. One participant noted that they had an advantage in being more experienced building complex mental models or algorithms that were difficult to visualize. More commonly, blind & low-vision Interactive Designers report that their usage of a screen reader at atypically high speeds allows them to process documentation more quickly than their sighted peers. (Mealín & Murphy-Hill, 2012, p. 73) While English is commonly spoken at around 120 to 150 words per minute, some blind & low-vision Developers work

with their screen reader set to 450 words per minute, and have trained themselves to process auditory language at that speed. (Ojala, 2017)

2.0.2 **Desire**

Research with blind & low-vision individuals exploring User Interface design has found that participants had both the desire and capability to understand visual semantics. Furthermore, these participants indicated that they see value in spatial layout design on both desktops and smartphones. (Potluri et al., 2021, p. 10) Other studies have documented blind & low-vision individuals with explicit interest in layout design, who want to be able to make Web Design changes beyond the manipulation of text. (Li et al., 2019, p. 2)

Today blind & low-vision individuals are actively creating visual content online, and building interfaces that contain visual elements. (Potluri et al., 2019, p. 612) When Claire Kearney-Volpe et al. organized a Web Design workshop for blind & low-vision individuals, they reported an eager interest from potential participants and a strong demand for enrolment. By the conclusion of the workshop, students had applied their understanding of design concepts, and demonstrated working knowledge of basic Web Development by creating and publishing their own websites. Researchers reported that these participants maintained a high level of interest throughout the workshop, and showed an increase in self-efficacy. Furthermore, there was enthusiastic demand for more such learning opportunities. (Kearney-Volpe et al., 2023, p. 30)

Claire Kearney-Volpe et al. conducted follow-up interview with workshop participants a year later.

“Students felt they had gained a greater and lasting understanding of visual and spatial design concepts, that the workshop helped them prepare for career changes or helped them in their current job functions, and that it gave them both the language and confidence to problem-solve web and accessibility issues (codes and themes broken down in Table 9). Regarding the visual and spatial design concepts, students felt that a year after the workshop, learning css and design concepts had proved useful. Specifically, participants felt that

they had learned more about sighted user experiences and were able to apply design concepts in other areas of their lives.

[...]

It has been life-changing because I have built on it...it opened up a pathway that I didn't know was there...I ended up taking Deque (web accessibility) classes, I was so jazzed about Web Development... I fit into a niche of testers (and) that side of things is helpful for getting a job. I've been getting a lot from Deque, and (the) class was a great foundation...I am now in the transition between getting free education and getting work”.

(Kearney-Volpe et al., 2023, p. 23)

2.0.3 Direct Effects

Interviews with blind & low-vision Software Developers found that participants reported that they find the work motivating and rewarding, citing reasons such as “creating something new” and overcoming perceived limitations of their disability. Some blind & low-vision individuals have reported being drawn to Interactive Design in order to be able to develop accessible software for themselves, when they had not been able to find suitable software otherwise. (Mealin & Murphy-Hill, 2012, p. 73) Blind & low-vision Web Developers have written about how they naturally gravitate towards understanding accessibility regulations and creating accessible work, as these are subjects that affect their day to day lives. (Beijers, 2018) One full stack developer has described how he naturally became his design studio’s “general accessibility consultant—or police; [depending] on how you look at it.” (Ojala, 2017) Perhaps the most famous example, is Michael Curran and James Teh, who developed NVDA (NonVisual Desktop Access), one of the most popular screen readers used worldwide with Microsoft Windows. (NV Access Limited, 2023)

“We believe that if more blind people brought their expertise and perspectives to Web Development, then this would contribute to the democratization of the web and accessibility for all.” (Kearney-Volpe et al., 2023, p. 2)

2.0.4 Indirect Effect

“Design education is improved when people with disabilities participate, and the practice of design will also improve when people with disabilities are recruited, educated, and supported in the design professions.”

(Ostroff et al., 2002, p. 90)

Within the HCI classroom, Chambel et al. found that there were many benefits from including blind & low-vision students. Furthermore, they found that both sighted students and non-sighted students reported benefits from having a shared curriculum.

“...Blind students found it useful and interesting to learn the same contents, because it is important to know what other colleagues in the area know, if they are to integrate the same professional environments.”

(Chambel et al., 2007, p. 5)

Sighted students who have had blind & low-vision peers in their HCI class have indicated that the experience gave them a heightened awareness and understanding of other people’s needs. They saw the experience as influential to their future work. The teacher of this class also reported personal benefits, citing that it raised their personal awareness and understanding of accessibility in HCI work. Through the experience, they believed that they were able to make HCI more accessible to blind & low-vision students. (Chambel et al., 2007, p. 7)

For the group work component of the course, students reported that they felt that groups with both sighted and blind students had an advantage. In these sections many of the designs integrated auditory feedback and speech interaction. Students in these groups described their experience as a “very enriching experience in human terms”, (Chambel et al., 2007, p. 7) and there was a consensus that everyone in the course experienced an increase in awareness. According to the teachers:

“We believe that, to some extent, this experience helped make HCI more accessible to blind students and also helped to increase accessibility awareness among sighted students, and even among teachers and researchers.”

(Chambel et al., 2007, p. 9)

Research by Kearney-Volpe et al. reported similar findings when running Web Design workshops with blind & low-vision individuals. One year after these workshops, participating TAs reported that the experience had a lasting impact on them personally. This included “increased confidence in understanding accessibility concepts, increased interest in pursuing work related to accessibility, and plans to apply what they learned.” (Kearney-Volpe et al., 2023, p. 1) The researchers adamantly asserted that Interactive Design classrooms that integrate blind & low-vision students with their sighted peers, will reap compounding benefits that improve the institution of Interactive Design. (Kearney-Volpe et al., 2023, p. 29)

2.0.5 Under-representation

Interactive Design is a growing field of employment opportunities, particular in the realm of Web Design & Development. The U.S. bureau of labor statistics predicts an 8% increase in Web Development & adjacent employment opportunities over the next ten years. (Kearney-Volpe et al., 2023, p. 2) This includes a demand for skilled workers in full stack development, Graphic Design, product design, user experience, web accessibility and more. Despite this strong growth, blind & low-vision individuals continue to be significantly underrepresented in those fields and related training programs. (McDonald et al., 2014, p. 276) (Kearney-Volpe, 2020, p. 2)

2.1 Barriers

There is ample research that indicates that blind & low-vision individuals face barriers that have a negative impact on their post-secondary education & training. (Reed & Curtis, 2012, p. 414) These barriers have been documented worldwide, including Australia, Canada, the USA and the UK, all nations that have legislated WCAG 2.0 based web accessibility standards. (Firat, 2021, p. 5) Furthermore, when selecting post-secondary studies, blind & low-vision individuals may avoid certain subjects and programs if those programs do not seem to be accommodatingly accessible. (Ostrowski, 2016, p. 21) While many post-secondary schools appear to be making progress in increasing the physical accessibility of their campuses, this progress does not seem to have extended to the design departments. (Ostroff et al., 2002, p. 87)

“Despite a growing demand for Web Development and adjacent tech skills, there is a lack of accessible skills training for screen reader users.”

(Kearney-Volpe et al., 2023, p. 1)

2.1.1 The Elephant in the Room

“Design students who are blind or sight-impaired face distinct challenges when studying a visually centric discipline such as design practice.”

(Bowers & Hayle, 2020, p. 1)

Interactive Design typically includes topics such as colour, typography, and spatial layouts on digital screens, subjects that present difficulty to blind & low-vision students. Compounding this, these topics are often taught in a highly visual manner, with techniques that are inaccessible to blind & low-vision learners. (McDonald et al., 2014, p. 275) (Baker, 2017a, p. 3) (Kearney-Volpe, 2020, p. 11) (Kearney-Volpe et al., 2023, p. 2) Computer Science, and coding in particular, is also typically taught and practiced utilizing visual cues. Data structures are another essential concept, most often taught through visualizations. (Baker, 2017b, p. 20)

Access to visual content is typically provided by alternative text (alt-text) that can be read by screen readers. This isn't always effective, and in some cases the text descriptions can be made up of an overwhelming amount of information for any individual to store in their working memory. (Bowers & Hayle, 2020, p. 2)

While programming in general is becoming more accessible, web programming is still often immediately assessed through the visual rendering in a web browser. Blind & low-vision students of Web Design have identified the spatial aspects of CSS to be particularly challenging. (Kearney-Volpe et al., 2023, p. 17) There are few accessible tools for blind & low-vision individuals to use to assess this visual output. (Li et al., 2022, p. 2) Of the tools and techniques that do exist, none of them offer a full visual assessment. (Ojala, 2017) (Kearney-Volpe, 2020, p. 25) (Potluri et al., 2021, p. 10) Furthermore, the typically employed workarounds for these limitations can give misleading feedback. (Bowers & Hayle, 2020, p. 2)

Some blind & low-vision designers have found that these accessibility gaps have resulted in them having limited participation in prototyping and building visual layouts.

(Potluri et al., 2021, p. 10) While blind & low-vision individuals are certainly capable of front-end design work, there are practical limits to this. For instance, some blind & low-vision Developers who work on the more visually oriented front-end side of coding, are reliant on pre-existing grid systems and libraries such as *Bootstrap* in order to execute a rough user interface on their own. (Ojala, 2017) In Web Design workshops, blind & low-vision participants have struggled to conceptualize what good visual design looks like, and how to achieve it. (Kearney-Volpe, 2020, p. 23)

Some blind & low-vision Developers have noted that they have avoided engaging in design processes. They have instead channeled their efforts into back-end development work, in order to avoid the complications and difficulties associated with the more visual nature of front-end work. One individual reported difficulty finding work, as employers only wanted to hire full-stack developers. He personally felt that this discrimination was unnecessary, as a division of labour between front-end and back-end work happens naturally amongst teams of developers and designers engaged on a project. (Kearney-Volpe, 2020, p. 23)

2.1.2 Attitudes & Assumptions

While blind & low-vision individuals acknowledge their personal limitations in engaging with visual work, a larger limitation appears to be the negative assumptions that sighted individuals make about the abilities of blind & low-vision individuals. (Kearney-Volpe, 2020, p. 24) Florian Beijers, a professional Web Developer who is also blind, describes how prospective employers would sometimes give seemingly hastily devised excuses to end a job interview early, the moment they realized that Beijers was blind. He advises that blind & low-vision individuals avoid needless discrimination by not disclosing the state of their eyesight when applying for jobs.

“It is a careful balancing act in the best of cases; these days, I tend to mention my blindness at the very last moment when I negotiate a job interview over the phone, by stating I will be bringing a dog to the office and asking if anyone is allergic to dogs. Usually, the next question is a very understandable ‘Why?’ and only then will I mention it, minimizing it as much as possible. Most of the time, this approach has given me at least a chance to come in for a first interview.”
(Beijers, 2018, p. 1)

Numerous students have reported stories about being dissuaded from studying design fields that are seen as having a visual or spatial component. In a 2019 study with blind Software Developers, half of all participants mentioned having an experience of being pressured by post-secondary faculty members to drop courses, reduce workload, or change majors. (Baker et al., 2019, p. 763) Prospective blind & low-vision students have also reported being informed that even if they were able to succeed in the program, they would never be able to maintain a job in the design industry. (Ostroff et al., 2002, p. 16)

2.1.3 Teacher Competence

Blind & low-vision post-secondary students have cited numerous barriers imposed by teachers who do not teach using best practices in accessibility. Some of the more common complaints include teachers communicating with a single channel or sensory modality (such as visuals) without any supporting secondary channel (such as semantic text). This includes teachers who rely on communicating with gestures or handwriting. (Baker et al., 2019, p. 761) Blind & low-vision students also struggle with their teacher's language usage, particularly those teachers who use vague or relative pronouns that require a visual reference to understand. (Ostrowski, 2016, p. 22) These inaccessible teaching practices have a compounding effect, beyond directly failing their blind & low-vision students. By not utilizing best practices in accessibility, these teachers are also failing to model those practices for their sighted students. (Kearney-Volpe, 2020, p. 26)

When teachers do provide accommodations, they are sometimes of such a low quality, that these accommodations have little if any of the intended efficacy. (Ostrowski, 2016, p. 15) Furthermore, blind & low-vision Computer Science students have complained about being made to needlessly feel conspicuous when receiving accommodations from their teacher. (Baker et al., 2019, p. 761) Many of these students are already self-conscious about the unwanted attention that they receive from their use of accessible technology in the classroom, and the teacher's behaviour can worsen this. (Baker, 2017a, p. 157) This problem can be compounded by teachers who lack experience or competence with screen readers. Web Development students have described how this lack of competency can lead to issues with screen sharing or other in-class

technological interfacing.

(Kearney-Volpe et al., 2023, p. 22)

2.1.4 Curriculum & Learning Materials

Research on blind & low-vision individuals studying Web Development has found an overall lack of accessibility best practices in course materials and curriculum. These issues have been described as both recurring and systemic. (Kearney-Volpe, 2020, p. 21) (Stefik et al., 2019, p. 771) Instruction on Web Design and CSS in particular were found to have not been made accessible to screen readers.

(Kearney-Volpe, 2020, p. 26)

Blind programmers have recounted how when they were students, they had difficulties in obtaining accessible versions of course materials in a timely manner. (Baker et al., 2019, p. 761) Students have reported needing to repeatedly request these materials from instructors, and in sometimes needing to seek out accessible alternatives themselves.

(Kearney-Volpe, 2020, p. 22)

Once accessible versions of these materials are obtained, audio book and screen readers sometimes read Interactive Design content poorly. Computer code is often read ignoring essential elements, such as indentations, and needlessly spelling out other elements one letter at a time. (Baker et al., 2019, p. 762) Furthermore, even when accessible alternatives to visual content is provided, it can be of such poor quality that it is not engaging for blind & low-vision students. (Stefik et al., 2019, p. 771)

Curriculum can sometimes prescribe that students use methods that are impractical, if not impossible for blind & low-vision individuals, even with accommodations. (Ostrowski, 2016, p. 19) These accessibility problems create barriers beyond the immediate access of materials. Research by Nogueira has correlated experiencing these barriers with negative emotions. (Nogueira et al., 2017, p. 95) Some blind & low-vision students have explicitly expressed low-motivation when assigned projects where the end product will be inaccessible to them, such as the design of a drawing application.

(Baker, 2017a, p. 158)

“And to be completely honest, I didn’t put a huge amount of effort into that assignment. Because I just hated the idea of kind of spending hours and hours of making something I’d just never be able to use.” (Baker et al., 2019, p. 763)

Beyond reducing motivation, inaccessible curriculum has been found to increase a student’s workload and interfere with concept mastery. In some cases, blind programmers have reported that they did not realize the learning that they had missed out on until years later. (Baker et al., 2019, p. 763)

Some blind & low-vision students have found that the accessibility of prescribed learning materials was so poor, they were better off learning the content themselves, and asking for help through online communities of creators and developers. In a study with blind Web Developers, Kearny-Volpe found that the majority reported that they were self-taught, despite having attended school for a Computer Science or similar degree. One blind Web Development student estimated that 70% of the learning he did in school was through resources he found himself, outside of the school curriculum. (Kearney-Volpe, 2020, p. 22)

“...college-level programs and courses in Web Development are failing blind students.” (Kearney-Volpe, 2020, p. 26)

2.1.5 Inadequate Tools

Interactive Design can necessitate writing, or at least navigating computer code. Even in a best-case scenario with an accessible Integrated Development Environment (IDE) or code editor, blind & low-vision students are at a disadvantage. While current screen readers can read out code in a linear fashion, they cannot give an overall contextualized view of that code as can be done on screen. Without being able to view code with the birds-eye view that sighted tools afford, blind and low-vision individuals are often unable to skim large amounts of code as quickly as their sighted peers. (Baker et al., 2015, p. 1) The surrounding context of the code being read by the screen reader can be unclear, and understanding the context of their current location in the code is a challenge reported by many blind & low-vision coders. (Baker, 2017a, p. 159) Screen readers are not well attuned to reading code, and users often must decide between

balancing various compromises between verbosity and accuracy in their screen reader settings. (Baker et al., 2015, p. 8) (Thompson, 2022, p. 1)

The state of available tools on the front-end side of design is much worse. Numerous studies have found that there is a general lack of accessible tools available that can assess, manipulate, or create visual elements and layouts. (Potluri et al., 2019, p. 612) (Kearney-Volpe, 2020, p. 27) Current screen readers do not even come close to bridging this gap. (Li et al., 2019, p. 1)

This paucity of accessible front-end design tools is notably evident with Adobe, an industry leader in providing software tools used in creative fields, including Interactive Design training. The Adobe website boasts:

“Adobe is an industry leader in accessibility and supports the creation of outstanding web experiences by encouraging developers to produce rich, engaging content that is accessible to all.” (Adobe, 2020, p. 1)

At the same time, there does not appear to be even one single reference to the accessibility of Adobe’s tools themselves, throughout Adobe’s sizeable website.

Florian Beijers has asserted that the accessibility of design & development tools is often an afterthought. He describes how industry up-take of the productivity software Slack badly outpaced the development of its accessibility features.

“This kind of deficiency can and does cause people to lose their job because they just can’t keep up with the communications within the company they work at.” (Beijers, 2018, p. 1)

Blind & low-vision Interactive Design students are often prescribed tools that have serious accessibility problems. (Stefik et al., 2019, p. 771) These students are usually reliant on their own specialized assistive technology, and will have to spend time investigating if the prescribed tools are compatible, and then configuring both the tools and their assistive technologies accordingly. Even a school’s website and learning management system can pose compatibility issues. (Ostrowski, 2016, p. 20) Sometimes the prescribed tools are only available on the school’s computers, but these computers are configured in such a way as to block the installation or configuration of the student’s necessary assistive technologies. (Baker et al., 2019, p. 762)

Even when the prescribed tools are compatible with the student's assistive technologies, this compatibility is often only partial, and some features remain inaccessible.

This can result in slower more arduous work, with blind & low-vision students stuck with more limited tools than their sighted peers. (Baker et al., 2019, p. 762)

(Kearney-Volpe, 2020, p. 11)

In some cases, blind & low-vision students need to seek out alternate tools entirely, going so far as to re-create entire server-side deployments. (Baker et al., 2019, p. 761) Beyond the time and financial cost that this might entail, these students are likely to run into further difficulties. Using a different platform or tools from the rest of the class can impede collaboration, group-work, and reduce the amount of support they can receive from both their teacher and peers. (Baker, 2017a, p. 157)

Because of these difficulties, blind & low-vision individuals often gravitate towards simpler less-powerful tools, such as their computer's built-in text editor. (Mealin & Murphy-Hill, 2012, p. 74) (Ojala, 2017) (Baker et al., 2019, p. 761) While this often has the least amount of accessibility issues, it also provides an inferior toolset, negatively impacting the amount of time required and the accuracy of their work. In some case, blind & low-vision students are simply unaware of the existence of tools that are both more accessible and much more powerful. (Mealin & Murphy-Hill, 2012, p. 72)

(Baker et al., 2019, p. 761)

2.1.6 A Lack of Information

Beyond failing to find more accessible tools, blind & low-vision individuals may be failing to find Interactive Design as a possible field of study and work at all. Blind & low-vision individuals have reported that they did not receive adequate information about Interaction Design or related field in their primary and secondary school education. (Reed & Curtis, 2012, p. 424) Furthermore they felt that the post-secondary recruitment materials being used were inadequate for attracting students with visual impairments to higher education. (Reed & Curtis, 2012, p. 422) Reed & Curtis found that in 2012, recruiters are often not aware of the scope of accommodations available to blind & low-vision students, and recruitment materials are often not available in an accessible format. (Reed & Curtis, 2012, p. 418) (Firat, 2021, p. 19)

2.1.7 Being Setup to Fail

For blind & low-vision individuals who do study design at the post-secondary level, they often find themselves at a disadvantage because they have been exposed to little visual design in their previous schooling. (Li et al., 2019, p. 4) They often apply for post-secondary education with both lower grades and lower self-confidence.

(Reed & Curtis, 2012, p. 422)

Compounding this, the supports that are available in post-secondary institutions are often not experienced with the particulars of design pedagogy.

“Of those who reported having offices of disability services on their campuses while in school, most said that these offices seldom understood what was required in studio-based education. There is a need for better communication between design school departments and offices of student services about the needs of students with disabilities in design education.”

(Ostroff et al., 2002, p. 87)

Some students ultimately find that despite their college’s good intentions to provide an accessible education, it is ultimately impossible to manage their personal healthcare demands, while negotiating the inadequacies on campus and in their studies. (Ostroff et al., 2002, p. 57) Beyond post-secondary training, individuals in the design industry can sometimes be expected to work long hours. Disabled designers and design students have both remarked upon the difficulty in balancing self-care with the demands of design training and work. (Ostroff et al., 2002)

2.1.8 Summation

There is very little established research on the barriers that blind & low-vision individuals face when seeking education and training as Interactive Designers. In fact, there is little information on blind & low-vision designers at all. Ostroff, Limont & Hunter’s *Building a World Fit for People: Designers with Disabilities at Work* focuses exclusively on interviews with twenty professionally successful designers with disabilities. (Ostroff et al., 2002) While this text arguably offers the most extensive insights about barriers faced by designers with disabilities, none of the participants

were blind. Furthermore, nearly all the professional experiences written about pre-date the World Wide Web, and subsequent changes to society. Nonetheless, it is assumed that the participants' experiences would have some commonality with the experiences of blind & low-vision individuals pursuing Interactive Design today.

More recent research that specifically engages with Interactive Design tends to focus on the Computer Sciences, with greater emphasis on programming than design. The most robust and up-to-date body of research on blind & low-vision students seem to be based on a general arts education, and does not engage with some of the field specific particularities of Interactive Design education and training. In reviewing all this research, it is often unclear what inferences can be confidently triangulated.

3. Methods

3.0 Theoretical Positioning

Arguably one of the most effective ways to increase the body of knowledge on this subject is through interviews and testimonies of its key stakeholders, namely blind & low-vision individuals with an interest in practicing Interactive Design. Furthermore, it is assumed that the secondary and tertiary anecdotes and experiences provided by the target audience will also provide valuable insights, regardless of their relative subjectivity or objectivity.

This exploratory study was mainly inductive in nature, with no initial hypothesis. Research was conducted from an interpretivist stance, with an emphasis on phenomenology, as defined by Gray's *Doing Research in the Real World*. (Gray, 2013, p. 23) Furthermore, data analysis was conducted with a constructivist grounded theory approach, as defined by Charmaz. (Denzin & Lincoln, 2000, p. 509)

This research looked to build on the work of Ostroff, Limont & Hunter's *Building a World Fit for People: Designers with Disabilities at Work*, which interviewed twenty professionally successful designers with disabilities. (Ostroff et al., 2002) While these designers worked mainly in fields dedicated to designing the physical space, this study looked exclusively at designers engaged with digital interactive space, through in-depth semistructured interviews with key stakeholders. These stakeholders have been defined as blind & low-vision individuals who express an interest in education, training, or professional practice in Interactive Design. This may include former students, current students, past students, and professionals working in the field.

These interviews were designed to prioritize the personal experiences, insights, observations, and opinions of the Participants over any formal knowledge of the subject matter. This study used a cross-sectional timeframe, utilizing a 'snapshot' approach.

Once this inductive research phase was complete, a more deductive approach was used to synthesize potential hypotheses for guiding principles, policy, and further study.

3.1 Interview Question Development

The interviews utilized a semi-structured format, with a set of pre-determined questions to guide the overall structure. These questions were developed and tested in a small-scale Pilot study, working with designers who self-identified as disabled. Using an iterative inclusive design approach, questions were re-formulated after each interview session. Participants were asked to rate the Interview questions and structure. The ratings were based on key considerations, which included identifying questions that prompted insightful or unique answers relevant to the research, questions that emboldened Participants to speak about whatever was important to them, and questions that Participants felt were a good use of their personal time. The final questions used to guide the Interview process were informed by this direct and indirect feedback from the Participants of this pilot study. Please see **Appendix A** for the semi-structured interview questions.

3.2 Participants

3.2.0 Participant Selection Criteria

Participation in this study was limited to individuals who were at least of age to attend high-school/secondary-school, and who self-identify as blind or low-vision.

Participants were asked to self-identify as fitting one of four key characteristic groups:

1. Individuals who have had an interest in pursuing an education, training, or work as an Interactive Designer, but did not pursue this interest.
2. Individuals who were formerly pursuing an education or training to become an Interactive Designer, but have abandoned this pursuit.
3. Individuals who are currently pursuing an education or training to become an Interactive Designer.
4. Individuals who are currently working as an Interactive Designer.

Beyond the criteria listed above, no other factors were considered in selecting potential Participants.

3.2.1 Recruitment

Prior to recruitment of Participants, the study and all recruitment materials were approved by the OCAD University Research Ethics Board (approval #2021-37).

Participants were recruited through a combination of Convenience Sampling and Snowball Sampling. Canada was the main focus for recruitment, followed by the United States, the United Kingdom, and Australia. Within each of these countries, digital recruitment material posting was primarily focused on organizations dedicated to blind & low-vision individuals, followed by professional design organizations associated with Interactive Design. Furthermore, some notable design & technology firms known to employ blind & low-vision individuals were also contacted, as well as a few relevant online communities, including *reddit/r/Blind*. Please see **Appendix B** for a full list of organizations that were contacted for recruitment.

Recruitment materials were circulated along with a request to forward this information to potentially interested Participants or organizations. Please see **Appendix C** for the *Recruitment Invitation*.

Some of the organizations that were contacted had formal approval processes and requirements put in place to vet such requests. All such processes and requirements were fulfilled, and subsequent online meetings or phone conversations were held with potential participant organizations whenever applicable.

Most notably, the Researcher met with representatives of the National Federation of the Blind (NFB), who approved the application and sent our recruitment materials to all members who subscribe to these notices. Nearly half of all Participants were recruited through this participation with the NFB.

The Researcher also met with representatives from the Canadian National Institute for the Blind, as Canada was our primary focus area for recruitment. Unfortunately the CNIB declined to allow the study to be shared with their members, citing that their

membership did not have an interest in Interactive Design. This was the only contacted organization that formally declined participation.

3.2.2 Participant Selection

Potential candidates who contacted the Researcher were only excluded if they self-identified as not meeting the aforementioned requisite criteria. All potential Participants who self-identified as eligible and completed the requisite paperwork were included. Please see **Appendix D** for the *Screening Questionnaire*.

The study originally aimed to recruit between 3–5 Participants per each category. In the end a total of eight Participants were selected, most of whom self-identified as belonging to more than one of these characteristic groups, fulfilling the established criteria. Further information about the demography of these Participants is included in the study Findings.

3.3 Interview Process

Interviews were conducted by the Principal Researcher throughout August to November 2021. All sessions were conducted remotely, a necessity during COVID-19 pandemic restrictions. Most interviews were conducted via video chat, while two were conducted with the Participant sharing audio only. Interview sessions were recorded in dual mono, with the Researcher and Participant recorded discretely on separate audio channels.

Informed consent was obtained in written form from each Participant prior to their first interview. Furthermore, a brief off-the-record discussion was held with each Participant prior to the Interview session being recorded, to ensure that their consent was well-informed. At the end of each session, the Participant was debriefed, and given the opportunity to discuss any questions or concerns off the record. The duration of these sessions was between 52 to 108 minutes, with a typical length of approximately 80 minutes.

Each interview began with the same seed question, and then progressed based on each unique Participant's input. Participants were always encouraged to speak as much

as they desired about whatever topic was of interest to them. The Researcher made extensive use of questions and proposed understandings of the Participants' assertions, to ensure that there was an ongoing understanding of each Participant's intent.

The pre-determined questions were only used as prompts at natural pauses and breaks in the conversation, to encourage progressing the focus of the talk to other potential areas of interest. The Researcher ensured that each pre-determined question was answered either explicitly or incidentally, before the end of each interview.

Immediately after each interview, the recording integrity was verified, and then a copy was sent to that respective Participant. They were each invited to ask for any revisions, omission, or additions to their contribution, and invited to request another interview session if they so desired. The first Participant opted to do a second interview session after all other Participants had been interviewed. This was the only Participant who did two sessions.

Audio recordings were manually pre-processed by the Researcher, with noise filtering, dynamic range compression, and equalization. Processed audio was then fed to an automated AI to perform the initial transcription draft. This draft was verified against the original recordings by the Researcher, and manually revised and verified for verbatim accuracy.

The contents of all these transcripts were then re-organized into emergent themes within a combined manuscript. Key exemplar quotations were identified for emergent themes, and content was re-organized under these thematic headings. Redundant content was removed, as was content that did not seem to be relevant to the stated aims of the study. Themes were continuously revised and re-organized throughout the process.

While there was a diminishing return on new themes established in each subsequent interview, there were still new themes present in the last interview executed, suggesting that a larger sample size would have been beneficial.

Participants were sent a full initial draft of the findings, and invited to request any modifications, subtractions, or additions to their contributions. Participants were sent a second draft containing the Findings and Discussion sections, and again invited

to request any modifications, subtractions, or additions to their contributions. Only incidental requests for revisions were made by Participants, and these requests were all honoured.

4. Findings

4.0 Participant Backgrounds

Participants ages ranged from their early twenties to their early sixties. They all self-identified as being low-vision, legally blind, or totally blind. This included individuals who had been born without eyesight, ranging to those who had lost their eyesight in the fast few years. Most Participants described having had various degrees of eyesight through their lives, and many currently had some degree of eyesight at the time of interview. All Participants self-identified as having an interest in pursuing education, training, or work as an Interactive Designer. Participants range of experience in working as an Interactive Design ranged from those who were just starting to explore the field, to others who had worked in it for decades. Most Participants were coming to the field of Interactive Design much later in life than the typical College or University student.

When describing the state of their vision, several of the Participants also mentioned that they had additional health care concerns such as Diabetes, Epilepsy, and Strokes. Many Participants reported having health conditions that required active management, and in some cases, at such a severity that these conditions could be considered disabilities. Some Participants noted that their blindness or low-vision was a result of complications from an underlying health condition.

Most Participants mentioned having financial difficulties.

All the Participants seemed well-educated, having finished high school and all of them with at least some post-secondary education experience. Almost all the Participants had already acquired at least one post-secondary certificate, while multiple Participants had achieved multiple degrees or other certificates of learning. One Participant had acquired a PhD before they lost their eyesight. Without prompting, every single Participant mentioned how important they believed education to be.

4.0.1 Design, Technology, & Certification

As a whole, Participants showed an abnormally high degree of intellectual consideration of Interactive Design. Participants had opinions on matters ranging from interactive form design, interface adaptation between mobile devices and desktop machines, among many other subjects.

Researcher: “Do you have any favourite fonts?”

Wren: “Right now, I do. Let’s see. I like sans-serif type of fonts. It’s smoother, easier to read, easier on the eyes. And something that’s bold. Big and bold, depending on what kind of emphasis I want to do on, usually something along that line. Is there a particular name? I like Helvetica, Helvetica is simple, but yet interesting. It’s easy to read. I’m not a fan of Arial, even though by studies, the recommendation for low-vision people is to read Arial. I kind of find it looks a little, meh, boring. [laughs]”

Researcher: “Well, I can tell you’re a real designer, because no normal human being sees a difference between Arial and Helvetica.”

Wren: “Really!?! I see it.”

Despite being legally blind, some Participants indicated remarkable high-detail powers of visual observation, while also explicitly describing how their diminished eyesight might make them a valuable voice to have on a design team.

“...obviously eyesight is a large percent of our sensory perception. I don’t know if it’s probably 80% or whatever, but maybe the visually impaired people might split up their auditory and their visual a little bit better amongst the senses [...]. You know, even though I suffer from a visual impairment, I’m still very much a visual person. I can learn a lot from a picture.” –Ash

One Participant referred to how different sensory reliance leads to different types of errors and misjudgments. He supported this assertion with an anecdote about an email that he had received.

“I actually have an email that I received like a couple of years ago or like a year or so. [...] It was from ‘Ama-zero-n’ to the screen reader and me, [but] it was probably one of

those fonts that to you, being able to see, it looked probably like an 'o'. [...] I know how letters look, and so I could tell how that's easily fooling to the eye.

[...]

Because, like with me being visually impaired for this long, it's a different way of thinking about stuff, but it's not a wrong way to do it. It's different, and sometimes that can make all the difference." –Dylan

Most Participants articulated a high degree of skill with computer technology. One Participant described how she was currently using her computer with a programmable sewing machine to help execute sewing projects. Multiple Participants indicated that they had learned to hack various technologies out of necessity, in order to make devices and services more accessible to them.

"For example, I got [my hacking technique with Chrome] to work for a CAPTCHA the other day. I didn't think I was ever going to do it, but one site apparently didn't do enough security stuff because I was able to get it to tell me the characters and it worked." –Dylan

When the researcher referred to one of the Participants as a "hacker," they responded by saying:

"Let's just say I've never paid for cable in my entire life. [laughs] And I've also made Alexa (a digital assistant product) say things she's not supposed to say." –Jamie

They then went on to talk about the history of codebreaking and intelligence agencies, and the value that their hacking ingenuity would have, if they could find accessible outlets to put it to good use.

"If you keep going with that thought and you look at past history and you look at the FBI and the CIA and also radar and codebreaking and stuff like that, isn't that how all this stuff starts? How education starts? The learning process is what we're not supposed to do, but then it becomes normal, right?" –Jamie

Some Participants described themselves as having been on the forefront of interactive technology as a user for decades. However, there were some Participants who did not grow up as voracious technology users.

“Yes, I’m totally blind. I use screen readers and Braille displays to interact with computers. I’ve known Braille all my life. I didn’t learn to use a computer until I was twenty-eight.” –Drew

Many Participants had experience working as accessibility testers on interactive projects, but none were working in firms as Designers. Some described their surprise that they were even qualified to do accessibility testing professionally.

“I just had the perception that, people that tested for accessibility were just kind of like volunteers, [...] or maybe there was a company that had technical people that knew the design aspects and actually could modify the code. I didn’t make the connection between testing and usability where even if an individual isn’t doesn’t have a technical background because they’re a user of assistive technology, their input is just as valuable. So they don’t always have a technical background to start with.” –Drew

Furthermore, some of these accessibility testers soon found that they were able to make contributions to interactive system designs, through the back-door of working as an accessibility tester. For some Participants, this was the first time they thought that they could potentially work as a professional Interactive Designer.

“I also think that there are people that don’t know their opportunities, and when they find about them out about them, they assume they don’t have the skills.” –Drew

These same Participants commonly expressed that they felt that even with their life experience and technical competence, they could never hope for more than temporary or part-time work in the field if they were not able to receive a recognized learning certificate in either Accessibility, Web Design, or Web Development.

“I also find other places I’ve talked to people that work there that, I sort of feel like in a lot of cases, screen reader user testers are just brought in to test, and in a lot of cases, unless they really have a background with Web Design and they’ve passed the IAAP certification, then they’re taken more seriously. But for someone who’s just new in the field, and hasn’t had a chance to climb the ladder, they just, you know, take us in and spit us out. I’m kind of in a situation like that now. I have some temp work, but I don’t know that it’ll lead to anything permanent.” –Drew

“I’m working with Fable Technologies as a web accessibility tester right now. They’re actually paying me 50 bucks an hour, which is nice. And I get to complain about companies like Walmart and Amazon and a couple of others, like Shopify, and it’s actually going really well. A lot of these companies are coming back to me and asking me for my personal insights about [things like] when I go around with my guide dog, and what it’s like to go in-store shopping and also online shopping. And I’m working my way up through the company, which is great. The thing is, if I had these certificates, I could work full time and come off of ODSP [Ontario Disability Support Program]. Because I do not have these certificates for my knowledge, I can only work part time self-contracted contracts here and there. That’s it. So I’m denied a really good living because of a stupid piece of paper, which is really annoying.” –Jamie

Some Participants expressed that they were seeing an increase in credentialed gatekeeping in the Interactive Design and adjacent technology professional industries.

“So Google, Amazon, Shopify, big companies like that, even cybersecurity, or white hat ethical hacking. Whatever you want to call it. They all require certification starting at about \$2000 and up. [...] You need that piece of paper to say you’ve learned this stuff and you know how to do it. So if I can’t get a school, a credible school that’s respected, how am I supposed to get a job in a respected company?

[...]

So that’s what’s blocking me the most. It frustrates me beyond belief that why wouldn’t [they] take the perspective from somebody who lives it every day? Why wouldn’t you give them certification if they wanted to learn? Why wouldn’t you hire them? And to be blocked by just that one piece of paper is just frustrating.

[...]

I can’t even [find] a school to finish up front-end development. If I could get a certificate just for that, I could get a \$40,000, \$50,000 a year job. If I could get my back-end server, then I’m looking at \$60,000 to \$70,000. If I can get all my certificates for full stack, I’m looking at about \$90,000 to \$100,000 a year. Three pieces of paper that are stopping me. I think that’s the biggest piece of insight that I can give you.” –Jamie

Many Participants expressed that they believed that blind & low-vision individuals were going to have to obtain more Design related credentials if they were going to have a bigger impact on the World Wide Web.

4.0.2 Motivations & Goals

Participants expressed some common goals and motivations for their interests in Interactive Design work. While many did cite gainful employment as a goal, there were many other reasons that they had been drawn to this field.

Some Participants expressed an interest in Interactive Design as a part of their ongoing passion to explore new technological frontiers, and to take part in shaping the future of HCI. These individuals often cited an interest in Artificial Intelligence or Machine Learning. Multiple Participants mentioned how they saw Interactive Design as a good match for their ongoing passion for new technologies, and appetite for continually evolving challenges.

“I’ve learned a lot. I still have a lot to learn. I know within this field it will never stop. I will never stop learning. And I know I have the right personality for that.” –Jamie

Participants also spoke about their interest in the applications of these technology, and how they could be leveraged in design, accessibility, and teaching. One prominent recurring theme was an interest in applying Interactive Design to consumer-centric health care.

Many Participants were drawn to the text-based nature of back-end design and development of Interactive systems. However, some expressed a preference for front-end design. One Participant described her interest in design as a logical progression of her life-long passion for creativity and visual-spatial relationships.

“I’ve always known I was creative. I’ve always just had a gravitation towards playing with colours. And I guess for me, I always knew that at one point in my life I would be going towards blindness as a young kid. So I just wanted to capture in as much of the colour world as possible. I just don’t see why not. There’s just so many ways to play around it and manipulate it, and [...] my brain kind of just goes towards it, like it just focuses on design. Just focuses on like, ‘Oh, I like how this looks, and oh, I like how that

looks. I like how, you know, like we used to have those telephone poles and how they would by distance in perspective would be stacked taller, medium, smaller, and it's like oh!' It just intrigued me in that way. People found me strange, and I just kind of look for those kind of details of things and being visually impaired, you know, I miss all of those details. I miss the attention to detail. So when I'm able to see it and focus onto it, it's just like, 'oh, this is very interesting!'

[...]

This was late high school, the pioneer days of social media. There used to be these websites, Asian Avenue, Magenta Black Planet, and so on and so on. Kind of like MySpace where you can design your own backgrounds and put music on and different page layouts and so forth, and that' what I did for my pastime. I was just designing my own web pages, and playing around with different colours and different design aspects, to sort of like, well, if I do it like this and I do like that, what kind of reaction is it going to get, a lot of likes, or a lot of boos or things like that? [laughs] So just more interesting in that way. So I just I asked some of my friends who are more into the coding stuff, I'm not really into coding and just figuring out where is it in the coding? Can we change the colour of this font or change the colour of the background and things like that? And they would show me where to find it, and it just always intrigued me in that sense. [...] Maybe if I change this colour, what kind of audience would come through my page? [laughs]

[...]

So I decided to just jump into it. Full-on into Graphic Design. I went to college for two years and I knew nothing about accessibility. Nothing at all. I wasn't brought up with accessibility around me. I heard of it, but I didn't have any formal training in accessibility. [...] I was the only one that I knew that had a visual impairment. And then when I was able to meet (in high school) another person who had a visual impairment, she was very shy to talk to me, so it never went anywhere. So then when I did go to school, at that time it was a school that did not have any accessibility and accommodation office. So there was no accessibility whatsoever. I had to figure everything out on my own and I learned the word discrimination, but I didn't know that it would apply to me, to my disability. I just thought myself as an individual, just like everybody else." –Wren

Challenging Expectations

Many Participants seemed to revel in the idea of challenging some of the low expectations they have faced because of their diminished eyesight.

“I’m actually going over to Playdium [a video game amusement facility] with my kids this weekend and I’m going to record me race-car driving, because the one thing they say is that you’re not allowed to drive. So I’m like, ‘ha ha! I’m going to defy you.’” –Jamie

One low vision individual was currently studying Graphic Design at College, and described how as her eyesight was failing her, she was increasingly more invigorated to follow her passion for the applied art.

“...I’m right now at a stage in my life, rediscovering my passion for the arts as a person with visual impairment and would really love to explore, is there a possibility? And it’s just so fun to do all of that. And I had many people tell me, Are you sure this is kind of something you want to do, instead of just your reading and writing type of program? And I’m like, yeah, I don’t see why not. So I guess I sort of like to push the boundaries a bit and burst people’s bubbles sometimes, a perception of what visually impaired having a slight disability can actually do.

[...]

Getting bombarded with some of the impossible tasks and the challenges, it does weigh me down a bit. But then, you know, I walk around, I go to bed and I still think about it. How am I going to overcome this? And there must be a way to me. I always see there’s a solution to everything. I just have to try to figure it out. What is the best approach, with trial and error basically.” –Wren

Along with challenging expectations, some Participants spoke about their interest in maintaining personal growth, and why that was particularly important to them.

“I mean, what good am I to someone else if I can’t take care of myself. But I’ve been on my own, independently for at least twenty-nine and a half years, and have been totally blind for thirty years. I’ve got some milestones built up underneath me and still trying to build more. It ain’t over yet.” –Casey

Multiple Participants also expressed that they were motivated by a desire to set a positive example for others, both in the blind & low-vision communities as well as outside of it.

“I don’t like what I see out here, it’s disgusting to me. I want to help make a difference. That’s my number one goal, to rest in my grave peacefully, knowing that I made a difference in myself, which projected outward and made a difference in other people. That’s my number one lifelong goal.

[...]

I used to try to avoid stuff, but it always will come back on you. So rather than avoiding the stuff, meaning try to go under, go around and go over top of it, GO THROUGH IT. And once you go through it, you mastered it. You can look back and see where you started, and see how far you’ve come, and then go from there. If it shows up at your door again, you can knock it out quicker because you got more fluency in it. It’s made you more fluent and more stronger, internally.” –Casey

Giving Back

One Participant described the transformative process of losing their eyesight and becoming sensitized towards the accessibility of Interactive Design systems.

“I started going blind at about 60, and by the time I was 62, I was completely blind and training and learning new skills that deal with the blindness. I consider myself lucky though, because unlike a lot of blind people who were blind since birth or since their young childhood or teenage years, I had vision all that time. I could get an education, get a job, raise a family without all the struggles of a blind person. But I do understand where they’re at, and I’ve become very interested in trying to help the younger people become educated and get jobs that they would like to have. And so that’s one reason why I became so interested in accessibility, because I have struggled so much with technology, with software that either is almost completely inaccessible or at least partially accessible and it’s just a constantly struggle. Even today for me, even though I know computers backwards and forwards, I’ve been dealing with them since the late 1970s, but it’s just a whole new world.” –Jesse

After taking a webAIM course (a non-profit organization based at the Institute for Disability Research, Policy, and Practice at Utah State University), they were further motivated to learn more about Interactive Design, as well as accessibility remediation. A life-long teacher, this Participant was concerned with the effect inaccessible Interactive Design was having on access to education. They described how they were motivated to help ensure that blind & low-vision youth could enjoy the same benefits and possibilities that they experienced in their own life.

“And I’ve had blind students who were very successful, not many, just a few. And I really would like all younger people to be able to have the access and to be successful in whatever walk of life they want to go down.” –Jesse

Many Participants expressed that their interest in Interactive Design had at least some connection to their desire to make a social difference, and they often expressed the desire to “give back” to others. They wanted to put themselves in the position to do meaningful work to help others, with the requisite skills and abilities.

“What I’ve learned in school, what I’ve learned from work experiences, what I’ve learned from church or everywhere I go, whatever I learn, I share it with other people.” –Casey

Participants gave examples of their desires to work with schools, education, and training centres, along with healthcare providers, and various local community clients. Many of the Participants described non-monetary motivations for their commercial design work. Even Participants who spoke about the financial hardships they had been facing, seemed to express greater interest in the social impact of Interactive Design work, than the financial security this training might prove.

“I don’t even want to make a salary. I just want to learn so that I can make my life and my friends life that much easier. [...] What I really want to create is something online so that when you do lose your eyesight, all this information, a community board for everything is in that one spot. Why can’t we do that? And I’ve got two people who want to help me out with it, but I don’t have the knowledge to create it yet. So that’s what started this whole process.” –Jamie

This Participant seemed to take pride in her ability to deliver small business websites well below market costs, in part, through arranging in-kind donations and similar

community bartering agreements. An interest in these community connections were cited far more often than an interest in the financial rewards of the profession.

“It’s not like I want to go out and make a whole bunch of money. You’re not going to make a lot of money being a front-end designer. I like helping out local businesses and stuff like that.” – Jamie

Another recurring motivation was to support the Participants own entrepreneurial efforts.

“I’m getting ready to open my own business too. Sewing in the Dark. I just have to make my own website and go ahead and do it because I’m not paying someone to do something like that.” –Jamie

Multiple Participants expressed a desire to better integrate with sighted people and culture. Some Participants mentioned wanting to learn more about Interactive Design because they wanted to better understand how to do more visually appealing work for those with low-vision and full-vision alike. They described the importance of visual aesthetics as part of the holistic usability experience.

“If I can make something that looks visually appealing to somebody with full sight, I think that would be great. [...] I’d really like to be able to do that.” –Dylan

Perhaps not surprisingly, virtually all Participants expressed a desire to be heard, and to have this information more broadly shared to help serve others. As one Participant put it:

“And if you need to call back or whatever, you have more questions. By all means, keep going. I do not want to be reimbursed for this. Just please get this information out there. Please try to move forward with this.” –Jamie

4.1 Design has a Public Relations problem

None of the Participants communicated that they saw Interactive Design & Development as an open, accessible, and welcoming career path, let alone as a field of study.

“Like, yes, there could be more visually impaired people interested in Web Development. Like there’s probably a lot of people out there that would welcome the opportunity, but it’s just that I don’t think it’s a field that’s very open to that segment of the population.” –Ash

Furthermore, many Participants seemed to share a common misunderstanding, confusing or conflating Web Design and Web Development. Some Participants were under the impression that Web Design consisted entirely of coding, when there are other aspects that have little to do with code. A few Participants repeated the misconception that Interactive Design was more about coding than it was about designing systems for people. One Participant even cited that this was one of the main reservations they have about Interactive Design.

“I find the coding aspect of things. I find that very, very tiresome. Just my eyes alone and my brain and numbers don’t get along very well, and I find that coding and mathematics are somewhat similar in how they’re structured.” –Morgan

This Participant also cited a preference for studying the humanistic aspects of design, over the systemic aspect of coding.

“I’m going to need to know more about people’s disabilities in their interactions than I am about coding. I can hire someone to do that. So that was [why] I didn’t go into Interactive Design.” –Morgan

Ironically, in further describing why he decided not to study Interactive Design, he seemed to describe himself as a potentially ideal candidate for the field.

Morgan: “...I’ve always been kind of a big picture person as opposed to micro details. I do the opposite. I start here, and come in, as opposed to most people like to take baby steps to get to the big picture. I like to say, well, hold on. This is what it could be. And then people usually reign me in, and I’m like, okay, that’s fine. I’m not saying that it could be that tomorrow. I’m just saying that, have you thought about this?”

Researcher: “What if we threw math and coding out the window, which isn’t uncommon [in design] anymore because projects are generally so complex that you have people working on different aspects. You clearly have a knack for information architecture and user flow. You could make all sorts

of recommendations and explore ideas that would go into an interactive system. I know that from talking to you. Would pursuing that be something of interest to you?”

Morgan: “So I hadn’t thought of that [as a possibility]...

[...]

...I hadn’t considered a white board approach to design, so as far as big picture, I think that there is still a, for lack of a better term, stereotype as to what design is. And I think maybe with more interviews like this or better marketing, design could be fleshed out into ‘you don’t have to know how to code and use WordPress and do all these other things to be a designer.’ Because I didn’t know that was an option. And to be honest, I would consider taking design if I didn’t have to do all of the micro steps.”

Furthermore, most Participants seemed unaware of the scope of Interactive Design and related disciplines, while simultaneously expressing an interest in the very subjects that these fields of study seek to address.

Drew: “I think from a user experience perspective, [the current computer interface paradigm is] not intuitive enough. Some people are able to grasp it. Other people are confused. And I would say for the people that are confused, it’s just [that] everyone’s brain works differently and there isn’t a one size fits all solution. But we’ve kind of been boxed into a one size fits all. And companies like Microsoft or even Freedom Scientific (which makes the popular screen reader software JAWS), their attitude toward the product, whether you’re using a website or developing or whatever, is just learning. If you can only learn all these keyboard shortcuts, you’ll be fine. Well, a sighted person doesn’t work that way. They don’t think about how they consume data or interact with data. They just use a mouse and their eyes and maybe they type a few things, but everything is visual and spatial. We really don’t have the equivalent. I would like to work on possible solutions for that, but I don’t know anyone who’s really interested in doing that. That’s not Web Design specifically, but that is the user interface.”

Researcher: “So that’s Interactive Design, right in the wheelhouse of the stuff that I’m researching, that I practice, and talk about. Absolutely related without exception.”

Drew: “Really!?! Because I’m really interested in Interactive Design, not just for using a website or an application, but using the operating system.”

Virtually all Participants described Interactive & Web Design as atypical fields of study and work for blind & low-vision individuals. Participants communicated that they felt that very few blind & low-vision individuals ever consider Interactive Design as a potential field of study and work.

“I think it just gets overlooked because there are not many blind people or people with certain other disabilities who have made it into professional life or educational higher education, which is what we’re talking about right now.” –Jesse

Some Participants noted the importance of representation of blind & low-vision individuals in Interactive Design, to signal and raise awareness of the possibility to others.

4.2 Finances & Funding

Financial limitations are well documented as a potential barrier to post-secondary education. Study Participants communicated that they faced disproportionate financial barriers, both in accessing education and skills training, as well as accessing the requisite technology tools.

Financial limitations were cited as a barrier for education and skill training for most Participants. Furthermore, some Participants cited the debt they had already incurred for other education and training was a barrier to enrolling in any further education and training.

“...how the hell am I going to pay for it? I’m not getting no more loans. I’m already in debt because of that. See, if I had the right mentor working with me or the right person working with me throughout college, I might not be in as much debt.

You see, that’s a problem too.” –Casey

Some of the Participants described how nearly all their productive waking hours were spent trying to secure funding to make it through another month of living expenses. These Participants also described trading their Web Design skills for in-kind

bartering and donations of food and other products to make it through their month-to-month expenses.

“So I’m currently working with local businesses and trying to update their small businesses help out with basic websites. And in turn I’m getting free products and food and stuff to help get through the month, because I’m on ODSF we don’t get very much.” –Jamie

Many Participants felt that the current models of financial supports for blind & low-vision individuals seemed better suited towards feeding them as life-long dependants, rather than getting them the training and certifications to be fully financially independent.

“I only lost my eyesight in 2019. I was going to school as an environmental engineer. I also have a degree in audio forensics. Basically I was told to go sit on the couch and do nothing.” –Jamie

One Participant described this social service model as harmful to the psyche of those dependant on it.

“No, it’s destroying people. It’s destroying their self-esteem, their self-worth. It’s causing them to have a lot of self-doubt. Then they get into destructive behaviours to themselves. They don’t feel like they’re worthy of anything. They don’t have a chance at life. Why the hell are they here? Why didn’t they go along time go? It’s very detrimental. I don’t like it. I don’t like to see what happens to people. I don’t like to experience it myself. And it really, really angers me, to still see that in 2021, [...] things are a lot better, but they’re still bad.” –Casey

4.2.1 Higher Financial Burdens

Many Participants reported that they spent disproportionately more on equivalent living expenses than their sighted colleagues. Medical and technology expenses were the two most commonly cited areas of disproportionate expense.

“I have all kinds of tools here. I even have a portable CCTV machine that comes in a little suitcase that I can bring. Like, it’s amazing and it’s all digital and everything. So I’ve

been lucky and been trying out all kinds of doodads and stuff, but I know a lot of people in my community don't have even half of what I have." –Jamie

This Participant suggested that it would be helpful to blind & low-vision individuals to provide them ubiquitous access to free high-speed Internet.

As one Participant explained:

"...for everyone else [high-speed mobile] Internet is very much a luxury. For me, it's very much a necessity. I need it for my GPS when I go out, for my navigation, so that I know I can get to the grocery store safely. And then when I'm home, I have my Amazon, Alexa, Google and stuff like that, that turns on my lights and stuff like that. But again, why do I have to pay almost \$200 a month to be able to function within my home, to buy groceries, and to be able to connect with the outside world?" –Jamie

One Participant suggested that access to high-quality mobile devices was increasingly necessary to function in a sight-centric world. He referred to the mobile device cameras being used with mobile high-speed Internet for A.I. assessment, to give low-vision people second-sight. Furthermore, he communicated that in his time experimenting with various devices, he found that the more expensive flagship brands of phones offered better cameras that in turn worked better with AI services, to deliver more reliable results to the blind & low-vision user.

"[Camera quality] might sound trivial. However, it matters if you're using something like a document reader, that uses A.I. and the Web and the camera on your phone. I've actually come across instances where the app itself was perfectly fine. The problem was the camera in my phone wasn't clear enough." –Morgan

Another financial limitation that some Participants noted, was being unable to try out various technologies that may aid them in their studies. For example, one student noted that it was mandated that she learn Adobe Illustrator in her Design program, and that her screen readers software cannot read the proprietary interface elements that Adobe uses. However, she recently became aware that a version of Adobe Illustrator exists for the iPad, and coupled with the iPad's accessibility features, and the ability to use an Apple Pencil, she wondered if this might be an easier and more effective way for her to use Illustrator. Unfortunately, she lacks the funds to be able to afford an iPad that would work with an Apple Pencil, and so this potential technological solution to

one of her current problems remains unexplored. Other Participants cited much more expensive emergent technologies that showed promise for them personally, but were financially inaccessible.

4.2.2 Higher Financial Risk

While the high cost of post-secondary education is common to all individuals, blind & low-vision individuals tend to have both lower income, and higher living expenses. This is further complicated by the uncertainty, and subsequent financial risk, of enrolling in an education program that may not provide the necessary accommodations for a student to be able to successfully progress.

“And people do try academic paths, but a lot of the schools will only provide you accommodations after you enrol. And then even then, it’s not consistent. I know at least one person who had trouble getting the accommodations she needed, so she just started her own business.” –Drew

One Participant expressed her frustration at contacting the University of Toronto, to inquire about a Web Design and development boot-camp program, that she hoped might fit her needs. When making inquiries as to the programs abilities to accommodate her, she was met with unsatisfactory answers. It was suggested to her that she enrol and pay the tuition fee, and discover for herself if the program could accommodate her or not. In her own words:

“And University of Toronto, when I contacted them, the continuing education program, the boot camp, they want \$12,000 in order to give me any information. And I’m going, wow, OK, so, I’m, I don’t even want to, I don’t... I can never earn an income. The amount of medications that it takes for me to survive on a daily basis is almost \$13,000 a month. For me to work... How do I do that?” – Jamie

If a program does not end up providing the student with the necessary accommodations so that they can competently pass the learning evaluation requirements, this can increase the amount of fees that the student may need to pay. This disproportionate risk translates to disproportionate costs for blind & low-vision individuals seeking accreditation.

“The IAAP is the International Association of Accessibility Professionals. They have certification and one of the exams is technical and the other is more models of disability and things like that. Employers like it if you have one or the other of those certifications. I would like to take them, but they cost money and [...] I want to make sure I pass so I don’t keep spending money.” –Drew

4.2.3 Lack of Relevant Supports

Many of these Participants were more interested in continuing education or adult learning programs, over conventional undergraduate programs. This brings another set of difficulties, as some student loan programs seem to be more oriented towards youth and conventional undergraduate and post-graduate programs.

One cited problem was the lack of government financial support for education and training that are deemed “continuing education” programs in Ontario. Most Participants had already completed a primary post-secondary degree or diploma, and would be interested in interactive Web Design training in a continuing education context. However, it was reported that assistance from the Ontario Student Loan Assistance Program (OSAP), is not available for continuing education students. Furthermore, some Participants communicated that they were able to find funding programs for continuing education, but they were not eligible because they were currently receiving support from the Ontario Disability Support Program (ODSP).

“I noticed that the college programs that are out there, are outdated, tremendously. They’re not keeping pace with what’s going on in the real world. The boot camps are not covered, the actual programs that are up-to-date are not covered by OSAP, which is why I have to hunt so bad for money. ODSP does not help me. ODSP is very... once you get on it, they don’t help you really to get off. They’re kind of like you’ve got your medical stuff, you’re good, you’re stocked. That’s it. There’s just no... you’re stuck.” –Jamie

Participants who were receiving ODSP support indicated that these support payments helped them to afford baseline hand-to-mouth living costs, but did not provide enough money for anyone to conceivably attend training or schooling.

Some Participants complained that they actually had reduced access to potential funds for education and training, because of their reliance on disability benefits.

“And the EI Reach-Back, which is basically the new... ‘if you got laid off during the pandemic, you can get up to \$25,000 and go learn certain sectors to help the Canadian government do whatever,’ but because I’m on ODSF, I don’t qualify.” –Jamie

“And if these programs are going to be continuing education programs, how am I supposed to get funding to learn? I don’t understand that. I don’t have twelve grand to learn a six-week boot camp. You know what I mean? Twelve weeks if I extend it to the disability part-time program. And it’s not even a tax write off.” –Jamie

And while it is common for adults to have increased earnings and savings with age, many of the Participants cited that they were unable to find employment that would allow them to save enough money for further education and training.

“And I’m not able to work a regular job because there’s a lot of times I’m down and out for the count. So I just consider myself a community activist or advocate, basically.” –Jamie

4.3 Finding a Suitable Education or Training Program

Many Participants described a voracious appetite to learn more about Interactive Design, as they pursued their own personal goals and projects.

“I’m currently trying to learn everything I possibly can.” –Jamie

“...I’m really interested after talking to you and hearing some other people actually have similar thoughts and they actually don’t think I’m not going anywhere with this. When I saw that study, like when I saw that you were asking about doing interviews for this type of thing, I’m like, wait a second. I just started my website a month ago.” –Dylan

These Participants were actively seeking opportunities to pursue their interest, and inquired if the Researcher had any information that they could share. Some Participants found that they were naturally drawn towards reading and writing code, but not knowing which fields or programs of study could accommodate and nurture this aptitude.

“I don’t even really know what all those terms are. I just know, I love writing code, I love writing it and I love going through it and I love how it speaks. And I think that comes from my love of reading when I was younger. And I love being able to envision the picture of what it’s doing and just see the changes and stuff. There’s not even that education out there to even show me what I’ve learned, to show what I’m going towards. When you’re in high school, you go to guidance and they kind of guide you. I don’t even have that.” –Jamie

While many Participants described financial hardships, some were able to secure funding that they could use to study at an approved program. These Participants reported that even when having secured a third-party scholarship, it was still difficult finding a suitable program that would enrol them as a student.

“So that reminds me, the other trouble I’m having is I have no idea where to look for education. There are so many ads, and so many misconceptions and so many convoluted full-stack designer development, whatever. There’s no real terminology. And when I go look at the universities, I’m looking at two, three years. Half of it, why am I taking physics and chemistry when I want to... you know what I mean? So I’m trying to figure all this out. And when I’m asking everybody else, I’m not even getting a straight answer. So I just picked U of T (University of Toronto) because I was like, ‘Well, that’s home.’ That was it. I typed into Google and it popped in as one of the top ten, but that was one of the university programs, not the continuing education program. None of the actual programs are running, so there isn’t even a list of the best online programs out there. So I have no idea where to go and even make a change. Couldn’t even give me any information. And is it worth it to spend \$12,000 when I can go to a website called Free Coding and work my way through it?

[...]

I can get people to give money for me. I seem to be really good at that. I don’t know why they keep saying I’m inspirational. That’s what it is. So. But yeah. And I’m up for a CNIB scholarship right now too. I’m just waiting to hear from them to see how much I get for that. And I can put it towards whatever program I want. [...] I just don’t know where to go or what to do with it.” –Jamie

Many Participants outright asked the Researcher if they knew of any suitable programs where they could pursue learning more about Web and Interactive Design.

“I’d love to have more. I love working with this type of stuff. [...] I don’t know if you have any info about programs or anything, but I’d love to look at any sources.” –Dylan

“Do you have any opinions of where I should go to try to learn?” –Jamie

4.3.1 Location

Multiple Participants lamented the lack of suitable opportunities in the area they were living, while seeing seemingly attractive opportunities outside of their area. Participants stressed the importance for remote school & work programs to be available for blind & low-vision individuals.

“I think a competent screen reader user, could be taught in a relatively short time how to do simple accessibility testing. The Carroll Center for the Blind, which is an agency in Massachusetts, just started a program like that. And I thought, oh, great, maybe it’s remote. It’s a six-week program. Well, I ask them, and they said that it’s in person and that there’s a cost involved, but I could ask my rehabilitation counsellor to fund it. Well, I can’t really do that because I’m going to school locally. I thought that before school started (the Web Design curriculum I’m taking [...]) I could do the screen reader testing program, but since it’s not remote, I can’t do it. Which I think is a real shame.” –Drew

Another commonly mentioned area of concern for Participants was managing a safe commute. blind & low-vision students are less likely to drive a car, and even more likely to be reliant on shared transit. However, Participants complained that access to public transit was sometimes a barrier to education. One Participant remarked:

“Durham Transit will not pick up people who are visually impaired because we cannot recognize our end destination to ensure that we get there correctly.” –Jamie

Multiple Participants noted how adverse weather could disproportionately impact their ability to commute safely, as their limited vision is further impeded by their environment, and they may not be able to recognize potential hazards such as ice.

“Now, throw in rain or snow or ice. Throw in [...] a gray sky that matches the pavement. And now everything is flat. There is no definition between the ground and the sky, which makes it even more difficult. So a two hour trip can feel like a two day trip by the time I get home.” –Jamie

Participants who lived in cold climates noted the particular dangers of winter for them. They described how when being blind or low-vision, all ice became what the sighted refer to as ‘black-ice,’ making for a disproportionately dangerous winter commute that required immense time and energy to try and safely navigate. Concerns about personal safely travelling amid icy & snowy weather were, for obvious reasons, commonly cited by Canadian Participants.

Overall, a lack of remote learning options was one of, if not the single most commonly cited accessibility barriers to education & training.

“[At the] Canadian College of Business I remember her telling me, ‘No, we can’t do remote learning with you because we can’t guarantee that you’d make it through. We need you to have us in our classroom.’ [...] If we’re doing computers, why do I have to be in your classroom? [...] I feel like a week could be mixed. It doesn’t have to be completely, 100% in the classroom. There should always be that mix, because in the winter time I run into [complications from] snow and ice on the ground...” –Jamie

In many instances, Participants were not able to find a work-around to this type of barrier.

“We need more remote learning options.” –Drew

4.3.2 **Lack of Clarity & Certainty of Accommodations**

Participants communicated that they needed to know that the program they were applying to was going to be able to accommodate them. They didn’t want to be setting themselves up for failure. Participants reported that few design programs advertised any kind of accessibility for low vision and blind individuals, and so they would need to proactively make inquiries. This process was often labour intensive, and yielded few positive results.

“So here I am trying to go to school. I’ve had funding through the [owm] Network, which is for Web Designers, and through the Dream Legacy Foundation. I also had funding through second career funding. I even had a business willing to sponsor me through the Canada Job Grant, which would have made the cost of school one sixth of the cost. And I’ve been told by four schools, that they cannot meet my accommodation requests,

so I can't go attend their school. My accommodation requests are, could I please have the class recordings in a timely manner, not five days later, which is what happened at one school. Please, if the teachers have one screen in light mode and the other screen in dark mode, please just pick one. Because it's like being blinded even for people who are sighted. If the teacher is bored, please stop fidgeting with your scroll mouse up and down because it gets very nauseating. And can I have a heads up as to what I need to download ahead of time, so that I'm not trying to download these things while the teacher is talking? That's it. It's all I requested." –Jamie

Another consideration for low-vision students is the post-graduation (or program completion) supports that a program is prepared to offer. Multiple Participants communicated that they felt that they may require more specialized post-graduation consideration and support, and were uncertain if programs were prepared to provide this to them.

"I mean, when I became a programmer, there was a program for the disabled in Chicago. You applied and you were accepted based on kind of not so much computer aptitude in terms of what you knew about programming, but what you were able to do by being willing to learn to type, use a screen reader, things like that. So I was accepted, completed the program and then the understanding of the program was they would pretty much guarantee you an internship. And the chances are once you satisfactorily completed that internship, you would be hired. There are a couple of programs now that will train people. But once you pass their program, you're kind of on your own. The school doesn't provide any support." –Drew

One Participant was in the process of applying for post-secondary programs in Interactive Design and Development during this study. She reported her ongoing experiences in trying to find a program that she could afford, that would accept her, and be willing and able to accommodate her.

"People need to be more open. Let me prove what I can do. Stop putting those barriers in front of me. I even offered, hey, just let me start and I'll let you know if I'm having trouble. I'll give you some insights. I'll work with you. I don't mind taking one course at a time." –Jamie

“So the one thing about Lighthouse Labs, I’ll give them credit. They did cop to, ‘look our program doesn’t have this. We are not able to accommodate you.’ It was the first school that actually told me why. Then they said, ‘we have two free programs on our website. We would love for you to take those two free courses, audit them, and tell us how we could make them more accessible. Let us know what your problems were, what you thought was good or bad, and then we’ll go from there.’ They’re applying for OWN and Dream Legacy Foundation again, 3.0 in April. So they’re hoping that I can take a flex program in July, which, instead of a twelve week boot camp, makes it thirty weeks so that it breaks it down into smaller hours and smaller chunks. So that being said, great, they’re moving forward. But why did I have to fight so hard? I’ve been fighting with Lighthouse Labs since last March. And emailing and talking to them and being shut down by them. Why did it take so long to get them to do something like this now? It’s frustrating beyond belief.” –Jamie

She ultimately decided that the best school for her was no school at all.

“So last night I took \$127 USD and paid for Code Academy so I can start learning, REACT and Java. And I kind of decided that I am done trying to find a school. I’ve spent too much time trying to find a school to teach me. I’m going to continue teaching myself and I’m hopefully I’m going to build a platform that is going to have all the information for the visually impaired and other people who are disabled that has all the program information all in one spot globally. I’m hoping we can connect to each other.” –Jamie

4.3.4 **One Theory of the Problem**

This same Participant theorized that some of these educational programs are not accessible to blind & low-vision students by design. She believes that some of these barriers are used by institutions to shield themselves from potentially difficult situations.

“They’re scared. But isn’t life about being scared, and trying new things and new experiences? If we didn’t, if we all stayed within our own little comfort zone, we’d never get anywhere within life. [...] I’m the first one to say, if I can’t do it, thank you for letting me try. I just wanted to try. Right. But shame on them for blocking me before I can even give it a shot.

[...]

I'm literally telling them, look, if you help me, you will be part of articles. You will get so many grants, you will have media coverage, you will like, you know what I mean? Like to have somebody like me who's being followed by CBC, Time and People magazine. If you let me go through your program, or even if I don't make it through your program, it doesn't matter if I fail. But let me, let me try, let me see what's going on. And then let's work together to find out what happened. You know what I mean? And that's what I said to Lighthouse Labs. Because [their] first response was, well, we don't want you to fail. And then, you know, they're following us in this negative media coverage. And I went, But it's not negative media coverage. I said, 'You're going to be the first school that actually lets me in, and is willing to try. I think that's amazing media coverage.' I said, 'and if you're willing to change your platform, learning platform, I think, again, that's another amazing step forward. So where's the negativity in that?'

[...]

You know, I keep thinking it's almost as if you need to encounter the right people at the right time who are willing to sort of put their thumb on the scale and say, well, technically this isn't right, but obviously this works. This is fine. It's as if everyone is petrified of what could happen if they don't follow the letter of the guidelines or the law or whatever it is, and would rather just cut things off before they become way problematic." – Jamie

4.4 Post-Secondary Pre-Requisites

For potential students who do find a suitable education or training program, along with the requisite funding, they still need to obtain the necessary pre-requisites to be accepted into that program. One Participant noted that the pre-requisite requirements in a post-secondary Interactive Design program would likely filter out the very few blind & low-vision individuals who were considering attending such a program. Financial constraints, and a lack of sufficient supports, could serve as substantial barriers to achieving the competence and credentials required to enter a post-secondary program in their desired field of interest.

“One major impediment is simply that there’s very little training for blind people to get them to the point where they could enter [an Interactive Design] program like you’re describing. I know that in Canada, one does not have the resources that we have in the United States. They don’t have these kinds of training centres that are run by States, apparently. Whereas I was lucky enough that I went blind [living] four miles from a training centre, and I could go through vocational rehabilitation and got accepted to it. But even there the training is not terribly good because there’s too many students, and not enough good instructors. And so a lot of people don’t get to that point. They need to start having that education in grade school, just like all other students, and to be able to advance to the point where at the college level they can participate in colleges and get the sort of training that would allow them to take part in [an Interactive Design] program like yours. [...] There’s just not enough [blind & low-vision] students to go into your program. So I would say revising all of that and making education and training open to more people who have these problems from the early years. That’s where I see the biggest problem. And then once they have that ability, they could take part in a program like yours.” –Jesse

One Participant expressed the profound difference that higher quality (and more expensive) schooling made for them personally.

“I was lucky that I had a family who could afford to put me through private school for pre-high school. [...] So at the end of grade four, because of my eyesight, I had a grade two reading level. And then I went to private school for grades five through eight. At the end of grade eight I had a grade nine reading level. That’s how well the private system does work. I mean, that’s why I can articulate what I’m thinking so well, is because English was four subjects a day. Grammar was a subject at that school. And I got to high school, and they wheeled in this tea with a pizza, dancing, singing ‘a noun is a person, place or thing,’ I’m already writing in noun clauses. I put my hand up and I’m like, ‘I’m taking a nap.’” –Morgan

This Participant also expressed a concern that blind & low-vision individuals may have lower grades than their peers, for reasons that have less to do with their own personal competency, and more to do with the competency of the educational institutions they had attended.

4.4.1 Lack of Recognition of the Value of Lived Experience

Multiple other Participants cited that they felt that blind & low-vision individuals learned disproportionately more from the complexity of navigating life with little to no eyesight. Some Participants felt that blind & low-vision individuals would have a greater chance at post-secondary education if their life & work experiences were given more consideration in admissions.

“...I wish [schools] would take more stock in work and lived experience than they do in academic achievements. For example my GPA at Sheridan, when I took that diploma, it was like a 4.3. I got like three answers wrong the entire course. But my GPA at Trent and at [University of Toronto Mississauga] combined, is probably maybe 3.0, if I’m lucky. So if I need a three to get into Ryerson [Toronto Metropolitan University], all that giving them my transcripts from twenty years ago is going to do is plummet my GPA. So I think if higher education would take the focus off of grades, [or] at least take into consideration that I’ve worked with people with disabilities for about four years now. I didn’t even go to school for four years before. [...] So I’ve worked longer than I’ve been in school, and yet my schooling is more important than my working work experience.” –Morgan

For Participants who attended specialized education and training for the blind, Interactive Design and related areas of study were not provided. Most Participants did not seem to become aware of this as an educational or work opportunity until later in life. Most Participants seemed much more interested in attending pragmatic continuing education programs to learn Interactive Design, rather than foundational college or university programs.

“My concern is we don’t really have entry level training programs that will take someone from nothing, who just demonstrates a willingness and an aptitude. We don’t really have any programs to take someone from there to passing these exams, taking whatever study path is appropriate, whether it’s Web Design or information security or whatever, and then helping them get jobs.” –Drew

4.5 Institutional Readiness

“It was my first day in college, and I was scared. [...] It was very lonesome. Not having the necessary support from a family member or friend, didn’t know anybody there, didn’t know my way around. And then there was nothing posted anywhere that I could physically access where it would explain to me all the prerequisites I would have to go through. It wouldn’t experience nothing, no handbook and nothing to really explain anything. I just had to roll with everything and just started asking people things.” –Casey

Regardless of how scholastically prepared they were, all Participants mentioned a common unavoidable challenge when they entered post-secondary education.

“In the post-secondary world, I think the hardest part for me is orientation and mobility. [...] The first school I went to was Trent University. It’s a small school, but it’s a sprawling school. [...] So that took me a little bit. Luckily, one of the adaptations of being born legally blind is I have an excellent memory, so I can literally map out a place in a month or two if I spend time in it.” –Morgan

The Participant found that the existing wayfinding materials provided by the school were of little use to him personally. Instead, he found the actual design of the campus and its buildings to be the most important factor in enabling him to mentally map the campus.

“I find that the easiest way for me to navigate the post-secondary world is not to bother with maps, but to try and use landmarks.” –Morgan

However, not all campus spaces are equally conducive to building a reliable mental model.

“Sheridan [College] was another one that was actually very confusing. A lot of the buildings look exactly the same. [...] The problem with Sheridan was that there was very little contrast. Like at least if you go to a hospital, for example, they’ll have a red line on one wall, they’ll have a blue line, another wall. And there’s at least a colour distinction. It was all blue and light blue at Sheridan, so it was very challenging to navigate originally.” –Morgan

Participants expressed that an overwhelming amount of the institutions that they work with, don't know how to accommodate blind & low-vision individuals in general, let alone those interested in pursuing design education & training. The schools seemed ignorant of what their own blind & low-vision students might need in order to successfully complete their program, while specialized advocacy groups such as the Canadian National Institute for the Blind (CNIB) seemed ignorant of Interactive Design as a field of study and work. While most students show up to school expecting to be told what to do, these Participants often cited that when they attended an educational or skills training program, they were instead asked what they would need, when they have no idea what they will be doing.

"People keep asking her what she needs, when she doesn't know what they have in store for her. She needs to help to know what. Do they not have a list?" –Ash

"I guess my first [frustration] would be, of course, knowing what to ask for from the accommodation accessibility, because I myself don't know. I don't know what is required of me or from me and I'm not there to, I didn't study the whole entire program to say, 'oh, these were the things, the areas I could have worked on, these are things I could improve.' So that was my first semester, getting into it was like, well, what do you need? I don't know." –Wren

"So when I first went on to the study anywhere, I shouldn't have had to spend the first month trying to find programs that work for me and then have to play catch up afterwards. You know, it should be already there. Or when I did contact the University of Toronto, they sent me to the Student Success Center and they asked me what I wanted. And I actually sat there and went, 'why don't you have a list?' I don't know." –Jamie

This lack of competence and readiness in the schools was often perceived by Participants as an undue burden. Sometimes this burden became so large, that it was no longer manageable. One Participant described her previous failed attempt at post-secondary education.

And after that, it became such a heavy load, handling the challenges on my own. I didn't know where I could turn to, to talk to somebody about the amount of anxiety I had. And I didn't know where to talk to people (even if I went to CNIB) who experienced going into Graphic Design, or highly visual art, or a design perspective, because I knew

that this is a very, very small niche kind of thing. Yeah. So I kind of dropped out of that and I just went to work from there, to try and pay off my student loan.” –Wren

The level of knowledge and expertise at the schools seem so low, that students often must seek advice from outsiders to help figure out what they might be doing, and what they might need. However, this peer support can be limited in scope, when no-one in the peer group have studied or practiced Interactive Design or related disciplines.

“So with some helpful supportive advice from friends who have went through post-secondary with disabilities, they suggested to me that I should go with this approach and that approach, speak to a coordinator and just get a feel for the program. And you get the feel for the attitudes, you get a feel for the mannerisms, and then that speaks to their accommodations ability. And basically when I went into the first semester in a highly visual program, which they probably hadn’t had [a low-vision student] in over twenty years that they admitted, I threw them in limbo. So they definitely wanted to help. And I was very happy to get a positive attitude from them, that they wanted to figure out how to accommodate and how to best serve me through this program. And then after that, it was all the technical stuff. So what technology do you need? What service do you like? I don’t know. I haven’t been in school in over twenty years. What is there? So then I had to do a lot of research, and then I couldn’t really ask anybody in the blind community, ‘hey, what do you guys use for Graphic Design programs? What’s accessible?’ They didn’t know because they just deal with reading and writing, right?

[...]

...what I’m going into is a niche. And if there are people who have such disabilities as going into the arts industry, it’s usually fine arts because it’s something they can tactile-y mould with their hands and do wonderful things with the canvas and do all sorts of mixed mediums.” –Wren

4.4.1 Problem-a-thons & Intensive Suffering

In some cases, Participants reported that it was their other health conditions that the prospective school could not accommodate. Even managing the same health

care concerns as other sighted students may pose larger challenges for some low-vision individuals.

“My biggest thing is I’m a diabetic. There’s no meters out there that I can properly use. There’s no insulin pumps that my endocrinologist feels safe enough to give to me.” –Jamie

This Participant was particularly concerned with the emergent trend of hack-a-thons, design-a-thons, and other intensive or condensed workflows in design education. Multiple Participants cited this kind of learning as structurally inaccessible to them.

Many Participants cited multiple health problems, and complications that required disproportionate time and energy. The density of these condensed programs were cited as being incompatible with a baseline quality of living and healthcare. These Participants expressed that they felt like these programs were either designed in such a way as to exclude them, or to have a disproportionately negative impact on their health.

“And if I don’t go for those walks, if I don’t leave the apartment, if I don’t go have fun and sit on a patio and interact with somebody socially, it impairs my life so much, so much. And visually, I’m already having problems. So why would I want to spend twelve hours on a screen to begin with? And they’re already talking about sixty to eighty hour weeks when you’re including your project. And I’m going, no.” –Jamie

When this Participant became too frustrated with trying to find an Ontario College or University that could accommodate her, she turned towards the private vocational schools as a hopeful alternative. There, she found an even higher reliance on intensive learning, which would have a devastating toll on her health.

“Lighthouse Labs wants you to sit there from 9 am to 9 pm. Juno [College] wants you to sit there from 10 am to 6 pm. I don’t know about, I didn’t even get that far with the University of Toronto, so I have no idea how long their days are. I can’t imagine the average user wanting to sit there through their boot camps, and it’s their boot camps that keep getting me denied because I refuse to personally sit there for twelve hours. I shouldn’t have to. Nobody should have to. Because I can only imagine what it would do to somebody even who’s healthy sitting there. It’s insane.” –Jamie

Beyond personal health, another lack of consideration in these high-density learning programs is the lack of accommodation for service animals. Support animals need to be walked, they need to be taken outside, and they cannot abide by the restrictions of these intensive programs. Participants who relied on service animals mentioned how even when they are able to receive adequate accommodations for themselves, they were less likely to be able to receive adequate accommodations for their service animal.

“Do I really need to sit there for the entire day of the boot camp? Can I just be there for the lecture part? Maybe there’s a lecture in the morning and then in the afternoon. And then the rest of it’s independent learning. I’d be fine with that. [Particularly] if we have access to all these great mentors online, forums and stuff like that. Again, why am I stuck there for twelve hours? I have a life to live too, and mainly I want to walk my dog. That’s really simple. I have a guide dog and I do need to walk her. And I don’t want to be stuck in a chair for twelve plus hours in a day. Nobody wants to.” –Jamie

In the end, she decided to proceed with the Juno College program, and to try and adapt to its demands.

“So the first week of Juno, I did it their way that they wanted. I sat there from 10 am to 6 pm. My class video would be uploaded the following morning, so I would have to do that day’s courses, then review yesterday’s recording. It was meant for very long days and by the time the weekend came I had massive headaches. I was throwing up. My sugar levels were completely out of whack because I wasn’t walking around. I was in a chair, and I was sore. There were times I came out of my office and my kids looked at me like, ‘Mom, this is not good.’” –Jamie

When accommodations could be made to reduce the density of such intensive learning programs, it sometimes came with a reduction of instruction and support to the blind & low-vision students

“As tired as I am and all the extra work I’m worried about, how do I get all that learning in for six weeks? [...] So then they’re like, well, you can extend it so it’s a twelve week program, but you don’t get the live teacher help, you only get the recordings. And I’m going, so I only get half-ass for the same money. Just doesn’t seem very fair. Yeah.” –Jamie

4.4.2 Lack of Physical Functional Diversity

One potential reason for this lack of competence in working with blind & low-vision individuals may be because of the physical homogeneity of the people who serve and staff these institutions. Some Participants noted that unless they were applying to work with organizations explicitly oriented towards the blind, it was very uncommon of them to come across low-vision individuals when pursuing education & training. Furthermore, some Participants explicitly noted that the existence of low-vision individuals in an organization made them feel optimistic that the organization would be able to accommodate them.

Drew: “The thing I liked about them is that they have a blind person working there who participates in a lot of the same forums I do. In fact, she saw some of my email on an email list and she said, Oh, you’re a good writer compared to the other people.”

Researcher: “How often do you end up finding someone from the community that you know and can identify with? And is that a very important thing for you when you’re looking at job opportunities?”

Drew: “It’s important. But I would unfortunately, I would say most of the time there either isn’t a blind person directly involved. [...] I have found situations where I interviewed for jobs and was told that some of the screen reader testers were blind, but I didn’t necessarily meet them. I was somewhat removed from them. [...] I really have known two or three blind people who had roles in companies other than just being a screen reader tester being paid as a contractor.”

Organizations that already had blind & low-vision individuals working there were cited as appealing to Participants.

“Well, they had visually impaired and blind people there working there before I got there, so it just made it that much easier. And I know I wanted to continue working with veterans, and learning more about veterans and then just learning more about diversity. I’m used to being in diverse environments, so segregation definitely wouldn’t work for me. But, you know, I would work with that as best as I can to get out of it, to get back into diversity, because that’s what I was born into.” –Casey

No Participants expressed a preference for working exclusively with blind & low-vision individuals. Diverse integration with sighted individuals was universally preferred to segregation based on disability.

4.4.3 Words Versus Actions

Many Participants expressed that they have found that institutions that purported to have the desire and will to accommodate low-vision individuals, lacked even the most basic competencies to be able to fulfill such goals. Often times, Participants would feel like they were paying to be test subjects in organizations.

While institutional and individual attitudes and assumptions were cited by many as a problem, a lack of knowledge, expertise, and skill in working with low-vision individuals was often cited as a large barrier.

“Well, I guess most institutions and schools want to be accommodating. They just need, I guess, expertise on how to accommodate certain individual’s needs. So they have the desires there, but they just don’t know what to do.” –Ash

“I think they just weren’t prepared for me to come in.” –Jamie

4.6 Hardware & Software

Participants expressed an ongoing concern of being prescribed, or needing to utilize technology that is not compatible with their screen reader or other preferred accessibility aides. This was commonly reiterated multiple times in the same interview.

One Participant felt that part of the problem, was that institutions were allowed to procure and prescribe inaccessible software tools, that essentially become roadblocks for blind & low-vision individuals.

“You know, I’m comfortable with screen readers, but what I don’t see in design programs, is that in many cases the school will use like ‘Whiteboard’ and you have to type during a lecture or use some platform and follow along or submit work. And in a lot of cases, those programs and those education interfaces are not accessible. Even though here in the United States universities and any institution that get federal money (which is

most), are required to have accessible goods and services including access to education, reasonable accommodations in the format of the user's choice (for example, hard copy Braille or maybe a Braille display.) [...] I would say the quality of services really varies from state to state. It really depends on where you are." –Drew

Another Participant felt that this was a situation that was not likely to change, until larger organizations, such as government, made accessible requirements a mandatory consideration for contract procurement.

"I'm also a member of the Canadian Council of the Blind and [other similar organizations]. The general thought there is that if we insist that the government in the educational institutions only use and accept software that is accessible, period, then that will put the necessity for the developers and the creators to make it happen. So without the government actually doing that, I don't think there's much of a chance. There has to be some 400 lbs gorilla putting their foot down and saying this is going to happen. So usually you hit people where the money is, right? So you ask the government, you know, let's implement these guidelines throughout our entire ecosystem." –Ash

Some Participants complained that they had seen public institutions contract out turnkey solutions to provide more accessible communications, that then end up imposing an additional tax on low-vision individuals.

"We also see the game where people say they'll provide the accommodation but they want to pass the cost on to the consumer. It's like, no, the laws say there's no cost to the consumer. It's up to you. You meaning the entity, the agency, company, whatever, to provide the accommodation and figure out how to accommodate it." –Drew

Participants expressed mixed opinions about accessibility add-ons to help address these problems. There was however, a consensus belief that it would be preferable to get to work with systems that had considered accessibility from their very inception.

"I know a lot of these things start if they work with the design and bake it in from the very beginning, it's much easier to accomplish and get things done that way rather than start at the end of the process. Right and go, 'Holy crap, how are we going to make this work?' Right? So I just wish that more Web Developers are designers would

implement accessibility or have the forethought at the initial concept, you know what I mean? And then develop it as it goes. Right?” –Ash

One Participant spoke about how they had used websites with so-called accessibility overlays, which ended up breaking the accessibility of some forms that they needed to utilize. They expressed concern with school’s adopting these so-called accessibility overlays for their own websites, which students increasingly need to access in order to facilitate their post-secondary education.

4.6.1 Technology Platform Diversity

One commonly identified complaint with mobile accessibility accommodations, was that sometimes a specific accommodation is exclusive to either Android or Apple platforms. Nearly all Participants mentioned a strong preference for only working with (and owning) one of these competing technological platforms. Some Android users were particularly vocal about this, seeing Apple iOS exclusive accommodations as an unreasonable financial barrier to accessibility.

Participants mentioned a plethora of different technology stacks that they relied on to do Interactive Design work. Some Participants expressed their enthusiasm for Apple’s technology platform as a superior option for their accessibility needs.

“I love Apple because they thought about accessibility at the very forefront and they baked in accessibility into the OS. And I mean, you’ve got voiceover magnifier and Zoom and everything right in the OS. So then all the screens are more accessible, like all the content and everything because of the forethought that they put in at the beginning. I also like Apple products because I like their design interface.” –Ash

Furthermore, some Participants preferred working with iOS touch-screen devices, over keyboard-centric desktop interfaces.

“If you use a Windows computer [...] you’re going to be reliant on keyboard commands for practically everything. Unless you’re using a Braille display and you can push a button to move the cursor or to simulate a mouse click. At least on iOS and Android you get spatial relationships and you can tap like a sighted person.” –Drew

“I like the fact that on a touch screen (we’ll use Apple for example) with the voiceover cursor, you can move it around the interface of the web page. And that makes a dramatic difference because you’re getting contextual feedback rather than if you’re taking a screen reader and you’re just controlling it by the keyboard. [...]. So that’s why I like apps on the iPhone, because the simplistic simplicity of the interface and you’re just pushing around a touch screen cursor and you can easily figure out what the layout is and everything else. And it just that the device and the interaction actually makes life easier, right?” –Ash

Yet other Participants found mobile devices to be comparatively less accessible than their preferred desktop platform. Many Participants expressed a clear preference for the accessibility of the Windows platform. A few Participants spoke of their personal preference for working on Android devices.

These were not mere preferences for seemingly similar products. Many of these Participants had spent a considerable amount of time, energy, and money investing in learning to be productive with their preferred technology platform. In some cases this also included purchases and training with specialized hardware devices, which may not be compatible or useful with a competing technology platform. Participants expressed a strong desire to be able to use their preferred familiar technology stack in any education or training scenarios. One Participant described themselves as a life-long Macintosh computer systems user, who had to switch to Windows after losing their eyesight.

“Oh, it was it was difficult. I mean, I had used Windows, but not very much. If I was working, say, in the advising office, I would have to use a Windows computer. But I never was very good at it because I never had learned it. But learning to do it blind, just using a screen reader and trying to visualize what was going on the screen, that was that was really tough. It still is. Sometimes I’ve gotten much better at it, but it’s a very tough transition for me. That’s why I wish I could have used Macintosh, because at least there I knew what was going on. And even if I couldn’t see, I knew what was going on in the screen. With Windows, it was trying to remember the little bit I knew, and then just trying to use a screen reader to figure out where I was and what was happening hierarchically and just on the screen in general.” –Jesse

This Participant noted how it can be difficult to migrate computer platforms for anyone, and how this is made worse when having to migrate from one GUI to another with limited, if any eyesight. Participants expressed that they want institutions to support multiple computer platforms, to reduce burden of migration and trade-offs of losing familiar tools, etc.

4.6.2 Text-Based Workflows

One Participant discussed how the fundamental underlying text-based nature of computer code, and the systems that makeup the Work Wide Web, represented an evergreen well of opportunity for blind & low-vision individuals.

“I mean, in the past a lot of the Web Development tools were not all that accessible, and maybe they are now. But it seems like more recently the data I hear is that there’s a shortage of jobs, and a lot of Web Development is text based. So this is something a blind person can do using a screen reader.” –Drew

Conversely, another Participant expressed how they could not find a single HTML editor that was accessible for them. They found the most accessible option for them was Apple’s TextEdit software, but this was an inefficient way to work.

“...I was using a free HTML compiler. It was very prevalent out there. I forget what it was, but it wasn’t accessible, and 100% needed eyeballs for it. I asked around in the blind community and nobody had any answers. So there’s no blind friendly HTML compilers, like when you type in the codes and then it has suggestions like what you can put in there, up to speed with like macros and other things that you can plug in and generate the code. [...] I couldn’t find an HTML compiler at all that was accessible. [...] If I really, really wanted to, it could do it with TextEdit on Apple. Just the text editor, but then you lose the tools for code generation automated stuff in there because you have to do it all entirely manually. Right. And then you’re more prone to errors, right.” –Ash

4.6.3 Industry-Standard Inaccessibility

In front-end Design work, Adobe software is often considered to be an industry standard set of tools, utilized in a variety of different ways. All Participants who

had experience with these software products expressed complaints at the lack of accessibility.

“...I had access to some of [the Adobe] software and I’m looking at it and there’s no way, no way to see it work at all. Right. But yeah, I understand. Like the little blurbs that I read on [Adobe’s website], like they talk the talk, but when it comes to their own product, it actually fully falls off the mark.” –Ash

Another Participant more pointedly called out the aspects of Adobe’s interface designs that were vexingly inaccessible. She mentioned the reliance on icons, embedded submenus under icons, minuscule target button sizes, and lack of screen reader friendly labels on elements.

Many Participants noted that they can accomplish most of the same tasks as their sighted brethren, albeit sometimes with different methods. This extended to software use as well. One Participant noted how the design software that she was prescribed to use were not accessible or screen reader friendly.

“Technology is slowly evolving. Four months ago, Adobe Illustrator and Photoshop were not screen reader friendly, as in screen readers just don’t have the AI intelligence to read what the icons are, so that is what it is. However, as I was in my discovery of what other alternative programs I can use to do some of the digital or enhancements of my traditional mediums, I found, Ooh. What was it? Pages. Pages. Writing program from Apple. It works with my screen reader. So it works in a way, not for drawing, but for layouts. Positioning where I want my image to be.” –Wren

One Participant noted that one of the challenges for blind & low-vision individuals in Interactive Design, is that it is an industry that often uses relatively new, novel software and related technologies.

“...I think that the screen readers have a hard time keeping up to all the different changes too, because they develop so rapidly.” –Ash

4.6.4 Individual Diversity

Some Participants also noted that regardless of what their research or popular opinion indicated, sometimes supposedly accessible software packages had serious roadblocks

for them, while sometimes they were able to find workarounds to sufficiently utilize supposedly inaccessible software packages. In order to discern the level of accessibility to themselves personally, they need to be able to try the software themselves, using their own preferred technology stack, including any accessible technologies that they rely on.

One Participant noted how the fear of COVID-19 transmission through contact surfaces has led more restrictions in her being able to touch and try products before she buys them. While asking customers not to touch goods may seem like a reasonable retailer's prerogative, this unduly affects blind & low-vision individuals who may need to experience something with their hands in order to make an educated purchasing decision. This same Participant noted that even when she was able and allowed to play with merchandise in the store, it was still often a less than ideal product audition, as they were not able to test the product with the target software, and their preferred assistive technologies.

"...I did go to the Apple store, and I did ask them about it. And of course it is still an accessibility thing. And they don't they don't necessarily have the right personnel to even be in the visual arts field to play around. They're not going to allow me to sit there and download Adobe Creative Suite and then, hey, it works, you know? So that's one of the challenges." –Wren

She also noted that in the past she may have been able to facilitate this necessary auditioning of technologies at her school, but again, changes made in reaction to the COVID-19 pandemic had intervened.

"And now that my program has went online. I can't even go to the school and say, 'hey, you guys have an iPad Pro? Let's download the Adobe Creative and see and see how it works!' I can even do that right now.

So COVID definitely has created this huge challenge where I have to figure out who I can best talk to, and I think my next step is to call the Apple accessibility line. And ask them to go do a demo for me. How is Adobe Creative Suite with Illustrator and voice over screen reader software on the iPad with a pen? Is it going to work and what are the technical difficulties I'm going to face?" – Wren

One low-vision Participant explained how including a simple LED light for her desktop computer display made a significant difference in her being able to effectively use her eyesight with her machine.

“They spent \$3,000 on a computer from Canada Computers that they got hand built for me that I actually got to pick out, which was great. I put all the specs in and then they also gave me a tool light that goes over my monitor. It’s called a [ScreenBar Halo by BenQ]. [...] Oh, so it’s just like a bar, but if I’m having a migraine or anything, I can actually change the light to a warm light, blue light, super bright, and I can dim it to different degrees. And it’s an LED and I never have to change the bulb ever again. And it literally sits on my monitor. So if I’m finding the big lights too bright and they’re hurting, I can just turn that one light on, which is really nice.” –Jamie

It is common for low-vision Participants to have more rigorous demands for needing to manage lighting contrast, in order to be able to work safely and effectively. Multiple low-vision Participants relayed the importance of customizable user interfaces in software. Some preferred light text on a dark background, but different individuals required a different level of text to background contrast to optimally suit their vision. Additionally, the ability to specify a user interface font, or the font for the coding window, were also cited as valuable considerations when selecting software tools. One Participant also noted the importance of being able to use a text editor that allows for some key customizable interface elements.

“And I have to watch when I’m coding because if there isn’t enough space between the text, ‘I’s and ‘l’s and ‘l’s look the same to me, they all blend. So there’s some programs that I’ve been using... I’ve been able to change the text colour and increase the size and make it dark mode and stuff like that. So they’re slowly coming. I’m slowly starting to find things, but my biggest problem is nobody’s out there to help me find these things. I’m finding them on my own. And it’s not from lack of trying, and that’s the frustrating part.” –Jamie

Difficulty in finding the right software packages that have these features, or even finding out if they exist at all, some a frustration echoed by many Participants. Some Participants mentioned that they had not been able to find any software packages that met their needs, while other Participants described using software packages that sounded like they would meet the needs of the other Participants. Most Participants

expressed the lack of clear standards, reliable information, and knowledge about the accessibility of various software tools as a time-consuming barrier for them.

Perhaps the single most important type of feature-set, were any features that allow the Participants to increase the size or magnification of user interface elements, as well as any corresponding content.

Participants emphasized the importance of more accessible technology, not only to realize their own potential, but to increase what they could do for others.

“I would say there are a lot of applications that still aren’t accessible, but in terms of Web Design and things like that, there is more of a path, and I think the accessibility efforts that have shed light on the Web are going to move out to any computer application. I mean, yes, things are changing all the time, we’re in reactive mode, but I think the accessibility efforts, especially for Web Design and things like that, will continue. And I think there will be career paths for people if there’s funding available and there are people that are willing to make this happen at all levels. I never thought of accessibility as a career until I was invited to work part time. And now I know I’m interested in Web Design because I know I need to know more about things so I can do remediation or at least recommend remediation.” –Drew

4.7 Teacher Competence

None of the Participants cited having disproportionate difficulties with fellow students in post-secondary education. Instead, teachers were most often singled out as those who seemed lacking in the requisite skill or understanding to effectively teach blind & low-vision students.

“I really didn’t have any problems with any of my classmates in college. It was mainly the teachers who were ignorant. They didn’t know how to teach a blind person certain things. They thought they were all supposed to memorize everything. No, certain things you can’t. Especially like, higher math or trying to describe maybe like a criminal disciplinary action. How are you going to expect us to remember? We can remember terms perfectly fine, but things that have multiple steps, that’s on a much greater level, much broader spectrum. There’s no way in hell we can memorize it. [...] And if it’s

something like math, I have to have it in Braille where I can feel the symbols and feel each step at a time in addition to hearing it auditory. And I just have to be able to do it multiple times redundantly. And then next thing you know, I start picking it up, but they just couldn't get that concept. It was nothing wrong with the brain of the student. It's the ignorance of the teachers.” –Casey

4.7.1 **Orthodox Inflexibility**

One common complaint was that some teachers were not receptive towards blind & low-vision students using atypical methods to complete tasks. In some cases, these students felt like they could have overcome some key difficulties if their professor had allowed them to take different approaches than their sighted classmates. When one Participant tried to follow the physical demands of the program she was attending, she suffered serious ill health. When she decided to prioritize her health over adherence to the prescribed conduct of her program, it helped improve her learning.

“So the second week I did it my way. I left the camera off. I entered ‘Hello, I’m here’ so at least the teacher knew I was there. I got up and wandered around because if I have to review the video anyways, why am I sitting here for eight hours? I turned off the volume so I didn’t have to listen to the teacher talking and I did the days before classes and I did my own independent learning and handed in all my assignments on time...

[...]

So, I can figure out how to do my learning. I know I can do a lot of self-learning. I don’t mind sitting there for two to four hours for a lecture as long as there’s a break in between. I don’t mind doing code-alongs. I’m fine with that, but I don’t know why I need to sit there and have a teacher stare at me while I’m doing independent learning or whatever. That just doesn’t make any sense. We’re adults. We’re not little kids. Don’t treat us like little kids.” –Jamie

Multiple low-vision Participants noted that they needed to make extensive use of zoom features on digital displays, sometimes putting their face very close to the display in order to discern the requisite level of visual detail. While these Participants were equipped to do this easily at home, they noted that classroom computers and shared computer labs were sometimes arranged in such a way to make this difficult, if not

impossible. Furthermore, some Participants felt socially awkward when they engaged in this practice in the classroom.

“But even when I did video conferences with [my teacher], he used to get upset because my screen was too zoomed in. I’m like, But how am I supposed to show you where I’m having an issue if I zoom it back out? Even if I took a screenshot and sent it to him ahead of time and use like a highlight pen to circle where the issue is within the code, the syntax code or whatever, he wouldn’t listen to what I had to say. He would just jump on the call and then wouldn’t be prepared for it whatsoever. So I think that’s an education for teaching, to be prepared as a teacher.” –Jamie

While digital systems can be rigid in the interactions they will accept, physical media can sometimes be more accommodating for innovative atypical inputs and approaches. However, if a teacher is unwilling to allow a student to use atypical methodologies to complete a task, they may not be able to complete it at all, rendering the education and skills training inaccessible.

“But then the next part was, well, is there even technology to help me further my career. And at that time, no. But it doesn’t mean that you cannot use any traditional mediums. And I figured out how to use traditional mediums, how it works for me, not how it works for everybody else. Unfortunately, my professor was also not very open-minded in finding an innovative approach to how I worked things out. Yeah, so that was my fun experience.” –Wren

Another related complaint, was that teachers who were giving instruction on software, often didn’t seem to have any knowledge of basic software interface customization options for the software they were prescribing. Teachers who seemed competent at teaching software tools to their sighted students, had less expertise to offer their blind & low-vision students.

4.7.2 Learning Materials & Lesson Plans

Multiple Participants noted that even though auditory or text descriptions of visual materials are a widely accepted baseline level of accessibility needed for blind & low-vision students, few teachers consistently provided materials in such a manner.

“I shouldn’t have to be requesting it. You should be doing these things accessibly by default. I should not ever have to request an accessibility accommodation other than maybe braille or large print or something.” –Drew

“And even the teachers, they’re always like, ‘yeah, please come on back.’ But even they have problems teaching me because often their videos had the coding within the video and I’m going, ‘I can’t see that’ and there’s no transcript.” –Jamie

One Participant noted that while including descriptions of visual materials was a baseline level of accessibility, the quality of these descriptions mattered significantly. She had encountered descriptions that had varied in quality from offering revelatory clarity, to providing obfuscating confusion. Most Participants mentioned times that they were given descriptive text that was of such a low quality, it had inadequate (if any) utility. Participants asserted that teachers who work with visuals must develop a competence in describing visual language for their students, and to make sure they are always including high quality descriptions with their learning materials.

One specific noted problem was when people in the classroom were sharing content on a screen, and directing focus by using the on-screen cursor. Low-vision Participants communicated that they could rarely see the cursor at default sizes, and both blind and low-vision Participants communicated how important it was to accompany cursor usage with verbal or auditory cues.

“Like if somebody is showing you their screen, I wouldn’t want them to just use the [cursor] and say, ‘Oh, I’m going up here on the screen,’ because I can’t see enough looking at the screen when you’re sharing it. [...] You don’t have to say ‘I’m going to the right side of the screen,’ but ‘let’s take a look at this element,’ because then that would tell me as the listener, ‘oh, they’re probably going in this area.’” –Dylan

One Participant noted that beyond needing auditory equivalent content, it was important that the content was read and recorded competently for her to be able to understand it.

“And then, a lot of the tests, some of them had to be read. I hated it because some people’s voice just wasn’t right for reading and pronouncing, some of the words I needed to hear, to understand. That was hard.” –Casey

Some Participants cited that even some of their most open-minded and supportive teachers, would habitually forget to follow through on the previously agreed upon accommodations. This would lead back to the Participants feeling like they had to continue to advocate for themselves, having to ask for the same accommodations multiple times, and all the while feeling like a burden in the process.

“[Handing in all my assignments on time] was extremely hard on the Thanksgiving weekend, because that Friday’s video didn’t get posted until Tuesday afternoon, and that project was due Tuesday morning and I was granted no extensions.” –Jamie

When accommodations are provided sporadically, and not in a timely manner, blind & low-vision students face a disproportionately difficult workload compared to their sighted peers.

4.7.3 Tasks & Timing

Participants stressed the relationship between difficulty and time when completing tasks. When tasks were disproportionately difficult for blind & low-vision students, they needed disproportionate time to keep pace with their peers.

One Participant described how they were making use of various online tools to analyze images and understand their semantic value for visual design.

“You can’t just do it overnight. Especially a visual product. But I could actually see that and see how it did. The description, if I see it doesn’t come up with anything or like if somebody tries to tell me, ‘Oh, this is a picture of a cat,’ and then it says like, ‘Stop sign with a car.’ It’s like, that wasn’t accurate, so let’s not use that for the page. I can’t just go by one description. You got to make sure your sources are correct. Like you got to make sure if I was the only one charged with doing this, like the only one asked to do this task, I would have to make sure I put work into it and make sure it’s exactly what we want. Because if not, somebody could think, I don’t know what the heck I’m doing.” –Dylan

This same Participant described how doing visual work without a sighted partner could take him significantly more time as well. He found that when paired with a sighted individual, his productivity was greatly enhanced on visual tasks, as otherwise he

often relies on cycles of trial and error and seeking feedback that could be quickly circumvented when working with a sighted teammate. Furthermore, when working with a sighted team-mate, he would find that they would naturally divide and specialize work in a way that was more efficient for all parties involved.

4.8 Attitudes & Ideology

Many Participants cited attitudinal annoyances they'd experienced in schooling, that they felt were a negative stimulus.

One Participant told a story where a teacher referred to them as “disabled,” which they did not appreciate. The student tried to explain their point of view and personal preference to the teacher.

“...when I hear [the word disabled], I hear ‘unable’ and I take an evaluation of my skill set and I’m like, there’s not a lot that I’m unable to do, so I’m not a huge fan of that word. I understand it’s the legal term and I use it in my job. But the point of this story is she’s like, ‘Well, what would you rather be called then?’ And I said, ‘Well, Morgan works, but if you have to put a label on it, I actually prefer visually impaired.’ She’s like, ‘Isn’t that more insulting?’ This is a sighted professor telling me this. [...] And the first thing I thought, but I never said to her, was ‘How would you know?’” –Morgan

This Participant went on to caution against relying on the currently politically correct language to refer to blind & low-vision individuals.

“...the problem with trying to choose the right language is that it’s going to be different next week. [...] And that’s what I was trying to get through this professor’s head, that I understand it’s in the textbook, and I understand it’s your best practice, however, practices are changing all the time. And I just thought you may want a perspective from someone with the condition. But apparently ‘impaired’ was more insulting to me.” –Morgan

He went on to describe how he personally tries to use the preferred language of each person he works with, a practice he would appreciate his own teachers to take up themselves.

4.8.1 Underlying Biases

Multiple Participants tried to make sense of the unnecessary educational barriers that they experienced by examining the underlying attitudes and ideologies affecting post-secondary institutions. Many Participants shared stories to illustrate the negative beliefs or assumptions that others sometimes hold.

“Unknown: ‘You don’t look blind.’

Jamie: ‘Well, you don’t look stupid.’” –Jamie

“There’s several articles I read recently about the stereotypes people hold about blind people and their competence, or actually lack of competence in educational work settings, which is one reason why so few get hired, because employers tend to have very negative stereotypes. People ask me, like, someone asked me a couple weeks ago, ‘well, who takes care of you?’ I take care of myself. I cook for myself. I live for myself. But they just can’t conceive of that. And I think that partly what you’re saying is that they’ve interacted with so few blind people because they don’t make it into the professions as often. They don’t make it in the college classrooms as often as others. And so a lot of faculty in that case are not familiar with blind people and would just think they’re incompetent and wouldn’t want to spend time with them. But that’s because they don’t have the opportunities. ‘There are no disabled people, there are only disabling environments, and we must strive to enable them for all.’” –Jesse

“So I play billiards. And they have a pub at the Mississauga campus called the Blind Duck. That’s the setting of the story. And these two guys came up to me [...] and this other guy, he was from Columbia. He was like a trick shot artist or something like that. And so they come up to me like, ‘Hey, I think it’s our turn for the table.’ And I just look at them like, you just said, ‘Bro’ at university, come on. But that’s what I was thinking in my head. And so I’m like, ‘I’ll tell you what, why don’t you play us for the table?’ [They responded with something] like ‘I don’t know. That guy looks pretty good.’ And I choose this story because it’s my favourite example of the difference between perception and sight. And I said, ‘Yeah, that guy is really good, but I’m legally blind. You can totally take us.’ So I threw the first couple of games on purpose and we played one last. He’s like, ‘Okay, okay, we beat you. It’s our turn now.’ I’m like, ‘All right, well, how about this one last game? \$5 a ball and winner takes the table. I’ll even let you break.’ Anyone who’s not a professional pool player is not going to sink anything on a break.

So they broke and they actually got one. I was surprised they got another one they missed. And then so I'm like, my turn. Yeah. So I literally went like this with my ankles and cracked them in front of me. I sunk five in a row. And then I missed. And they sunk one or two. And my partner cleaned the table. And then the guy comes up to me and he tapped me on the shoulder. And this is the part that I love. He said, 'Hey, I thought you said you sucked.' I'm like, 'No, no. I said, I couldn't see. You heard, I sucked.'" –Morgan

4.8.2 **Self-Attitudes**

One Participant, who had expressed criticism of her previous teachers, took the time to express the positive effect that competent teaching has had on her. She expressed how having her teachers recognize her own expertise, increased her own realization of her potential.

"But one thing my teachers did find was because I pay such attention to detail, I can pick out those errors within the code and I can generally read it and go, 'Oh yeah, that's what's going on.' [...] That was really interesting with me in the beginning because I didn't think that I could do that." –Jamie

Multiple Participants stressed the importance of a positive personal mindset to be able to adapt to the challenges of post-secondary education.

"I have this mantra. There is a very large difference between observation and sight." –Morgan

"...especially with the schooling, they're like, How are you even doing that? Because you're blind. I'm like, Just because I'm blind doesn't mean I'm helpless, if we can put it that way, because you have to adapt. Like I say that word adapt because you can't just let yourself down. You've got to think of the disability as an ability because you have to be able to find ways to complete your education. And if I would have been 'Negative Nancy' all the way through college, I don't know if I would have been graduated by now. I probably would have let myself down, stressed myself out, not been able to complete stuff on time." –Dylan

"Nobody else is going to do it for you guys." –Casey

4.8.3 Social Service Ideology

One Participant brought the unique perspective of having attended post-secondary school for social services training. This Participant was highly critical of the associated underlying ideology being taught in schools, and how that ultimately made his life worse.

“So while I was in school, everything was social services and that’s all that mattered because I needed the grades. When I got out of school, I was like that for a little while just because I was pre-programmed. But the minute that I said, you know what, this does not need to apply to my daily life, the better my life got.” –Morgan

He gave a few examples of some of the problems he witnessed, that he believed were ultimately affecting the delivery of social services downstream.

“[...] Like I was trying to point out while I was at Sheridan, they were trying to teach people empathy. Is that possible? I wasn’t allowed to use the word ‘understand.’ But I was allowed to use the word ‘understandable.’ [...] And then they say in the same breath, ‘you have to be detached from your clients.’ Well, you’ve got to pick one.

And they’re teaching all these nineteen-year-old kids, that as long as you say these words enough times, you’re empathetic. But it’s not true. What you’re actually making are automatons. You’re making robots who don’t think for themselves and [...] are quoting textbooks that are probably outdated by the time they’re dealing with clients.” –Morgan

The Participants did not want to see those same ideologies laundered back into academia to inform various services, and ultimately, staff working there. He expressed an ongoing frustration with being treated as a class of people, rather than as an individual human being. He emphatically stated how important it is to simply listen to people, to take cues for what labels they may self-scribe, and to avoid labelling people in ways that they do not label themselves.

4.8.4 The Soft Bigotry of Low Expectations

“When people say, ‘well, how do you see?’ I inevitably answer, ‘well, normally as far as I know.’” –Morgan

One Participant offered a theory linking attitudes of some blind & low-vision individuals, with social services ideology, and the importance of inclusive design.

“And I just think sometimes, as inaccessible as things are, I also think that in some respects blind people have a lack of imagination. I know that sounds like a mean thing to say, but I think sometimes, we’ve seen from history that, not always, but in many cases the person that had a problem was the one that solved it. Edison in developing recorded media. Well, he had a hearing problem. Alexander Graham Bell invented the telephone because his wife was deaf. So we have problems. And in a way, I don’t fault people. I think our education system, where the blind doesn’t help people, doesn’t help people connect the dots automatically, there’s we have rote learning. And that’s just not working. That’s not good for user design. I mean, we have a rote approach, the blind person learns how to take activities of daily living, cooking, cleaning. And then beyond that, education, reading, writing, traveling with a cane or a guide dog, preparing for employment. So we have this rote system that the assumption has always been, well that’s how the system and it’s going to continue to work.

[...]

So, I think it’s low expectations. I think it’s [that] agencies that either serve the blind in terms of employment and training or the partners, state agencies that work with them really have low expectations. And when someone tries to challenge them, they sometimes, some of the people feel like their turf is being threatened, like ‘we know what’s best for you. How dare you hold us accountable for what we’re not doing?’ Yeah, that’s one problem. And the other problem is we just don’t invest in people.” –Drew

Some Participants bemoaned the lack of ambition in the specialized education & training resources available for blind individuals.

“But why not use us? Why not put us back to work? Why are we considered retired? I don’t get it.” –Jamie

“I think our system is broken because it really doesn’t prepare people for jobs that are competitive. I mean, the goal or what people have done for a long time is just steer [blind & low-vision individuals] to customer service jobs. And yeah, some people would say that a lot of blind people aren’t prepared for the work world in terms of not

knowing how to use a cane or use Braille or whatever. But beyond that, those skills can be taught. But beyond that, there really isn't much available. I mean, the focus has been on people who are newly blind, but once they're taught to be independent, assertive, where things stop. And then if there's some employment, then it's the call centres." –Drew

Technology is Proactive, Accessibility is Reactive

This same Participant also described what he saw as a fundamental ideology underpinning many accessibility problems.

"But I would say, especially for people who can't see at all, the present paradigm is reactive. We're not thinking ahead about what's the Internet or what's technology of five years from now going to be like?

[...]

We're not educating blind people to say, okay, here's what's coming. We're letting people guess. We're waiting until people run into a problem. And then it's like, okay, what do we do? So then we. I would say in most cases, our assistive technology has resulted from some reactive problem. Especially with regard to graphical user interfaces and Web Designs and mobile applications. We're in reactive mode. We're still in a reactive mode. We have a fire, someone lit a fire. We have a fire that we have to put out. It's like, how do we prevent the fire in the first place? So, in an ideal world, you wouldn't need an accessibility field. You might get researchers to work with people with disabilities and say, this is an idea we're thinking about. What do you think of it? Is this something that you can use? And if not, we won't do it." –Drew

4.9 The Burden

The lack of competence, knowledge, skill, and readiness in working with low-vision students ends up adding the most commonly cited burden by Participants. They are forced to become advocates for themselves, constantly requesting accommodations and changes in order to receive equal access to learning materials. One Participant shared the following anecdote:

“She’s going to College and she’s interested in Graphic Design and everything, and her visual acuity is not that high. So she’s using Adobe stuff. And it’s entirely not accessible, right, and I’m going... I tried to discourage her, but she’s adamant that she’s going to do this right. And she’s just I’m sure I know the lady that works in the Accessibility Office at [the College] and I go, ‘Oh crap. She’s probably just shaking her head going, what are we going to do with this?’ Because I don’t know what you have the person who has the desire, but all these things have to be changed to accommodate her. She could spend probably years advocating to get things set up more copacetic for her even before she dabbles in that.” –Ash

While many Participants indicated that advocating for themselves ultimately yielded better outcomes, many of them struggled to do this, for various reasons.

“So people expected that because I have this disability, I automatically got training with the CNIB on how to advocate for myself, or at least in the community. It wasn’t true for me that way, and [people] expected me to just advocate for myself and like, no, not all of us got that kind of training and people just didn’t understand that. I’m a very shy person and to step out of my comfort zone and start speaking up and advocating for myself, it was really difficult. [...] Not even with my friends that I made at school was I comfortable talking about it. So that was a challenge for me.” –Wren

Beyond just the extroverted nature of self-advocacy, this Participant also expressed a concern about individuals having to reveal personal information in order to get accommodations.

“I’m very open to talk about my disability to other students and professors. I think that opens up a whole new world of conversation and understanding. But however, I think there’s a lot of people, part of the disability community, that are not comfortable enough to talk about that. And however way they decide to approach their education, whatever tools they decide to use, it’s probably more of a private matter.” –Wren

Participants expressed a desire to be able to live and work as inconspicuously as everyone else. Not everyone wanted to talk to others about their disability or expose to others what they personally have to do in order to get by.

These concerns don’t stop with school, as some Participants expressed skepticism of the job prospects for low-vision Interactive Designers, even with adequate

knowledge & training. No-one wants to be a burden or make too many demands when taking on a new job.

“You want to make yourself attractive to the employer to hire you, right? So I can do this, I have the skills, but then there’s all these other things that they have to fix before you can even work there, right? [...] You don’t want to give the employer too many hurdles into taking you on as an employee either. You want to make it nice for them to take you on too, right, you know what I mean. Not making all these demands of them right off the bat, even before you’d done anything for them.” –Ash

4.9.1 **The Toll of Constant Advocacy**

Participants described this constant state of advocacy as a life-long battle.

“I was determined not to become the next statistic. Negative statistic. So I had to fight for what I wanted. Not like literally fist fight or not. I had to learn to advocate, and learn to prove to myself that I am somebody. I can do. I can endure and overcome.” –Casey

Multiple Participants described the emotional and psychological toll this constant need to advocate takes on them personally.

“...especially if I get rejection or ignored or don’t get the results I’m fighting for and I’m doing it the right way. Oh, I just shut the hell down, sometimes. So I’m working on that diligently with my therapist and my psychiatrist and with my creator.” –Casey

“I’m tired of being brushed off. So I’m very much a dog with a bone right now. And I’m not going to give up. I’m very determined. And then at the same time, [...] I have to look at my health, I have to look at my family, and I have to be I have to wonder why I want to do this. And there are times. I’m ready to give up. I cry. I yell, I scream. I end up in the hospital, because I’m just too sick.” –Jamie

4.9.2 **Feeling Like an Inconvenience**

Many of the Participants self-identified as being “difficult.” Sometimes this identification seemed in earnest, other times it seemed to be either humorous or

self-deprecating. These same Participants who self-identified as being difficult, also shared their thoughts on accommodations for blind & low-vision individuals.

“Well, I totally understand that not all media or content can be accessible just by its very nature. Right. I mean, it’s not like I’m demanding everything. Just what can be made more accessible would be nice. Like simple things or important things, right?” –Ash

“In some things some people have to recognize that their job necessarily requires eyesight no matter what. I mean, we can be accommodating, but in the end, you need to have a certain amount of visual acuity to perform certain jobs. So I think it’s a bit of combination working with the employers and working with the employees as well.” –Ash

“But I think that’s I think it’s important that the visually impaired community actually step up to the plate, too, and improve their skill set. And I mean, don’t cry foul all the time. Give it a shot. What’s your skill level, meet them halfway or something.” –Ash

Some Participants commented that low-vision students must take the lead with professors, in order to have their needs met.

“...it has to go both ways. Like I wasn’t needy. I told them I was like, ‘Hey, what if we did [it] this way?’ They’re like, ‘Oh, I actually didn’t think about that. That’ll make it easier on me as the professor as well.’ [...] We just worked together. But it wasn’t like, ‘Oh, I have to have it this way.’ I’m like: ‘Hey, here’s a few options. Would you be okay with either of these?’” –Dylan

The same Participants noted that some students can do this, but many students struggle to advocate for themselves. Most Participants communicated that they did not want to be a burden on their teachers. This was sometimes said explicitly, and other times it was implicit in the conversation.

“You don’t need to have somebody going out of their way more than they need to just because you can. I mean, you can ask for help, but it’s like if I don’t have to or if I can help the teachers, I’m going to because they already do enough work as it is.” –Dylan

4.9.3 Denied & Discarded

Beyond feeling like a difficult inconvenience, many Participants described instances where they felt that they were being pre-emptively denied access in order for an institution to avoid complications from the accommodations that a blind student might need.

“Juno informed me that maybe I should take a deferral or ask for my money back, as their sighted users have no problems with their program and they see no issues with their program. Lighthouse Labs, yesterday (the only reason I met with them yesterday after five months of trying to get in with them and speak to somebody) somebody actually came on video and actually admitted to me why they couldn’t accept me. And it’s probably the stupidest reason I’ve ever heard. Their program ‘Compass’ does not have dark mode. Therefore, my accommodation request can’t be met.” –Jamie

Low-vision designers who do find themselves employed, may find themselves caught in a conflict of interest. They can advocate for what they need to be successful, which may come at the price of appearing as burdensome or needy or difficult, or they can avoid being a burden by not asking for the resources they need to be an effective employee. Neither state is an optimal condition for continued gainful employment.

Over a third of all Participants mentioned that they had disputes at school, or in the workplace, where they felt they had no other option than to consult a lawyer. One Participant noted that many of these same education programs like to market their so-called diversity, but their actual experience was that the diversity that they brought to the program wasn’t celebrated at all.

“...it almost felt like I was an inconvenience in the program.” –Jamie

Multiple Participants noted that they felt that they had been dismissed from jobs because their employer did not want to provide the accommodations that the Participants required in order to remain a productive employee. Despite this being illegal in the Participants’ jurisdiction, they claimed that this practice was not uncommon. One Participant claimed that their manager told them that they had been reprimanded for renewing the Participant’s contract in the past. Another Participant

was currently in the process of suing the post-secondary institution that had employed them as a professor.

4.9.4 Hiding Disability or Health

Participants expressed concerns about being discriminated against because of the potential inconvenience of providing accommodations for their low-vision or health conditions.

“I still, to this day, as comfortable as I am with my eyesight, I still to this day shy away from clicking that ‘if you need accommodations button,’ because I was in employment services, and when people say, ‘oh well they can’t discriminate [because of] your disability,’ I’m like, no, they can’t. But they can find other language where I don’t get the job.” –Morgan

One Participant described how they considered which of their medical conditions to disclose, and to whom, on a case-by-case basis. The expressed that were concerned that their disclosure of disability could lead to discrimination. They also expressed that they felt that some individuals may feel understandably overwhelmed if they were to dump on them all this unfamiliar information about their eyesight and other health conditions all at once.

“There’s times when you should disclose, there’s times when you shouldn’t. I’ve had problems with that in the workforce. I just think that if you if you can [disclose] to put someone at ease, that’s the time when you should do it.” –Morgan

Another Participant recounted her experience applying to multiple Web Design program in the Toronto area, to disheartening results. She was asked what she would do if she were to go back in time and reconsider these applications. The first thing she said was:

“...I wish I had never said I was blind. And I shouldn’t have to feel that way. I’m very proud to have learned how to be blind during the pandemic. It’s not like I wanted to. I just woke up this way one day.” –Jamie

One Participant described their strategic approach to disclosing their blindness and their health problems.

“What I usually do is, I will tell, depending on the job, the CNIB or jobs with vision loss or disability related fields [...] that I am a person with dual disabilities in the cover letter. Now, if I was applying to a bank, I wouldn’t have done that. What I would have done is during the interview I would have mentioned it then and flipped it on its head and saying, and they’re going to. And if they said to me, ‘well, why didn’t you mention it, that you need extra accommodations?’ I’m going to say ‘because I don’t. All you need to do is turn on Microsoft Magnifier on the computers you already have. And I will be one of your hardest working employees. In fact, there are statistics proving people with disabilities work twice as hard as people without. And the other thing that I can bring is a different perspective that you don’t already have.’ So I would rather explain it and prove it as a strength, rather than have someone read it in [an application], in a tone that I don’t intend.

[...]

And so I would tell them about the vision loss in the interview. They don’t get to hear about the epilepsy until I’ve signed on the dotted line.” –Morgan

One Participant had successfully served as a College Professor for many years when they lost their eyesight.

“I taught my last semester was the fall of 2018. About halfway through that semester, I lost a bunch of eyesight. So at the end of that semester, I went on [medical leave], and was supposed to get training that would allow me to go back and teach. But because of I had two or three more surgeries and the pandemic, I did not finish my training in the fifteen-month period that they allotted.

[...]

They told me to resign, or else they could let me go because they had in their rules, they had written a fifteen-month limit to medical leave like that, getting training, and I asked for another four months and they did not want to give it.

[...]

There’s a compliance issue with the ADA and I did bring a lawsuit, and we’re in the process of settling that right now. So they’re wanting to settle. I’m moving on transitioning to a new career.” –Jesse

It seems that at that particular school, it was preferable to pay out an early retirements settlement to rid themselves of a blind Professor, rather than investing in an individual who could have been a unique asset to the student body, particularly their blind & low-vision students.

This Participant has since moved on from teaching, and was working in the field of medical writing and other medical communications.

4.9.5 **A Lack of Compliance & Enforcement**

The constant need for advocacy may come down to a fundamental lack of compliance and enforcement of accessibility standards. All Participants felt that there were aspects of institutions that were not meeting the legally mandated accessibility standards in their jurisdiction.

“The Web Content Accessibility Guidelines. So that’s pretty good. But not everybody follows that, right? No.” –Ash

Multiple Participants indicated that they have had to get a lawyer involved with their post-secondary institution, for reasons ranging from wrongful dismissal, to violating the AODA. Another Participant indicated that she was currently looking to the legal system, to help her address the access to education discrimination she had been facing.

“I am trying to find a lawyer that will help me right now to bring this up. Not so much to get money for myself. I just want things to change. And if this creates something, fine, create a scholarship or something. But this has to stop. I shouldn’t have been denied because there’s no dark mode and you can’t give me a class recording in a timely manner. I think that’s pathetic.” –Jamie

Nearly half of the Participants mentioned initiating legal action at some point in their lives, to try to get a public institution to meet their legally mandated accessibility responsibilities.

“I don’t think these things are actually taken seriously. And until there’s somebody literally legitimately trying to sue them for inaccessibility and it’s a problem, up until that point it’s business as usual. Right. And then what I’ve been looking at is, you know,

they're just interested in making it go away, make the client happy or what can we do the minimal effort to make it go away or not necessarily embracing it.” –Ash

4.10 Ideal Interactive Design Education & Training

Towards the end of their interviews, Participants were asked to share their thoughts on what an ideal education program for Interactive Design might look like, and what changes could be made to enable more blind & low-vision individuals so successfully pursue education, training, and work in Interactive Design.

4.10.1 Design Education & Industry Messaging

One Participant started by talking about the wording, and inherent messaging in how the program was represented and marketed.

“It’d definitely be a cool idea to have a mix of those with and without visual acuity, designers that can be both visual learners as well as learning by listening. [...] I personally think there’s a lot of visually impaired people that would be interested in a class like that if they knew what went into it, and knew that even though it says design, it also says we’ll focus on both how and when to include certain types of texts as well as making graphics accessible ‘to those with disabilities.’ Because if they say ‘to those with disabilities,’ you’re showing that you’re including everybody, but you can also say something about ‘but that’s also visually appealing’ because then, you’re not singling out one because they might think, ‘oh, this is just a design class for those with disabilities.’ But if you say the ‘visually appealing,’ you’ve covered your bases for everyone, you want to include everyone in this, but you’re not singling out. And that’s what I think would make a good program, and also knowing that everybody could be involved, anybody who wants to take the time, you got to put work into it, but don’t feel like just because you see the word design, if you see accessibility, like accessible, like a fully accessible course to both those who are visual learners and those who learn by listening. You bring up confidence in those people, too, because, if somebody that’s totally blind sees ‘Graphic Design,’ ‘oh, next page!’ but if you see ‘Web Design,’ that

*doesn't even mention the word graphics, but also the word 'interactive,'
...that helps a lot." –Dylan*

Another Participant stressed the importance of these education programs providing much better exposure to blind & low-vision individuals. They felt that the fields of study were unduly intimidating, and needed to be de-mystified for blind & low-vision individuals to know that this was a pursuit that was open to them.

4.10.2 **Financing**

Financial limitations were often cited as one of the first barriers that blind & low-vision student faced when seeking education and skills training. Some Participants described an ideal program as having unlimited access for all. Other Participants preferred unlimited access for those with the ability and drive to see it through, regardless of previous knowledge or funds. While others suggested that there should be unlimited access for the blind, who are often coming from higher living expenses, lower-income, and less exposure to the skills training to have built up a competitive portfolio. One Participant suggested that by simply lowering the financial burden, it would increase diverse participation, and force accessibility to meet greater blind & low-vision student enrolment.

4.10.3 **Integration & Group work**

Not one single Participant expressed a desire to be segregated based on their eyesight. Virtually all Participants expressed a desire to work alongside sighted and non-sighted students alike.

"Because, you know, the more adaptations, the more education, and the more we come together as a team, the more we can all make a difference in our own lives as well as everyone else's life. That's where I'm going out with this." –Casey

One Participant made extensive reference to the well-established body of knowledge on how to help individuals overcome negative stereotypes that they might hold, and how this research was relevant to blind & low-vision individuals.

“In social psychology, and actually there’s a research study I read earlier this year in the Journal of Blindness Innovation Research, the NFB Journal, that having a semester long class where blind people and sighted people work together cooperatively on some projects. So in this case, if it has something to do with people interested in Interactive Design, have a class of blind and sighted people, work together on some projects to do with that. And they found that leads to a lot of change in attitudes about blind people and of course, a better understanding of what blind people have to deal with. So I would say, it could not be just a two hour seminar or something. It would have to be some very in-depth, cooperative experience. And of course, in social psychology, lots of studies have done like that where trying to decrease racist stereotypes and attitudes, having people of different races work together cooperatively on some tasks and build that sense of camaraderie, but also understanding, mutual understanding. So that one research article talks about a classroom situation or a semester long one where it seemed to be very beneficial in reducing stereotypes and prejudice about the competence of blind people.” –Jesse

This Participant also noted that many post-secondary institutions seem to increasingly ignore this established evidence-based research, in favour of methods rooted in Critical Theory. His assessment of these methods was highly critical.

“Yeah, they don’t work. They don’t lead to any kind of change.” –Jesse

He re-iterated that an ideal Interactive Design education would forego this trend, in favour of evidence-based solutions grounded in the established Social Psychology research.

“That’s the best way to do it. This is a hard class to teach and it’s really dependent on the people and the circumstances, how it evolves, but it can lead to really good results.” –Jesse

Another Participant noted that for this integration to have a profound effect, it would need to be happening in Elementary Schools. An ideal post-secondary design program would be taking in students who had already been exposed to the blind, and worked in integrated classrooms starting in Elementary School. Beyond the previously aforementioned benefits of this type of integration, she thought that this would also

increase Blind & Low-vision individuals' exposure to Interactive Design by sharing more of a curriculum, culture, and opportunities with their sighted peers.

Many Participants expressed that they felt that group work alongside their sighted classmates, was beneficial to their learning and enjoyment, particularly when working on design projects. Furthermore, Participants expressed that having at least one sighted student to work with on a project increased their confidence in that they were delivering what the teacher expected.

"...the word interactive to me, really kind of presses up against collaborative. And I think that, so, I did quite well in the groups I was in. I don't know if you do group work in Interactive Design. [...] I think a lot of group work would be helpful because anything that I couldn't see or was visual, I could rely on my sighted colleagues to help me with." –Morgan

"...personally, if I have the chance, as long as people are willing to work with me, I actually like working with or like collaborating with others quite well, because as I've said, there's no one right way. And if I'm working independently, I might think it's the best way. But that's why, if I could work with at least one person or a group of people that could see visually, then I could say, 'hey, how is this look to you guys?' And then maybe have a couple of blind, visually impaired collaborators and see like, 'Hey, so how does this appeal to you? What do you think?' And then also, just even to help design, like if we were to all put in towards a big project, that could be an accomplishment." –Dylan

4.10.4 Training People

One Participant brought the unique perspective of having experienced teaching a few blind & low-vision students while serving as a post-secondary Professor. They themselves were sighted during this experience and began to lose their eyesight at age sixty.

"Well, my first [blind student] would have been 1994 when I was teaching at the University of Missouri when I was on my postdoc. [...] She only had peripheral vision and she seemed very bright and very capable. I never had that bias that so many people seem to have about blind people being incapable of doing things that others

could do. I always assumed she could, and I just would modify my test to make them very large type for her and work with her as much as they could. And I guess as a faculty member, I was kind of rare because talking with disability service people, I found out a lot of instructors did not like to work with blind people, just saw it as a nuisance. And I guess I always just wanted to see help them be successful. So she was the first one and she was I think she got an 'A' in the course. And then I've had a couple of one or two others again who were very successful in the course. They actually would go through disability services, but I would make sure there were recordings for the book and give any extra help I had to and work with the people at disability services. I just saw it as part of my job, just as I would help any other student.

[...]

I had written my own textbook and [Disability Services at the College] would have people read the textbook and record it themselves, make sure they had copies of it and would answer any questions they had, but they would do the recordings. I never used online textbooks. Well, I eventually created an online textbook, so they would have been able to use screen readers to read it.

[...]

...tests would be read out loud to them by people at Disability Services, so I'd have to make sure it was supplied to them. One thing, of course, would be in class, making sure that if something was visual that I would explain it like an audio described almost thing. If I showed a video or if I was writing something on the board, making sure I took the time to describe what it was that I was presenting visually. So just being constantly aware that there was a blind student in there and that I had to accommodate that too. But I can't think of anything special other than that." –Jesse

The Participant, now blind, was asked if there was anything they would have done differently, given their first-hand experience of now living without eyesight.

"Well, now, knowing how difficult it is to find accessible websites and accessible material, I would have taken much greater care in creating my material, especially my online [learning] material, which now I know was not terribly accessible because I did not have descriptions of graphics of all text in there. And I'm sure that screen readers probably had difficulty given the way it was set up, because now, as I've discovered,

to get screen readers to read everything, sometimes you have to modify your text. For example, having a graphic with text to the right of it or something might mean that graphic itself does not get read. So I would wish now that I could have learned about accessibility and made sure my documents, my online documents especially, were more accessible. That's one thing I thought a lot about.” –Jesse

Teachers

Most Participants expressed a desire for the teachers to have more expertise in dealing with students with physical disabilities. Participants wanted teachers who were better trained, and more knowledgeable in how to accessibly teach all their students, including Blind & Low-Vision individuals.

“I would require that all secondary post institutions now start going through training. Extra training to work with disabled people. They might have them in their class! How the hell are you going to know what their needs are? How to help them? You come at them nasty. Or you just ignore them like they're nobody. Or you don't stop to ask them some questions so you don't get to know who they, are or what what their needs are, besides a learning centre specialist writing up a paper, 'this is their needs...’” –Casey

Many of these Participants wanted the teachers to have gone through some type of mandatory experiential “empathy” training, as a mandatory building block for a teacher’s education.

“They train different skills, different encounters, different experiences. I say for example, we'll put them in a wheelchair. They cannot get out of the wheelchair during the training. They have to be in the wheelchair at all times and be able to navigate life in a wheelchair. The next two weeks, they might have to be given a seeing eye dog or a cane. 'Now put a blindfold on.’” –Casey

Learning to use a screen reader, or at least, how a screen reader works, was also mentioned by Participants as a desirable part of a teacher’s education. One Participant stressed how when he learned to use a screen reader as a trainer, it had other trickle-down effects that helped improve his personal communications.

“So I never used a screen reader before working at the CNIB, but a lot of my Participants do. So I learned how to use a screen reader so that I could communicate with them better, to the point where I changed my language while speaking with them instead.” –Morgan

Furthermore, some Participants expressed that they wanted their Teachers to at least have some familiarity with the accessibility features and options of any software tools that students are being prescribed to use. They wanted to be able to ask their teacher’s questions about how to use the software, just as their sighted peers are able to ask questions and get help.

One Participant stressed that to have the desired impact, this push for improved competency training would need to extend beyond teachers, but consider the wider campus, and ultimately the design industry itself.

“...I don’t mean just for teachers. That should just go for any industry.” –Casey

An ideal program would also reach outward, seeking to pre-emptively spread knowledge to the industry where these students would ultimately be seeking jobs.

Personalized Adaptation

One Participant wanted to mention that it is important for people to understand that there is an extreme amount of variability in the eyesight of low-vision individuals.

“...it’s not every day that you get somebody with a visual disability entering into a highly visual industry, especially in particular, Graphic Design. And then at the same time, everybody, all of us have different degrees of visual impairments. So we have different degrees of what our different challenges are. So we’re sort of like a bit unique in that sense.” –Wren

It was common for Participants to express pessimism towards any ‘one size fits all,’ with a clear preference for a fundamentally adaptive approach taken for each individual.

The previously cited Participants was less concerned with their teachers’ training and expertise, and more concerned with their mindset.

“First and foremost is attitude. Attitude from the student bodies themselves and the attitudes from professors. And [regarding professors], it’s also about opening the mind. To be open minded as other ways to accomplish the task.” –Wren

Teachers who were praised were consistently cited as providing blind & low-vision students with alternate means to complete tasks, or at least, being open to allowing the student to use alternative means to reach the required learning outcomes.

A few Participants note that teacher training can only prepare a teacher so much. One Participant noted that there needs to be outside resources available for both teacher and student alike, to help them both collaborate more effectively in finding mutually advantageous solutions.

“I think for me, I believe in keeping that communication open. And knowing where to find those resources, when there is a challenge in the classroom to figure it out from both sides, for both parties to say, okay, these are the people I can go to or the resources I can go to, to help understand what [the challenges] are, and then also speaking to the student themselves, what are their more customized challenges? And figuring out what works and what doesn’t work.” –Wren

Another Participant suggested that it may be more effective if the exact same resources were shared by both the student and teacher, to help aid this productive communication and collaboration.

Students

Another Participant started by identifying what they saw as necessary baseline skills for the blind & low-vision students entering the program.

Researcher: “What would an ideal accessible Interactive education look like for you?”

Drew: “It would start by an assessment of someone’s screen reader proficiency, and then if the person needed kind of a remedial or brush up education on their assistive technology, that’s where things would start. So by the time they were actually learning development, they’d be comfortable with their screen reader. And I think that assessment would also include typing. The person would be comfortable typing.

And or if they were a deaf blind user or blind user that like Braille and they had a Braille display with a Braille keyboard, they would be comfortable writing that way, but ideally they would also know how to use a keyboard, since that's the standard."

When the Participant was asked if this baseline assessment & training should only be for the low-vision students, or for all students alike, they liked the idea of all students taking part, but didn't find it realistic. Instead they suggested something more easily attainable.

"Have someone that works in the program be screen reader proficient. So if someone got stuck, they wouldn't just get assistance with Web Design questions. But also if there was some screen reader interference, they would get some help or suggestions. This is a workaround you can use here. Because I would say that half of what blind people do when they interact with the Internet or any application is workarounds, because things aren't accessible enough." –Drew

Education Assistants

One Participant referenced the positive impact her Educational Assistants (EAs) was able to make for her. However, finding this EA was not easy.

"So that was the first challenge, finding an EA that has the language, the technical terms and things like that to work with me. So that was very, very... it took a little while. But once we found her, it was, she was, absolutely wonderful and she's very open minded to help. To help understand and help basically be my visual interpreter to see what I couldn't, and see what information, visual information, that I was missing. And she was able to communicate that with me." –Wren

This Participant felt that it was advantageous for an effective EA for low-vision students studying Interactive Design to have knowledge or training in visual media, or better yet, design. However, she also noted that she felt that a lack of this pre-requisite knowledge could be overcome if the EA was a keen learner themselves, and able to keep pace in the course with the student.

Accessibility & Accommodation Departments

Most Participants expressed that they felt that things were improving in some ways. The emergence of Accessibility & Accommodations offices in schools was generally seen as a welcome addition. In some cases, these offices were making positive changes for blind & low-vision students.

”And as I’m pursuing postsecondary school right now, I’m actually very, very happy to get the support and from the Accommodation Accessibility Office. And they have the full training to help people [like] myself, to figure out what it is that I need, the mental support, and how to advocate to help professors and other students understand.” –Wren

4.10.5 Preparing Learning Materials

One of the most common cited improvements was to simply receive accessible digital copies of documents and in class presentation materials. Some students reported that this simple accommodation could make a dramatic impact of enabling them to succeed in the classroom:

“...I went to Central Michigan University, which is in Mount Pleasant, Michigan, and what was nice is a lot of the professors there were ones that would actually work with me. They’d send me the materials through email, I hardly had any paper I ever had to work with because they were like, ‘Well, how about you just do your assignments on the computer like you want to?’ Because then it saves us both paper and I have electronic copies of this all ready to where my screen reader on my computer would actually help with the document reading. And then I wouldn’t need to ask everybody for help. Like, a lot of times I sent it to the person by the end of class, because I was able to follow along as they gave me their PowerPoints for class too, so I could read it as they were going on the board.” –Dylan

Interactive Digital Documents

Many Participants spent time describing accessibility accommodations that made an impact on them, that were little more than design that met or exceeded the WCAG

guidelines. This was very common amongst most of the Participants, to describe at length the little Interactive Design details that made a difference to them personally.

“Even headings can be so much more help to the next person that’s looking at it. That can make more of a difference than what you would even possibly think.” –Dylan

“But also making sure there’s at least some sort of caption on the picture, on the image...” –Drew

It seemed ironic that these baselines interactive accessibility practices were both being held in such high regard, while also described as absent in post-secondary learning materials. The most commonly cited accommodations were so simple and basic, such as:

- Using proper semantic markup on plain text.
- Providing alt-text on all images.
- Using navigable headings or sub-pages to help divide content into management chunks.
- Ensuring full keyboard navigability.
- Labelling all form elements.
- Avoiding clutter and superfluous detail.

Beyond these basics, there are more challenging elements that teachers need to learn to provide accessibly. One Participant expressed the importance of have multi-format data displays, that included tabular graphs that correlated with any data graphics.

“...but also if there’s a sort of plain text option, like even if you show it as a diagram, or a graph for somebody, like when you’re talking about the math aspect because there’s a lot of that in the design, you got to know exactly what you’re coming into. You could make that same info into a table or something that the one just reading. You could even put like the amount of graphics on the page and then put like twenty. But like to somebody who’s looking at it, you could say like the different elements on the bottom of the graph, left or right. And then you could show those bars like a bar

graph. But to make it easier to the reader that's just listening to it, you could do it as a table side by side, and it would still be the same info. But somebody might be more comfortable looking at a graph and aligning it with the numbers on the left side. Go up and down.” –Dylan

Whenever possible, teachers should consider dynamically formatted learning materials. This gives students the ability to choose their preferred display format for the learning materials, without the teacher having to manually style things with a one-size-fits-all approach. One Participant described an example of this with a simple interactive data display.

“Now, pie charts, that would be a little different, but that's when you can bring in the percent. That's when you can put the percentages in a table. And so it doesn't mean it can't be done. You can have both there, [and] to make sure it's not cluttered, you just say plain text version, click here or accessible like adaptive click here. And then it would open a subpage like a new tab.” –Dylan

Hand it Out Beforehand

Participants stressed the importance of having all learning materials available to them at least one day before class, if not sooner.

“It's actually one of the best [accommodations], because [...] that still gives you somewhat of an input, like of an idea. Oh, so we're probably going to focus on this tomorrow. Let me make sure I even take these few notes before going into the class in case I don't have my computer with me, like if for some reason something happened to it. That way I can know, like you can kind of have an idea, you don't feel left out because then you're like, 'Oh yeah, I read about this yesterday.' See, that's what I loved doing, because the teachers would often send me the stuff the day before. They wouldn't wait until the day off. They'd send it at least a day before. And so that's already happened at my college, and that's actually a really good tactic to use, like a really good way to get people involved because then it makes them feel like they're less lost. And if they don't look at it, then, well, you told them that you were going to send it [to them] ahead of time. You don't want to blame them for not looking at it, but you at least tried to help them.” –Dylan

Beyond the utilitarian consideration of enabling blind & low-vision students to prepare for class, some Participants mentioned that getting materials beforehand made them feel cared for, as it pre-emptively opened the lines of communications for adaptation.

“Even if they don’t happen to look at them, as long as you tell them that you’ll be sending that type of stuff, you’re doing a great job of showing that you’re going not even necessarily out of your way, but you’re caring about the students, not just your career. And that’s a big thing.” –Dylan

Many Participants cited this as the single most important accessibility accommodation that made an impactful difference for them in university. Perhaps just as important as giving students learning materials early, is giving student course and assignment parameters early, so that they can trouble-shoot potential difficulties, and brainstorm solutions in advance with teacher.

“That will give me a lot of ways to figure out, number one, how to get on to class first. And number two, what are the expectation and requirement and criteria [of] the different assignments,. That will also[help me] then be able to seek the help that I need from this as a technologist, and how to best approach it.” –Wren

4.10.6 **In the Classroom**

One commonly cited principle was to make sure that no student is needlessly singled out.

“...you don’t want to make people feel left out, but you also don’t want to single them out either.” –Dylan

Blind & low-vision students often felt that they were singled out in the classroom with the accessibility accommodations that were being provided to them. Participants expressed a preference for when teachers provided adaptive or inclusive delivery methods to all students, so that no-one would need to be singled out with individualized delivery methods.

Some Participants explicitly expressed that they do not personally care whether or not they are singled out in the classroom, but they know this to be an inhibiting or discriminatory factor for other blind & low individuals that they know.

Visual Materials

One of these requested inclusive adaptations was for teachers to always describe areas of focus in visual materials, by indicating the relative position and direction of where to look. Again, Participants did not want to be singled out with this information, they just wished that teachers would make these descriptions an ongoing part of their delivery of visual materials, to help low-vision and blind individuals much more quickly orient themselves.

One Participant asserted that normalizing these kinds of communications, wasn't just for the benefit of the low-vision individuals in the classroom. They thought that by using a more inclusive integrated delivery approach, all students would feel more comfortable in the classroom.

"...you can do it in ways that doesn't single out any person. Even if I don't care, some people might think that's not a good way to teach them, because you're almost singling out the one blind student that you have. For example, you've got to be able to have [it available in accessible interactive form] for everyone. But even though I don't care, you've got to make sure it's not going to make people feel uncomfortable." –Dylan

Equal Curriculum

While accommodations seemed to be universally appreciated, it was also noted that Participants did not want accommodations that pre-emptively excluded them from course content. One Graphic Design student described how she found value in the various foundational art and design courses she was taking. She spoke about the importance of being aware of the different rendering and techniques and styles that a designer may want to have executed, even if they could not be effectively executed by the student themselves.

"I'm in a sort of portfolio building program. We are just exploring everything. I did do some of the classes that would not necessarily be geared towards Graphic Design. I still find them to be useful, to know the techniques, to know the skills, and to understand the methodology for getting from point A to point B. So, for example, [there was a] figure studio where I had to learn how to draw anatomy of a person. Yes. I didn't realize that there was so many different techniques in order to draw anatomy of a

person, and then it has different outcomes. [...] So then if I was approached one day to [a client saying] ‘We need a poster to look like this,’ [...] I know this technique. Maybe I myself am not the best person to draw the anatomy of a person using that particular technique. But I know how it gives it substance, and then I can approach whoever else, my teammate to say ‘Let’s go with this kind of approach. Let’s go with that approach. I think this will work best.’” –Wren

Conversely, some Participants indicated that they felt that an ideal Interactive Design curriculum would also integrate accessibility focused research and design.

“We don’t have enough use case documentation. I think part of a design curriculum should be, [learning] use cases for Web Design and assistive technology. I think part of that would be making people review persona documentation and models of disability. Looking at tests, looking at fictional cases of someone with a disability who is trying to use the Internet. And this is the barrier they encounter. I’ve written those kind of personas before.” –Drew

Hands-on & Practical

While it is common to hear that students prefer hands-on learning, it should come as no surprise that the low-vision & blind Participants were emphatic about their preference for hands on learning.

“I want it to be hands on, like, a lot of hands on...” –Dylan

One Participant expressed their enthusiasm for interactive digital textbooks and quizzes. They personally found that interactive quizzes that they could take repeatedly to test their knowledge, helped them verify that they were not missing anything that their sighted classmates may have picked up, and pointed them in the direction of what they might have missed.

Many Participants stressed the importance of being able to practice whatever they have learned in the classroom. Again, while this is a common preference expressed by students, it seems to be even more emphatically expressed by the study Participants.

“Like if you could just practice, you’ve got to be able to have some ways to get yourself the experience along with the teaching, like learning. Those are a couple of the big things or else I don’t see myself getting anywhere if I can’t practice this.” –Dylan

One important aspect of this is that the quizzes and/or interactive textbooks must be able to provide automated validation. This feature helps reduce the student receive feedback without feeling like they are being a burden on their classmates and teacher.

Participants expressed that in order to fully understand the lesson delivery, they often had to use additional technologies and means such as screen readers, high magnification, etc. Because these means are not always practical to use in real-time during class, it is very important that blind & low-vision students be given the resources to effectively review and practice the curriculum in their own time, with their own preferred accessible technologies.

4.10.7 **Technology, Innovation & Invention**

Accessible technology was seen as a fundamental baseline for any successful Interactive Design program.

“Accessible technology would obviously be a must, things like screen magnifiers, the design being able to be read by a screen reader if a person’s completely blind.

[...]

To summarize, I guess the accessible technology is probably the most important, the collaborative piece or group assignments, and then the interactive feedback using either technology or focus groups or something along those lines.” –Morgan

One Participant was adamant that if institutions did not know what to do, they should allow blind-and low-vision students to audit programs for reduced fees, as student and testers to gather knowledge about what needs to be done.

“One of the greatest things I could say is if you want us to go to school, and both sides [...] don’t really know what we need to be able to accomplish this. So why not let someone audit a program? Why not let a few people go through and see what happens? I don’t care if I get the certificate at the end of it. I just want the knowledge to help

my friends. That's it. But let's find out if I can actually make it through. Let's make sure that [I can understand the] videos and the demonstrations. Let's make sure the transcripts are there. Make sure I can read these things and do what I need to do. Let's make sure those programs are accessible." –Jamie

No Participants described an ideal Interactive Design education as one where everything was handed to them. Many Participants described a baseline level of pragmatically realistic accessibility accommodations, and the opportunity to collaborate on the rest.

Beyond providing accessible technology, Participants took the opportunity to suggest technologies that could both be developed by and used by Interactive Design programs. One area of focus was technologies that would better enable low-vision users to interact with the graphical user interfaces that are common on today's computing devices.

Multiple Participants spoke about the emergent possibilities of AI to provide breakthrough technologies to enable blind & low-vision individuals to effectively utilize previously inaccessible software tools, and to complete previous unimaginable tasks.

Multiple Participants also asserted that further development of human computer interfacing that provided haptic feedback could be advantageous for blind & low-vision individuals. One Participant spoke at length about the existing possibilities, and further work he would like to take part in executing.

"...one of the potential solutions for a blind person to use software would be some kind of haptic feedback, not just from a touchscreen, which we're getting, but actual use of game controller. So you could slide the controller around and when you got to vibration, you could you could click the mouse. I have tested a couple of prototype products like that. The mistake the developer made was they wanted the device to be both a mouse and a tactile array. And I said, 'do one or the other.'

[...]

There was a Canadian company that did something like that called Beta Comm, and they had a force feedback mouse and you can interact with things. And I remember talking with a blind guy from the company who was just thoroughly delightful, and I think there's a need to explore that. And most people I talk to aren't interested.

They say things like, ‘Well, why would I want to do that when I can use a toolbar with a keyboard?’ Now touch interaction in Windows is not standardized like it is in iOS. And because of that, I think I’m going to have to use a different paradigm that is standardized. Microsoft project like that. But they you know, I wish I could find someone to work on a project like that with me.

[...]

I was able to locate buttons with my husband’s [Wii] controller. I was able to locate the OK button, I just moved it in the air slowly. I thought, ‘Oh, here’s an interactive element, what is it?’ Now, if they’re had been speaking with the button, I could have interacted with that. [...] We just need the software. We need the way of clicking, you know, drag and drop. Left click, right click. Mouse lock. Just the same interactions.

[...]

I think the thing about [video game controllers] that I like is unlike a Braille display or something, it wouldn’t require building some expensive hardware. It just might require some software tweaking.

[...]

You know, I would love to work on a project like that if I could find someone to help me do the testing and the idea brainstorming.

[...]

I know some things are really impractical, but I also think that rather than just shutting the door on an idea, let’s at least see if something is feasible. Don’t just say ‘no.’ You know, I think a lot of blind people wouldn’t be interested, but I think if they saw that a chance to interact with something like this, they would change their minds. I mean, a good example is touch screens. When the iPhone became accessible, pretty much most everyone was really skeptical, like ‘so?’ But a few early adopters said, ‘no this is great.’ And then the word spread.” –Drew

Full Circle

One Participant felt that in order to capture the attention of blind & low-vision individuals, technology developments would need to come first. As design has

traditionally seen as a sighted task related to visual art making, it had likely been previously dismissed by many potential blind & low-vision Interactive Designers. An ideal Interactive Design program may need to pre-emptively show off breakthrough Accessible Design Developments themselves, to capture the imagination of the Blind & Low-Vision community.

“But what I would really like to see is exposure. Exposure to the visually impaired disability community, that it is a possibility to interact with technology and design and to draw digitally, because in the sight disability [community] this is a very, very intimidating industry, and people [have] already become close minded, and so it’s like, ‘well, how can I draw?’ And it’s like, ‘how can you not?’” –Wren

5. Discussion

5.0 Analysis

During these interviews, the Researcher found himself repeatedly noting that Participants often sounded like the Researcher's own design students. Participants modelled an atypically high level of knowledge about Interactive Design for people who have neither formally studied the field nor worked in a professional design firm. Not only does this appear to be a waste of human potential, but it is also a loss to sighted Interactive Design students, who are missing out on having these voices as a part of their classroom experience and their professional cohort.

Many of the Participants expressed wanting to specifically learn Web Design in order to better serve their community, social-welfare minded small businesses, and to help others with disabilities. Furthermore, many Participants expressed a desire to reduce their dependency on government benefits and to help other people with disabilities to live more financially independently as well. Assuming the veracity of these stated intents and the potential success of these Participants, it seems that many of these Participants would have a higher return on investment for each tuition dollar invested in them than the average citizen.

Some participants described experiencing a last-resort model of social services where people with disabilities are paid a stipend to stay home and live in poverty, and this was unanimously criticized. The current social services model would appear to be a poor use of monetary capital, and an appalling waste of Human Resources.

Participants identified a myriad of barriers that they had personally faced, and that they felt were real or potential obstacles in pursuing Interactive Design training. In aggregate, these barriers seemed to have a chicken-and-egg nature to them. Blind & low-vision prospective students of Interactive Design are not applying to the existing programs because the field and the associated training programs appear to be ill-prepared to accommodate these students, and those institutions and programs are not making

greater strides to adapt for blind & low-vision students because they don't currently have any blind & low-vision students that they need to adapt to.

Some schools and their Interactive Design programs appeared to communicate their commitment to diversity & inclusivity but offered little meaningful action to support such assertions. Of the schools and programs that offered meaningful actions, all too often those actions were reactive, only accommodating existing students who make ongoing requests for special support. A lack of blind & low-vision individuals may remain a chicken-and-egg problem, until Design Schools pre-emptively build out the expertise necessary to accommodate these potential students.

The most important attitude shift that may support meaningful change is to move from promising to provide reactive accommodation to pre-emptively providing adaptation that actively looks towards designing for the future. It is understandable that an institution or program might not want to risk investing in adaptations for students who are not currently enrolled. At the same time, if these institutions are not seeing blind & low-vision individuals applying for entry and succeeding in their program, it may be time that they asked themselves why this is, and what they can do about it.

5.0.1 **Insidious Effect**

There may be another, more insidious effect from a reactive approach to accommodation and a last-resort model of social services.

When asking Participants about attitudes, it was the Researcher's intent to discuss this topic in relation to the attitudes of the sighted. Numerous Participants instead discussed the attitudes of blind & low-vision individuals themselves, and the importance of a positive, constructive, mindset. Furthermore, multiple Participants communicated negative thoughts and emotions when recalling stories where they dealt with what they saw as ignorance, apathy, or systems reverberating with negative feedback cycles.

Many Participants described in similar detail an experience that this Researcher has nicknamed "The Burden." This experience is that they disproportionately must act as advocates for themselves, or fall through the cracks and get left behind. Some

Participants described this as a state of constant advocacy that takes an emotional, mental, and physical toll on their lives.

When Participants expressed their desires for social changes, many of the wishes were extraordinarily mundane, such as a desire to see organizations follow the existing laws in their jurisdiction. Every Participant expressed their desires in a manner that seemed pre-emptively tempered with pragmatic considerations for all people. Most of these same Participants also explicitly described themselves as ‘difficult,’ numerous times. Without having a baseline for how commonplace it is for people in the general population to self-identify as ‘difficult,’ it is impossible to know for sure if this label was used disproportionately. However, it is the Researcher’s opinion that this label was used in a disproportionately self-deprecating manner.

This may be a self-selected group bias. It may be reasonable to assume that qualified prospective Participants who were happily employed in Web Design might be less likely to contribute to this study. Perhaps Participants who applied for this study were disproportionately low in agreeable personality traits, and genuinely difficult to work with. However, in the course of the Interviews, the overall impression given by Participants was that they were good-humoured, pragmatic, collaborative, and generally personable and agreeable. Furthermore, the supporting anecdotes that Participants provided where they described themselves as being ‘difficult’ made the label seem even more unwarranted, and needlessly self-deprecating.

It is the Researcher’s hypothesis that “The Burden” is ultimately destructive to the attitudes and self-image of the individual. Further research would be necessary to explore what, if any, veracity there is to this conjecture.

5.0.2 **Moving Ahead**

The Participants, in their own words, have communicated what they thought would make up an ideally accommodating Interactive Design program. However, most of the collected findings appear to contain little information that is exclusive to Interactive Design education and training. Perhaps blind & low-vision Interactive Design students face few unique barriers that they would not also face in other fields of study. Perhaps these interviews did not adequately encourage Participants to reveal barriers that were

more specific to the field of Interactive Design. In any case, this study did not include a control group of blind & low-vision individuals interested in studying a field other than Interactive Design. Without this control, there are few inferences that can be made regarding the exclusivity of these findings to the fields of Interactive Design.

Regardless, the nature of this research was to capture the subjective experiences and opinions of qualified Participants. There was no effort made to verify or validate their claims, as this was outside of the scope of this research. Findings can be interpreted as potential areas for further study, rather than evidence-based policy recommendations. At the same time, it was the explicit opinion of a few Participants that the last thing they wanted to see was more research. While they were happy to take part in this research, they wanted to see more action, experimentation, and adaptation. In a follow-up interview, one participant explicitly expressed that he felt that it was important that this research point towards possibilities for tangible positive change.

With both these limitations and considerations in mind, the following sub-sections attempt to synthesize the Participants' contributions into a series of pointed questions, aimed at Interactive Design training program administrators, teachers, and other personnel. The implication is not that these questions contain the defining considerations necessary to make an Interactive Design program inclusive of individuals who are blind or low-vision. Instead, the goal of these questions is to extend the dialogue with these Participants beyond the pages of this Research Report, and into other institutions. There is an underlying assumption that many of the adaptations needed to remove unnecessary barriers to Interactive Design training do not require top-down policy directives from government or other regulatory bodies. The implication is that any Interactive Design training program could begin to make the adaptations necessary to attract and support blind & low-vision individuals right now, by continuing this research through the critical assessment of their own program offerings.

5.1 Considerations

5.1.0 Recruitment Considerations

None of the Participants communicated that they felt confident or well-informed as to what, if any, Interactive Design programs could successfully accommodate them as students. There appeared to be a communication barrier, where prospective students were not able to find or receive the information that they felt that they needed to make an educated decision about a prospective program. Furthermore, there appeared to be a barrier imposed by a scarcity of suitable opportunities, where few of the contacted programs could offer the expertise and assurances that they would provide the accommodations necessary for blind & low-vision students to succeed.

Some Participants described the high cost of post-secondary education in relation to the relative risk that the program they were entering may not adequately accommodate them. If a school is serious about providing financial assurances to students, they need also re-assure these students that they are able and committed to providing the supports and adaptation that blind & low-vision students need in order to succeed.

Questions to Consider

- Can the admissions and recruitment staff accurately address the questions, concerns, and requests from blind & low-vision students before they enrol in the program?
- Can staff confidently assert that the institution and the associated program has both the competence and commitment to successfully support blind & low-vision students?

5.1.1 Financial Considerations

While some Participants cited government bodies that give additional funding to students who are considered disabled, no participant cited any specific Interactive Design schools or training programs that offered additional funding to support blind & low-vision students. There may be an opportunity for these institutions to consider re-allocating student funding in a manner that increases the physical functional

diversity of their student body by making it more appealing and accommodating to blind & low-vision individuals. The same is already done at various institutions based on an applicant's skin colour or gender or sexual orientation, and eyesight disability has an arguably greater impact on one's access to education and training than these other immutable traits.

Questions to Consider

- Have the financial supports being offered to blind & low-vision students been assessed to ensure that they are proportional to these students financial needs?
- Are the financial supports being offered adequate to encourage blind & low-vision top talent to apply for the program?

5.1.2 Program Delivery & Scheduling Considerations

Full-time only learning programs appear to be inadvertently filtering out blind & low-vision individuals by their very nature. Meanwhile, the growing popularity of hack-a-thons and other dense, intensive and time-constrained learning experiences seem to be increasing the barriers for blind & low-vision students. The desire for part-time options and remote or flexible program delivery was re-iterated many times, by many Participants. Furthermore, it should be noted that blind & low-vision individuals are disproportionately likely to have other healthcare concerns that require additional time to manage.

Questions to Consider

- Does the program provide part-time learning options, that can accommodate the additional amount of time that some blind & low-vision students may require?
- Does the program provide remote delivery, or hybrid in-class / online classes at the student's discretion in order to accommodate the health and safety needs of blind & low-vision students?
- Will any of the student learning be delivered through intensive programs, course, or events? If so, does the program provide lower-density alternatives that provide an

equivalent learning experience for students whose bodies cannot safely participate in intensive learning?

While many Participants have advocated for being able to take classes from home, students are limited to the resources and tools they have in their household. Special consideration (or financing) may be necessary to ensure that these students don't face a technology gap that reduces the quality of their education.

5.1.3 Program Desirability

Integration with sighted peers was universally advocated for by Participants. The prevailing belief is that this would increase the learning opportunities for all students involved. Evidence-based research would indicate that there may also be broader societal benefits to seeding this integration. And while Participants recognize that asymmetrical adaptation may be necessary in some circumstances, they also expect to receive an equivalent education and opportunities.

Questions to Consider

- Does the program integrate sighted and non-sighted students together?
- Does the program have any blind or low-vision alumni or professors who can attest to the program's competence and commitment to student success?
- For institutions that offer internship, or other real-world experience as part of their programs, is the program prepared to find placements where blind & low-vision students can succeed?

5.1.4 Admissions & Pre-Enrolment

Many Participants communicated that they thought that they would be under-qualified for a formal Interactive Design education. While feeling under-qualified may be a common concern among prospective students, it seemed that these Participants were more acutely concerned about this. They seemed less confident that their existing schooling provided them an adequate background in the subject matter, and more concerned that they may have not been exposed to the things that they will need to

know and understand. It did seem like many of the Participants had not been exposed to Interactive Design in previous formal education.

Another concern was that the quality and scope of education provided to blind & low-vision individuals could vary greatly based on where they had lived, and the quality of nearby institutions. Multiple Participants made reference to their real-world learning experiences and wanted to have that considered in any post-secondary application assessment. On average, Participants were significantly older than the typical age of College & University recruitment, and presumably had a greater amount of real-world experience. Many Participants explicitly opined that when compared to their sighted peers, they felt that a disproportionate amount of their lifetime learning had been from real-life experiences. Interactive Design training institutions may need to assess if their admissions process is equitable for blind & low-vision candidates.

Questions to Consider

- Does the program offer any workshops, or other pre-enrolment events where prospective (blind & low-vision) students could get a better sense of what will be expected of them? This could also be useful for these potential students to identify what, if any, further training they should embark on before considering going through the applications process.
- Does the admissions process consider an alternate assessment formula for blind & low-vision students, based on the assumption that they have likely had less opportunity and instruction in some of the pre-requisite subjects associated with Interactive Design?
- Does the admissions process consider that blind & low-vision students sometimes have lower grades than their sighted peers, for reasons that have less to do with their own personal competency, and more to do with the competency of the educational institutions they had attended?
- Is real-life experience considered in the admissions evaluation process in a manner that adequately and equitably assesses blind & low-vision applicants?

5.2 Facilities Considerations

It may be beneficial to approach assessment and remediation of physical facilities with a team comprised of multiple stakeholders in an institution, including students. This kind of work can be an enriching learning experience for staff and students alike, where they can collaborate as designers together, and stakeholders in their program.

5.2.1 Campus Considerations

It is unlikely that most campuses have been designed with adequate visual contrast for blind & low-vision individuals to easily navigate. Again, it may be up to the individual program within a school to initiate change. One would hope that Design programs in particular should be able to make modest visual improvements to improve wayfinding within and between the key classroom and facilities that their student need to use.

Questions to Consider

- Are the classrooms and facilities utilized by the program appropriate and ready for blind & low-vision students?
- Are the student facilities and class schedules appropriate to accommodate the needs of service animals?
- Before classes begin, are students able to preview the classrooms and facilities that they will be expected to use, so that they can get a spatial sense of the facilities, and develop confidence in being able to navigate within the spaces?

5.2.2 Classroom Considerations

Classroom considerations may require training for staff and students alike, to remind them of their obligation to return shared resources to their designated storage spots in order to be retrievable by students who cannot rely on their eyesight to locate them.

Questions to Consider

- Is there adequate visual contrast to differentiate and identify classrooms, and other facilities and equipment that blind & low-vision students will need to access?
- Within classroom, are key items and equipment consistently stored in accessible spots?
- Are computer systems for student use configured in such a way that students can alter the screen resolution & contrast?
- Are the computer displays for student use arranged in such a manner so that students can move them up much closer to their eyes if necessary?

5.3 Technology Considerations

Access to accessible technology was a ubiquitous subject of concern. Some Participants expressed concern in trying to discern, before purchasing a technology product, if it would adequately interface with their accessible technologies. Perhaps we need expanded, differentiated consumer rights for how consumer products can be tested, tried, and returned when assessing these fundamental needs. For instance, there could be a mandatory minimum return policy on software and hardware if it does not prove to be accessible enough for people with a disability. At the same time, schools could help pre-emptively address this problem through the accessibility and diversity of technology products that they acquire for student usage.

5.3.1 Procurement Considerations

Schools and training Institutions do not always procure hardware and software that are accessible to blind & low-vision individuals. One could infer there is either a lack of awareness, conscientiousness, competence, or integrity in these procurement processes. This is a situation where the institution is the customer, with significant purchasing or leasing power. It may be up to the institutions and individuals who procure technology for these institutions to leverage their purchasing power and provide a more diverse technology stack for their students. Educational institutions could enact policy to

mandate that accessibility for blind & low-vision students be a consideration in procurement of student facing goods and services. Schools could lead the way with a better experience than the rest of society, by forcing companies to compete in terms of accessibility for the lucrative on-campus contracts to access the captive campus market.

Questions to Consider

- Has the technology procurement program made accessibility a significant pre-requisite criterion for assessing hardware and software acquisition and deployment?
- Is there a budget allocation and procurement process in place for being able to adapt mid-semester, with supplementary technology purchasing to accommodate unforeseen student needs?

5.3.2 Technology Deployment Considerations

There are potential inaccessibility issues when deploying identical technology stacks without suitable adaptability to meet the diverse needs of students. As more and more students approach post-secondary education already owning a suitable personal computer, Interactive Design programs could consider re-allocating some of their technology budget to a more diverse array of specialized technology. Learning institutions could embrace the role of exposing their students to a more diverse array of hardware and software tools, rather than equipping identical hardware and software packages. Both sighted and non-sighted students alike may benefit from access to a diversity of technological tools and interfaces, giving them a more accessible and richer education experience. This would likely require additional competence, and without increases to budget allocations, may require reducing the overall amount of technology provided without volume discounts.

In the past decades, Adobe software has been an industry standard tool in many design fields, including Interactive Design. Participants cited innumerable accessibility issues with this software, which uses novel interface elements that do not effectively work with accessibly aides. It seems that until the inaccessibility of Adobe's software is addressed, or industry standards change to sufficiently accessible software, this

stubborn barrier will limit the amount of involvement that blind & low-vision individuals can have in front-end Interactive Design.

Questions to Consider

- Are students able to work with their preferred technology platform of either Apple, Android/Google, or Microsoft Windows?
- Are any hard limits on technology platform or choice of software tools to use in the program, or individual courses? And if so, are these limits clearly communicated to potential students before they enrol?
- How well do the mandated and/or licensed software products integrate with Jaws, NVDA Access, and the built-in screen reader on Apple, Android, and Windows devices?
- Are the online learning platforms that the institution uses similarly accessible with the aforementioned technologies?
- Are the individuals who teach and support technology products competent with the basic accessibility features and interfacing in the software that they support?

5.4 Teaching Considerations

In many of the conversations with Participants, there seemed to be an underlying frustration that sighted individuals don't always recognize the additional cognitive burdens associated with certain tasks when one cannot rely on eyesight. Memorization, both short and long-term, becomes critically more important. Furthermore, no human being has infinite energy and capacity to memorize everything. An awareness and understanding of these principles is critical for teachers to understand and accommodate in their teaching.

Perhaps the single most important fact in understanding disability, is time. Participants noted that there was very little that they felt they couldn't do without eyesight, but they also asserted that in some cases they needed more time to complete the same tasks. Teachers needs to be aware that blind & low-vision individuals may require disproportionate, if not prohibitive amounts of time for certain tasks. This is critically

important for in-class activities, which should be structured so that those specific tasks do not have to be completed in-class.

Beyond accessibility, there was a desire for Teachers to already understand that blind & low-vision individuals may need to do things that are atypical, such as holding screens up close to their faces, wearing an earpiece, and using online services in real-time while the teacher is speaking. Teachers should endeavour to avoid misinterpreting these behaviours, and never draw undue attention to them. Most people don't want to be made to feel conspicuous, and no-one wants to feel that they are being judged for doing something untoward.

5.4.1 **Mindset**

Questions to Consider

- Do teachers understand how and why blind & low-vision students are likely facing disproportionate cognitive burden?
- Do teachers understand and appreciate the relationship between cognitive load, physical burden, and the amount of time necessary to complete a task?
- Are teachers prepared with a flexible mindset to address to unforeseen issues and requests that may come up during their course?

5.4.2 **Processes, Tools, & Limitations**

Questions to Consider

- Are the processes and tools being mandated for this course or assignment strictly necessary? Could alternate processes or tools be used?
- For any strictly necessary processes or tools that may pose an additional burden to blind & low-vision students, is this information explained and readily available before prospective students enrol in a class?

- Are teachers familiar with the accessibility features and interfacing in the software and other tools that have been prescribed for their class?
- Are teachers prepared to allow the real-time use of online and AI powered tools in the classroom in order to support accessibility?

5.4.3 Professional Development

Questions to Consider

- Do teachers have basic familiarity with using a screen reader?
- Do teachers understand how to provide **effective** descriptions for visual materials?
- Are teachers adequately prepared to teach an integrated class with blind & low-vision students where nobody feels left out?
- Are teachers adequately prepared to teach blind & low-vision students so that they do not need to single them out, or draw undue attention to accommodations during class?
- Are teachers prepared with a strategy and mechanisms for effectively presenting materials on screen to both sighted and non-sighted students simultaneously?
- Are teachers prepared to model effective cross-sensory communication and delivery for all their students to learn from?

5.4.4 Pre-emptive Adaptation

Questions to Consider

- Has administration considered the auditory clarity and acoustics of the classroom space, and pre-emptively addressed any accessibility shortcomings?
- Are teachers prepared to provide each class's learning materials days, if not a week, in advance of each class?

- Are teachers prepared to provide outlines of every assignment in the course early enough so that students can request, and receive approval for adapted or alternate assignment without undue stress?
- Whenever possible, are teachers instructing with a variety of communication modalities, including physical tactile exploration?
- In classroom delivery, are teachers in the habit of always providing effective descriptions for any visual content that they display?

5.4.5 Accessible Learning Materials

What Participants described as accessible learning materials, sounded like little more than what is commonly considered good accessible design. It is difficult to imagine that any of these points would be foreign to any Interactive Design teachers. Many of these so-called accommodations are so basic, and so commonly prescribed, it seems strange that these aren't even considered best practices, let alone a mandatory level of accessibility for teachers to provide for all students.

Questions to Consider

- Are teachers consistently providing learning materials as digital files that are properly semantically structured and compatible with screen readers?
- Are teachers consistently providing effective descriptions for any visual content embedded within, or referenced by learning materials?

5.4.6 Reliable Consistency

Questions to Consider

- Are teachers consistently providing accessibility accommodations without their blind & low-vision student needing to remind them, or make special requests?

- Are there effective mechanisms in place for teachers to receive ongoing feedback from students, and to self-monitor their performance in teaching a blended classroom of sighted and non-sighted peers?
- Do teachers know how to get support and training in order to meet unforeseen challenges while teaching a blended classroom of sighted and non-sighted peers?

5.4.7 **Supporting Self-Reliance**

Questions to Consider

- For work that may require significantly more time or carry disproportionate burden for blind & low-vision students, has it been structured in a group or other peer-supported format in order to keep all students on pace together?
- Are teachers providing practice tests, or other similar instructive exercises that blind, low-vision and other students can use to review and verify their learning and understanding?

5.5 *Interactive Design* Teaching Considerations

Most of this content could be relevant for any teacher working with blind & low-vision students. Participants provided few notes on teaching that were explicitly specific to Interactive Design.

Because Accessibility is a common topic in Interactive Design Education, one may hope that all teachers of the subject have a higher-than-average competence with creating and delivering accessible digital communications. This should give these teachers some advantage in adapting their digital learning materials and communications. Furthermore, it would seem reasonable for teachers to mandate that all Interactive Design students should be trying their best to prepare digital materials to accessibility standards. Beyond the obvious implications for inclusivity, this would seem to be good prudent training for professional practice.

One particular concern is that Interactive Design students are often expected to present work on screen. There may be a great disparity between the settings that a low-vision student utilizes, and what would be appropriate for sighted teachers and peers. This could include modified, screen contrast, colouration, enlargement or zoom. Both sighted and low-vision peers will need to learn protocols to effectively share work with each-other in the classroom. If the school is not providing such training, it will be up to the individual teachers to take the lead, explicitly instructing, supporting, and most importantly, modelling this behaviour.

Another concern is the accessibility of software training or other technical processes demonstrated through screen sharing. It is likely that sighted teachers use demonstration methods and preferred computer display settings that are not ideal for blind & low-vision students. In some cases, it may be possible for teachers to adapt with more inclusive methods, and compromised display settings that will work for all settings. In other cases, it may be necessary for teachers to explore delivering such lessons with multiple differentiated channels of real-time, or asynchronous presentation. However, it was suggested by Participants that much of this could be alleviated if teachers were thorough in pre-emptively providing access to what they intend to present in advance of each class.

Another concern has to do with blind & low-vision students using different software interfacing from their peers. While it may be unreasonable to expect that everyone is a screen reader expert, it would also seem to be unreasonable for a teacher to be functionally illiterate in the methods that their students need to use with the prescribed software and assignments. All students want teachers who are technically competent in what they are teaching.

Typical Interactive Design education and training likely includes disproportionately more emphasis on visual delivery and assessment methods than many other subjects. Group-work or tandem work may be one of the simplest solutions to this problem, where sighted and non-sighted peers can support each-other with minimal teacher intervention.

Further research would be useful in better discerning the more specialized teacher considerations for Interactive Design, and to investigate the identified specialized areas of concern in more depth.

5.6 Public Relations

The first barrier that was cited in this study's finding was one of Public Relations. Many Participants had misconceptions about the field of design, and more particularly Interactive Design education, training, and professional practice.

Key Misconception: Interactive Design is synonymous with Interactive Development and writing computer code.

More Accurate Conception: Human-centred activities of research, planning, testing, and iterative creation and revision are substantive aspects of Interactive Design.

There appears to be a disconnect between the Interactive Design education and training programs, and the specialized institutions that are commonly accessed by blind & low-vision individuals. Either of these two institutional bodies could hypothetically reach out to the other, in order to perpetuate awareness of Interactive Design as a potential field of work and study for blind & low-vision individuals.

5.6.1 Communicating Change

Furthermore, among the Participants who were more familiar with and knowledgeable about Interactive Design, none of them saw it as a particularly open and accommodating field. While it appears that substantive improvements can be made to reduce or eliminate barriers, it is likely just as important that organizations communicate and market the changes that they have made or are planning to make, if they wish to attract more physically functionally diverse participants.

Questions to Consider

- Has the program or organization reached out to institutions that support blind & low-vision individuals, to make them aware of learning opportunities for the aforementioned individuals?
- Has the program or organization considered partnering with the aforementioned institutions in order to both better implement accessibility considerations, while raising the profile of the program or institution?
- Has the program adequately communicated that they welcome blind & low-vision individuals to apply, and will adequately support qualified applicants to find success in the program?
- Is the program or organization adequately communicating the various steps that have been taken to improve the accessibility of the program, in channels that blind & low-vision individuals are likely to come across?

5.7 Interactive Design

Interactive Design is arguably a form of Systems Design, and a lack of blind & low-vision Interactive Design students could be approached as a systems design program. Any Interactive Design education or training program could choose to utilize their own expertise to address the aforementioned barriers.

As the accessibility of technology has been cited multiple times as a barrier for blind & low-vision Interactive Design students, it can be inferred that further development of such technologies could reduce barriers and increase success rates. Some Participants explicitly outlined their own ideas for software projects that could try and address these barriers directly. Ironically, the technology ideas proposed by Participants sounded like projects that could very well be pursued in post-secondary Interactive Design programs. If institutions want access to an under-utilized talent pool that would increase the diversity of their student body, they may consider partnering with outsiders, such as the keen Participants who contributed to this study.

“...why not use us for our perspective on UI UX design, why wouldn’t you use our community to do this stuff and why wouldn’t you employ us when we have the highest unemployment rate out there? Why wouldn’t you put us in with the technology that we live and breathe every day?” –Jamie

The untapped opportunity to address these technological barriers could be an engaging part of the curriculum for current students, while making a competitive investment to access a deeper talent pool in the future.

“Don’t let this die on the vine.” –Casey

6. Conclusion

As more jurisdictions legislate web accessibility guidelines conformance as a means to provide accessibility for blind & low-vision individuals, there is growing research that indicates that this approach is failing to achieve that goal. This report reiterates the assertion made by many designers with a disability, that superior solutions to accessibility problems will come from disabled designers themselves. In support of these solutions, this study has sought to better identify the barriers that blind & low-vision individuals face when pursuing education, training, or work in Interactive Design.

There is very little research on blind & low-vision Interactive Designers, and most of what exists comes from related disciplines in Computer Sciences or Web Development. This report has addressed this gap in the research through an exploratory study with blind & low-vision adults who had experience and/or interest in Interactive Design education & training. Eight individuals were interviewed and asked about barriers they had faced, and how they would envision an ideal Interactive Design education. They reported a multitude of barriers including finances & funding, finding a suitable training program, post-secondary pre-requisites, institutional readiness, hardware & software tools, teacher competence, attitudes & ideology, and ‘the burden’ of having to constantly act as advocates for themselves. This ‘burden’ was a recurring theme in many of the experiences shared by the Participants, and this extended well beyond their relationship with the field of Interactive Design. Participants described the emotional, mental, and physical toll that this ‘burden’ has on their lives.

The Participants’ input was synthesized into a series of questions aimed at Interactive Design training program administrators, teachers, and other staff. This robust collection of questions are meant to extend the dialogue with the Participants beyond the pages of this report, and stimulate better consideration for blind & low-vision individuals. Further research will be necessary to test the efficacy of these considerations, as well as to better discern the degree to which the reported barriers and recommendations are exclusive or disproportionate to Interactive Design education & training. Conversely, further research could also discern the degree to which the reported

barriers and recommendations are worthy of consideration in other fields of schooling and training beyond Interactive Design.

Some Participants expressed that while they were happy to partake in this research, what they really wanted was to see more real-world action. This reaction is understandable. When evaluating this study's findings against the pre-existing research in related fields, there is a high degree of correlation in research dating back decades. The most important shift that may support meaningful change, is to move from promising to later provide reactive accommodation, to pre-emptively providing adaptation that actively looks towards designing for the future.

7. Bibliography

- Adobe (2020). *Adobe accessibility*. Adobe. <https://web.archive.org/web/20230720130858/https://www.adobe.com/accessibility.html>
- Baker, C. M., Milne, L. R., & Ladner, R. E. (2015). StructJumper: A Tool to help blind programmers navigate and understand the structure of code. *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems*. <https://doi.org/10.1145/2702123.2702589>
- Baker, C. M. (2017a). *Understanding and improving blind students' access to visual information in computer science education*. University of Washington. <http://hdl.handle.net/1773/40540>
- Baker, C. M. (2017b). Increasing access to computer science for blind students. *ACM SIGACCESS Accessibility and Computing*, 117), 19-22. <https://doi.org/10.1145/3051519.3051523>
- Baker, C. M., Bennett, C. L., & Ladner, R. E. (2019). Educational experiences of blind programmers. *Proceedings of the 50th ACM Technical Symposium on Computer Science Education*, 759-765. <https://doi.org/10.1145/3287324.3287410>
- Beijers, F. (2018). *Stories from the trenches: What I've learned from working as a blind developer for a sighted dev team*. 24 Accessibility. <https://web.archive.org/web/20230107170626/https://www.24a11y.com/2018/stories-from-the-trenches/>
- Bernardi, N., & Kowaltowski, D. C. C. K. (2010). When role playing is not enough: improved universal design education. *International Journal of Architectural Research: Archnet-IJAR*, 4, 376-390.
- Borka, A. (2020). *Developer toolkit*. NVDA Community Add-ons website. <https://web.archive.org/web/20210308081337/https://addons.nvda-project.org/addons/developerToolkit.uk.html>

- Bowers, L., & Hayle, R. (2020). Creative haptics: An evaluation of a haptic tool for non-sighted and visually impaired design students, studying at a distance. *British Journal of Visual Impairment*, 39, 026461962091277. <https://doi.org/10.1177/0264619620912771>
- Chambel, T., Antunes, P., Duarte, C., & Carriço, L. (2004). Teaching human-computer interaction to blind students. *Proceedings of HCI Educators 2007*.
- Charmaz, Kathy (2000). Grounded theory: Objectivist and constructivist methods. In N. K. Denzin, & Y. S. Lincoln (Eds.), *The Sage handbook of qualitative Research*, 3rd edition. (pp. 509-535). Sage Publications.
- CNIB. (2022). What is blindness? CNIB. <https://web.archive.org/web/20230205100524/https://www.cnib.ca/en/sight-loss-info/blindness/what-blindness?region=on>
- Connelly, R. H. (2010). Lessons and tools from teaching a blind student. *Journal of Computing Sciences in Colleges*, 25, 34-39.
- Cooper, A., Reimann, R., Cronin, D., & Noessel, C. (2014). *About Face (fourth edition ed.)*. John Wiley & Sons. <https://dl.acm.org/doi/10.5555/2688796>
- Elkes, J. G. (1982). Designing software for blind programmers. *ACM SIGCAPH Computers and the Physically Handicapped*, (30), 15-17. <https://doi.org/10.1145/964167.964173>
- Firat, T. (2021). Experiences of students with visual impairments in higher education: Barriers and facilitators. *British Journal of Special Education*, 48. <https://doi.org/10.1111/1467-8578.12365>
- Goodwin, K. (2009). *Designing for the digital age: How to create human-centered products and services*. Wiley Publishing. <https://dl.acm.org/doi/10.5555/1550878>
- Gray, D. E. (2013). *Doing research in the real world (third edition ed.)*. SAGE.
- Horton, S., Sloan, D., & Swan, H. (2015). Complementing standards by demonstrating commitment and progress. *Proceedings of the 12th International Web for All Conference*, Article 33. <https://doi.org/10.1145/2745555.2746654>

- Institute for Disability Research, P., and Practice. (2023). *WebAIM: Virtual web accessibility training July 5–6*. <https://web.archive.org/web/20230528042100/https://webaim.org/training/virtual/>
- Jernigan, K. (2005). *A definition of blindness*. NFB.
<https://web.archive.org/web/20230128002107/https://nfb.org/sites/default/files/images/nfb/publications/fr/fr19/fr05si03.htm>
- Kearney-Volpe, C. (2020). Accessible web dev: curriculum development and program evaluation. *SIGACCESS Accessibility and Computing*, 123, Article 2.
<https://doi.org/10.1145/3386402.3386404>
- Kearney-Volpe, C., Fleet, C., Ohshiro, K., Arias, V. A., Xu, E. H., & Hurst, A. (2023). Tangible progress: Tools, techniques, and impacts of teaching web development to screen reader users. *ACM Transactions on Accessible Computing*, 16(1), Article 8.
<https://doi.org/10.1145/3585315>
- King's Printer for Ontario. (2012). *How to make websites accessible*. Ontario.ca.
<https://web.archive.org/web/20230614010432/https://www.ontario.ca/page/how-make-websites-accessible>
- Krug, S. (2014). *Don't make me think, revisited: A common sense approach to web usability (3rd ed.)*. New Riders Publishing. <https://dl.acm.org/doi/book/10.5555/2663393>
- Li, J., Kim, S., Miele, J. A., Agrawala, M., & Follmer, S. (2019). Editing spatial layouts through tactile templates for people with visual impairments. *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems*, Paper 206.
<https://doi.org/10.1145/3290605.3300436>
- Li, J., Yan, Z., Jarjue, E. H., Shetty, A., & Peng, H. (2022). TangibleGrid: Tangible web layout design for blind users. *Proceedings of the 35th Annual ACM Symposium on User Interface Software and Technology*, Article 47.
<https://doi.org/10.1145/3526113.3545627>

- McDonald, S., Dutterer, J., Abdolrahmani, A., Kane, S. K., & Hurst, A. (2014). Tactile aids for visually impaired graphical design education. *Proceedings of the 16th international ACM SIGACCESS conference on computers & accessibility*, 275–276. <https://doi.org/10.1145/2661334.2661392>
- Mealin, S. P., & Murphy-Hill, E. R. (2012). An exploratory study of blind software developers. *2012 IEEE Symposium on Visual Languages and Human-Centric Computing (VL/HCC)*, 71–74. <https://doi.org/10.1109/VLHCC.2012.6344485>
- Nogueira, T. C., Ferreira, D. J., Carvalho, S. T., & Berreta, L. O. (2017). Evaluating responsive web design's impact on blind users. *IEEE MultiMedia*, 24(2), 86–95. <https://doi.org/10.1109/mmul.2017.21>
- Norman, D. A. (2013). *The design of everyday things: revised and expanded edition*. Basic Books.
- NV Access Limited. (2023). *About NV Access*. NV Access. <https://web.archive.org/web/20230801151217/https://www.nvaccess.org/about-nv-access/>
- Ojala, T. (2017). *Software development 450 words per minute*. Vincit. <https://web.archive.org/web/20220624070726/> <https://www.vincit.com/blog/software-development-450-words-per-minute/>
- Ostroff, E., Limont, M., & Hunter, D. G. (2002). *Building a world fit for people: Designers with disabilities at work*. Adaptive Environments Center. <https://web.archive.org/web/20170511032738/> <http://www.humancentereddesign.org/adp/profiles/index.php>
- Ostrowski, C. (2016). Improving access to accommodations: reducing political and institutional barriers for Canadian postsecondary students with visual impairments. *Journal of Visual Impairment & Blindness*, 110, 15–25. <https://doi.org/10.1177/0145482X1611000103>
- Owen, C., Coburn, S., & Castor, J. (2014). Teaching modern object-oriented programming to the blind: An instructor and student experience. *ASEE Annual Conference and Exposition, Conference Proceedings*. <http://dx.doi.org/10.18260/1-2--23100>

- Persson, H., Åhman, H., Yngling, A. A., & Gulliksen, J. (2015). Universal design, inclusive design, accessible design, design for all: different concepts—one goal? On the concept of accessibility—historical, methodological and philosophical aspects. *Universal Access in the Information Society*, 14(4), 505–526.
<https://doi.org/10.1007/s10209-014-0358-z>
- Potluri, V., He, L., Chen, C., Froehlich, J. E., & Mankoff, J. (2019). A multi-modal approach for blind and visually impaired developers to edit webpage designs. *Proceedings of the 21st International ACM SIGACCESS Conference on Computers and Accessibility*, 612–614. <https://doi.org/10.1145/3308561.3354626>
- Potluri, V., Grindeland, T. E., Froehlich, J. E., & Mankoff, J. (2021). Examining visual semantic understanding in blind and low-vision technology users. *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*, Article 35.
<https://doi.org/10.1145/3411764.3445040>
- Power, C., Freire, A., Petrie, H., & Swallow, D. (2012). Guidelines are only half of the story: Accessibility problems encountered by blind users on the web. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '12)*. ACM Press.
<http://dx.doi.org/10.1145/2207676.2207736>
- Reed, M., & Curtis, K. (2012). Experiences of students with visual impairments in Canadian higher education. *Journal of Visual Impairment & Blindness*, 106, 414–425.
<https://doi.org/10.1177/0145482X1210600704>
- Sharp, H., Preece, J., & Rogers, Y. (2019). *Interaction design*. John Wiley & Sons.
- Stefik, A., Ladner, R. E., Allee, W., & Mealin, S. (2019). Computer science principles for teachers of blind and visually impaired students. *Proceedings of the 50th ACM Technical Symposium on Computer Science Education*, 766–772.
<https://doi.org/10.1145/3287324.3287453>
- Sterling, T. D., Lichstein, M., Scarpino, F., Stuebing, D., & Stuebing, W. (1964). Professional computer work for the blind. *Communications of the ACM*, 7, 228–230.

- Stone, B., & Brown, D. (2023). Anyone can learn universal design: An interdisciplinary course centered around blindness and visual impairment. *Journal of Postsecondary Education and Disability*, 2023, 36(1), 65-74.
- Thompson, G. (2022). *Web design*. Perkins School for the Blind. <https://web.archive.org/web/20230804221423/https://www.perkins.org/resource/web-design/>
- Valipoor, M. M., & de Antonio, A. (2023). Recent trends in computer vision-driven scene understanding for VI/blind users: A systematic mapping. *Universal Access in the Information Society*, 22(3), 983–1005. <https://doi.org/10.1007/s10209-022-00868-w>
- Vollenwyder, B., Petralito, S., Iten, G. H., Brühlmann, F., Opwis, K., & Mekler, E. D. (2023). How compliance with web accessibility standards shapes the experiences of users with and without disabilities. *International Journal of Human-Computer Studies*, 170, 102956. <https://doi.org/10.1016/j.ijhcs.2022.102956>
- World Wide Web Consortium (2018). *Web accessibility laws & policies | Web accessibility initiative (WAI)*. W3C. <https://web.archive.org/web/20230815045505/https://www.w3.org/WAI/policies/>

8. Appendices

Appendix A:

Interview Questions

Interview Questions

The following questions were used as the anchors for the semi-structured interviews. Please note, participants for this study were classified as one or more of three different categories:

- A) Blind or low-vision individuals with an interest in pursuing an education, training, or work as a professional web/interactive designer.
- B) Blind or low-vision Individuals who are currently pursuing an education or training to become a professional web/interactive designer.
- C) Blind or low-vision individuals who are currently working as a professional web/interactive designer.

Mutually exclusive variations of questions for each participant group have been notated with corresponding letters.

Onboarding

1. Tell me about yourself. Anything at all you would be willing to share for the record.
2. Can you tell me a little bit about your disability?
3. How did this impact your schooling when you were growing up?
4. How did you get interested in web/interactive design and/or development?
5. What has been your experience with web/interactive design pedagogy or training?

A) Questions

6. How are you considering pursuing education & training to work as a professional web/interactive designer?
7. What obstacles are you concerned with facing?
8. What would you want in an ideal post-secondary web/interactive design program?

B) Questions

9. How are you currently pursuing an education & training to work as a professional web/interactive designer?
10. What obstacles are you currently facing with this pursuit?
11. What changes would you want to make your post-secondary web/interactive design program more ideal?

C) Questions

12. How did you obtain the knowledge and skills to work as a professional web designer?
13. What were the obstacles that you faced in pursuing an education & training to get yourself to this position?
14. What would you have wanted in an ideal post-secondary web/interactive design program?

Wrap-up

15. How would you change the world so that we could have more blind and low-vision individuals working as web/interactive designers?
16. Is there anything else you would like to share as part of this interview?

Appendix B:

Organizations Contacted for Participant Recruitment

Professional Design Organizations

Australia

- Australian Graphic Design Association (AGDA)
- Australian Web Industry Association (AWIA)
- Design Institute of Australia

Canada

- Registered Graphic Designers (RGD) [Canada]
- Graphic Designers of Canada (GDC)

United Kingdom

- Chartered Society of Designers [United Kingdom]
- Design Council [United Kingdom]

United States

- American Institute of Graphic Arts (AIGA)

Organizations dedicated to Blind & Low-Vision individuals

Australia

- Blind Citizens Australia
- Queensland Blind Association Inc.
- Royal Society of the Blind
- Vision Australia

Canada

- Canadian National Institute for the Blind (CNIB)
- Canadian Council of the Blind
- Canadian Federation of the Blind
- Centre for Equitable Library Access
- Fighting Blindness Canada
- Vision Loss Rehabilitation Canada
- Vision Loss Rehabilitation Ontario
- W. Ross Macdonald School for the Blind [Canada]

United Kingdom

- Royal National Institute of Blind People

United States

- American Council of the Blind (ACB)

- American Foundation for the Blind (AFB)
- Blinded Veterans Association (BVA)
- National Federation of the Blind (NFB)

Design & Technology firms known to employ Blind & Low-Vision individuals

- NV Access [New Zealand]
- The Paciello Group International [USA]
- Vincit [Finland & USA]

Online Communities

- AppleVis
- MacForTheBlind
- Reddit/r/Blind

Additional Contacts

After these entities were contacted, recommendations were made for the subsequent organizations & individuals, who were also contacted.

- John Kennedy, University of Toronto [Canada]
- Mouth Media
- PS&Co brand Studio
- Texas School for the Blind and Visually Impaired [USA]

Appendix C:

Recruitment Invitation

Invitation to participate in a study of Blind and Low-Vision individuals with an interest in web/interactive design

2021 06 03

Hello there,

My name is Adam Rallo and I am a professional design and design educator, working on my Masters in Inclusive Design at OCAD. I would like to invite you to participate in a research study for Blind and Low-Vision individuals with an interest in web/interactive design.

The purpose of this study is to identify the unique barriers and difficulties that blind or low-vision individuals face when pursuing education and work in the field of web/interactive design. The ultimate goal of this research is to help build towards a future where more blind and low-vision individuals are able to obtain and maintain gainful employment within the web/interactive design industry.

I'm looking for participants to interview who meet one of the following three criteria:

1. Blind or low-vision individuals with an interest in pursuing an education, training, or work as a professional web/interactive designer.
2. Blind or low-vision Individuals who are currently pursuing an education or training to become a professional web/interactive designer.
3. Blind or low-vision individuals who are currently working as a professional web/interactive designer.

As a participant, you will be asked to take part in a private interview with the researcher. Participation will take approximately one to two hours of your time.

The main benefit of participating in this research is to help accurately identify barriers that blind and low-vision individuals may face in pursuing their interest in web/interactive design. The Researcher's intended focus is to help reduce these barriers, and increase professional design opportunities for blind and low-vision individuals.

There also may be risks associated with participation. The Researcher may ask questions to identify relevant barriers or obstacles that you have experienced in life. Recalling these experiences may cause emotional or psychological distress. You can choose not to answer any question at any time. Furthermore, you can indicate any subjects or themes that you do not wish to be asked about, and the Researcher will abide by this request.

If you are interested in participating in this research with me, or if you simply wish to find out more, please email me, the Principal Investigator at: adam.antoszek-rallo@student.ocadu.ca or the Faculty Supervisor Richard Hunt, using the contact information provided below. I am happy to answer your questions over the phone, via video chat, over email, or any way that suits you, just let me know what you prefer. If you know anyone who may be interested in participating in this study, please don't hesitate to forward this invitation along.

This study has been reviewed and received ethics clearance through the Research Ethics Board at OCAD University, REB approval #2021-37. If you have any comments or concerns, please contact the Research Ethics Office through research@ocadu.ca.

Appendix D:

Screening Questionnaire

A study of Blind and Low-Vision individuals with an interest in web/interactive design

2021 06 03

Hello there,

Before agreeing to participate in this research, I need to verify your eligibility. Please answer the following five questions with a YES or NO. If you are unsure as to how to accurately answer any of these questions, you are welcomed and encouraged to contact the Researcher at adam.antoszek-rallo@student.ocadu.ca for assistance. Any resulting discussion will not be recorded or documented in any way.

Questions

1. Are you able to communicate in English? YES / NO
2. Are you a blind or low-vision individual? YES / NO
3. Do you have an interest in pursuing an education, training, or work as a professional web/interactive designer? YES / NO
4. Are you currently pursuing an education or training to become a professional web/interactive designer? YES / NO
5. Are you currently working as a professional web/interactive designer? YES / NO

Thank-you for your time and interest in participating in our research.

I will endeavour to get back to you as soon as possible.

