DISABLING ACCESS: BARRIERS TO EYE GAZE TECHNOLOGY FOR STUDENTS WITH DISABILITIES

ALEXANDER SAM

Supervisor's Name: Gillian Parekh
Advisor's Name: Rachel Da Silveira Gorman

Supervisor's Signature_____

Date Approved_____

Advisor's Signature_____

Date Approved_____

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Abstract

Research Intent

This MRP is intended as a resource for parents, educators and support workers to identify systematic, financial, and training barriers for students. The research takes readers through Federal (i.e. Canadian Charter of Rights and Freedoms) and provincial legislation (i.e. Education Act [1990], Ontario Human Rights Code, Accessibility for Ontarians with Disability Act [2005]), disability support programs (i.e. ADP and SEA), as well as education policy (i.e. TDSB Accessibility Policy P069, TDSB Equity Policy P037, TDSB Special Education Plan [2017]) to highlight the government policy responses to disability in Canada and outlines how access to Eye Gaze technology encounters numerous barriers. The goal is to demonstrate the need for critical discourse focusing on the connection between historical discrimination and biases embedded in Canadian policy, and their role in perpetuating barriers to accessing assistive technology for students with disabilities. The Toronto District School Board is used as the setting, while Tobii Dynavox is the Eye Gaze technology vendor under review for analyzing how policy, programs and institutional practices enable or disable access for prospective students.

Theoretical Discussion

An analysis of the scientific (i.e. Biomedical, Functional) and social models of disability (i.e. Environmental, Human Rights) is used to illustrate how each perspective shapes understandings of disability differently, then moves to examining the dominant disability perspective guiding legislation, policy and programs affecting persons with disabilities in Canada. Both a human rights approach to disability and critical policy frameworks are used to analyze the context within which social and education policies are entrenched and administered in Canadian society, contributing to systematic, financial, procedural, and training barriers to accessing Eye Gaze technology.

Conclusion

The MRP concludes that scientific and biomedical models of disability have historically shaped government policy responses to disability and continue to do so today. Canadian policy and programs meant to facilitate access to Eye Gaze technology are guided by scientific understandings of disability, which embed systematic, procedural and training barriers into policy programs that are supposed to provide funding support to overcome financial barriers. A list of 10 classroom recommendations for barrier free access to Eye Gaze technology is presented using the social model approach, to help parents, educators and support workers identify and eliminate obstacles for users. The MRP ends with a call for further discussion and scholarship of Eye Gaze technology in classrooms, which provides readers with 6 recommended areas of Eye Gaze technology research.

Table of Contents

Acknowledgments

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Positionality In The Discussion

I am an able-bodied racialized male that works as an educator in a special education classroom at the TDSB. My focus on Alternative and Augmentative Communication (AAC) is rooted in wanting students under my care to have access to communication to direct their daily personal care, express thoughts or ideas, and be able to participate socially in their world. The primary experiences with Eye Gaze technology presented have occurred at Beverley Street School, a unique self-contained TDSB community of wonderful students, dedicated parents and student-centered educators.

Introduction

Eye Gaze technology has emerged as an assistive augmentative and alternative communication (AAC) device system for persons with speaking and physical disabilities,

who require eye gaze operated technology to communicate. Persons with Retts syndrome, Amyotrophic Lateral Sclerosis (ALS), Autism, Cerebral Palsy, stroke survivors and those who have become disabled later in life have been using Eye Gaze technology to communicate (Allen, 2016; Ball, Nordness, Fager, Kersch, Mohr, Pattee, & Beukelman 2010; Borgestig, Sandqvist, Parsons, Falkmer, & Hemmingsson, 2016; Walker, 2016). Initial findings detail benefits of using Eye Gaze technology for persons with speaking or multiple disabilities, who may be unable to use other existing hand operated communication technology options (Ball et al., 2010; Borgestig, et al., 2016) as an assistive device to participate in school activities (Murphy, 2011), and to communicate thoughts, feelings and needs (Allen, 2016). Much has been written about the benefits of having access to AAC for students in the classroom (Beukelman & Miranda, 1998; Calculator, 2009; Ganz, Morin, Foster, Vannest, Genç Tosun, Gregori, & Gerow, 2017; Romski, Sevcik, Barton-Hulsey, & Whitmore 2015; Sigafoos & Drasgrow, 1996). Despite initial reported Eye Gaze technology successes in classrooms as an AAC intervention (Allen, 2016; Ball et al., 2010; Borgestig et al., 2016; Murphy, 2011), access to the technology for students in Ontario classrooms is limited, as is academic literature addressing the limited access to participation to this technology.

Disability in Canada

The recent Statistics Canada Survey on Disability Report (2017) characterizes disability as affecting 22% of the Canadian population aged 15 and over and comprising about 6.2 million people. “Of the 6.2 million people identified in Canada with a disability, 37.2% were classified as having a mild disability; 19.9%, a moderate

disability; 20.7%, a severe disability; and 22.2%, a very severe disability" (Statistics Canada Survey on Disability Reports, 2017, p. 7). The range of categories describing disability by the Statistics Canada Survey on Disability Reports (2017) illustrates the complexity of 'disability' as an umbrella word and is indicative of the unique, individual and varied personal lived experiences of living with a disability in Canada. The government's commitment to servicing persons with disabilities is revealed through disability policy; a term McColl, Jaiswal, and Roberts (2017) describe as an entangled network of "legislation, regulations and programs, crossing many departments within government and multiple layers of jurisdiction" (p. 4). A multitude of goals for disability policy have been explored; as a social intervention to enable people with disabilities to live socially fulfilling and happy lives (Fox & Willis, 1989), to create programs and services enabling persons with disabilities to participate in society (Prince, 2004), and a response to historical inequalities (Stienstra, 2018). Bickenbach's (2006) description is human rights centered, describing overarching goals for disability policy as to achieve equity, through protections, which target disability discrimination, access to programs to increase opportunities for persons with disabilities to participate in society, and support to ensure equipment and programs are available for persons with disabilities. Other's critique disability policy as opaquely complex, requiring careful examination of legislation, regulations, programs, providers and entitlements to navigate and understand policy (McColl et al, 2017). Access to disability programs, supports, or assistive equipment is not automatic or guaranteed for persons with disabilities, and disability policy has the power to enable or disable admittance to support resources. A thorough

examination of how disability is managed by Canadian legislation, policies and schools is crucial to understanding how policy can be both an enabler to government support or a barrier in itself.

Eye Gaze Technology at the TDSB

Recent studies have focused on Eye Gaze technology as an assistive communication technology for persons with speaking and physical disabilities (Allen, 2016; Ball et al., 2010; Borgestig et al., 2016; Walker, 2016). I will be using the province of Ontario and the Toronto District School Board (TDSB) as the setting for an examination of educational policies affecting Eye Gaze technology access and support as an AAC intervention. I will be drawing on my own experiences as an educator within the education system to discuss the availability of Eye Gaze technology in classrooms using critical disability theory and critical policy theory to examine access to the technology through legislation and policy.

My goal is to examine the role of policy in enabling student access to Eye Gaze technology in Ontario schools.

Chapter 1: Introduction to Eye Gaze Technology

Eye Gaze technology emerged as a communication option for persons with disabilities (i.e. non-speaking and limited fine-motor control) and is particularly important for persons who cannot use hand-operated AAC systems (i.e. AAC systems (i.e. PECS, PODD, Proloquo2Go or AAC on the iPad). PECS, PODD, Proloquo2Go or AAC on the iPad are all designed with the physical requirements of hand-muscle control

to select, grab or activate communication selections using fingers to push or grab. Tobii Dynavox's Eye Gaze technology is the subject of focus in this MRP and is currently deployed in a select number of classrooms within the Toronto District School Board in Ontario, Canada. Eye Gaze technology communication systems can be operated either using hands or one's eye gaze. The Tobii Dynavox Eye Gaze technology functions by sending out an infrared light, which uses cameras to track light reflected off the user's eyes, then computer software calculations with filtering determines where Eye Gaze technology users eyes are focusing (Tobii Dynavox, 2018). Eye Gaze technology users can change the preprogrammed voices to differentiate their identity from other users.

Who Uses Eye Gaze Technology?

Persons with Retts syndrome, Amyotrophic Lateral Sclerosis (ALS), Autism, Cerebral Palsy, stroke survivors and those who have acquired disability later in life could benefit from access to Eye Gaze technology for communication (Allen, 2016; Ball, et al., 2010; Borgestig, et al., 2016; Walker, 2016). This list is not absolute and there may be future persons not identified in this list who need the gaze access of Eye Gaze technology to communicate. Students that I have worked with using Eye Gaze technology have physical disabilities, which affect their ability to control all their muscle movements and are unable to use any other assistive communication technology.

AAC and Eye Gaze Technology at TDSB Policy At Toronto District School Board

The Toronto District School Board is the largest school board in Canada, and one of the most diverse student populations with approximately 246,000 students and 583 elementary and secondary schools (TDSB.on.ca, 2020). Education curriculum within the

TDSB is largely predicated on the notion that students communicate verbally; however, there are students who require augmentative and alternative Communication (AAC) to participate in classroom activities. Winzer defines alternative and augmentative Communication (AAC) as “a group of procedures designed to support, enhance, or augment the communication of non-speaking individuals or utilize and supplement whatever vocal skills an individual possesses” (2008: p. 507). AAC assistive devices come in both low and high tech systems. Growing consensus amongst families and educators is that multiple viable communication avenues are necessary for students to communicate and express their identities through their "voice," (Sigafoos & Drasgow, 1996). Eye Gaze technology systems are only in a handful of classrooms at the TDSB and some systems are provided to students through the Assistive Devices Program (ADP) or the Special Education Amount program (SEA). All the TDSB’s internal education policies (i.e. Special Education Plan 2019, Accessibility Policy P069 [2017], Equity Document P.037 [2018], and PR606 Use of Assistive Devices by the General Public [2012]) and institutional practices are accountable to the Education Act (1990), OHRC’s disability grounds, and the AODA standards for barrier free access to school spaces (2005). It is important to note that Eye Gaze technology is not listed in any policy documents released by the Ministry of Education or within TDSB policies.

Historical Emergence of Eye Gaze Technology

Early Eye Gaze technology began as a military-funded internal project, tracking pilot eye gaze movements in 1947 during World War 2 using 500,000 frames of movie film (Mohamed, Perreira Da Silva, and Courboulay, 2007). Military interest in analyzing

pilots' gaze started with a belief that a fixed eye gaze signaled what the individual was thinking (Mohamed et al, 2007). Data gathered on eye gaze was also used "in ophthalmology, neurology, psychology, and related areas to study oculomotor characteristics and abnormalities, and their relation to cognition and mental states" (Morimoto & Mimica, 2005, p. 5). The Eye Gaze technology was also deployed for use in Internet advertising and marketing, as well as in computer engineering, to determine if software or web design was intuitive and easy for website viewers to navigate a web page (Morimoto & Mimica, 2005). Some websites generate financial income from Internet users clicking online advertisements on their page and thus potential financial value can be predicted by web page developers when they have access to eye gaze data. User selections tell them where potential websites may benefit from positionally strategic advertisements. In 2001 Tobii Dynavox (2018) took the concept of Eye Gaze technology and repackaged it for use as an assistive communication technology.

The TDSB Provides Eye Gaze Technology Through a Special Education Amount Claim (SEA)

Families of students who need assistive technology equipment used for AAC in Ontario have access to funding through SEA from the Ministry of Education (Special Education Plan, 2019). SEA's mandate is "to provide students with accommodations that are directly required and essential to access the Ontario curriculum and/or a board-determined alternative program and/or course and/or to attend school." (SEA, 2018, p. 2). SEA funding claims that the Ministry of Education covers the cost of supportive equipment listed in the student's Individual Education Plan (IEP). The SEA per pupil

amount covers the costs of computers, software, robotics, and computing related peripherals (SEA, 2019). Eye Gaze technology, along with the supportive mounting equipment, is available through a SEA claim, but needs supporting documentation in the form of assessments from outside professionals (i.e. physicians, psychologists, optometrists), as well as TDSB occupational therapists (OT/PT) and speech language pathologist (SLPs) (Special Education Plan, 2019). SLPs, OT/PT, educators, psychologists, social workers, and physiotherapists mandated assessment goal for students is "Their needs as learners can best be understood and addressed through detailed, standardized individual assessments" (Special Education Plan 2017, p. 23). Data gathered through assessments help determine a student's readiness for assistive technology and is necessary for a SEA claim to proceed. Results of assessments by occupational and physiotherapy services (OT/PT), SLP, a primary educator, psychologists, social workers, physiotherapists include recommendations for physical management, mobility, seating and positioning for function (Special Education Plan 2019). Each request requires individual review. To date, no policy or policy programs identify Eye Gaze technology by name. A significant restriction on claiming Eye Gaze technology provided through SEA is that it cannot leave school property to travel home with a student for use at home. An assistive communication device that travels home must be acquired through the ADP policy program.

Eye Gaze Technology Provided through Assistive Devices Program (ADP)

ADP applications for Eye Gaze funding are handled by Holland Bloorview Kids Rehabilitation Hospital, which has an AAC support service called Communication and

Writing Service (CWAS) program. Holland Bloorview Kids Rehabilitation Hospital houses its own school for students with complex or multiple disabilities, the Bloorview School Authority, while also providing support programs and consulting for students with disabilities at the TDSB and other school boards in Ontario. The CWAS program pairs SLPs and children with communication support. CWAS AAC service provides a support team of speech-language pathologists, occupational therapists, communicative disorders assistants, and assistive technology consultants for persons up to 18 years of age (Holland Bloorview Kids Rehabilitation Hospital, 2019). ADP's mandate is "To provide customer centred support and funding to Ontario residents who have long-term physical disabilities to provide access to personalized Assistive Devices appropriate for the individual's basic needs." (ADP, 2016, p. 11). First hand experience with CWAS AAC service requires a referral form from a physician or health professional to start their AAC support assessment of support needed and to be eligible to be considered for an Eye Gaze technology system for personal use (Holland Bloorview Kids Rehabilitation Hospital, 2019). The CWAS assessment process for prospective Eye Gaze technology users is opaque, as the assessment rubric is not shared, leaving Eye Gaze technology users unable to prepare for the process. I have been told verbally during a consultation meeting for a student that a student needs to demonstrate their ability to navigate between 3-5 Communicator 5 software communication pages and assemble a multi symbol communication utterance to be considered for an ADP provided system, however, the actual rubric has never been shared. To support new Eye Gaze technology users, CWAS will provide a short term loaner device (i.e. one month).

Chapter 2: AAC Past, Present and Limitations of Current Tools

This chapter provides a historical overview of Augmentative and Alternative Communication (AAC), identifying limitations within current school assessment practices used by educators and speech-language therapists (SLPs) using examples from within the TDSB are the focus of this chapter.

Defining AAC and Situating Its Use Historically

AAC systems are differentiated by complexity of operation, separated into two broad categories of "aided" using technology equipment or communication boards with images or line drawings that can be manipulated into communication combinations and "unaided", which rely on natural gestures - using body communication, hands or gesturing (Sigafoos & Drasgow, 1996). Eye Gaze technology falls into the "aided" category of AAC systems and devices. Other examples of aided AAC include Proloquo2go software, Pragmatic Organized Dynamic Display (book or software) and Picture Exchange Communication System (PECS).

Historical Emergence Of AAC As A Communication Support

AAC's first reported use occurred in the 1970s, relying on symbols with manual signs and later photographs or line drawings (Harn & Ogletree, 2001). In the 1980s and 1990s, enhancements in technology developed AAC aids that could verbally announce one's communication choices and this method of language intervention was commonly used for persons with autism (Harn & Ogletree, 2001). Deployment of AAC is not limited to specific disabled identities and can be made available to anyone seeking to increase communication in social opportunities - working at a job, going to a party,

communicating with friends at school. AAC systems come in both low-tech or high-tech designs, with some lower-tech ones utilizing a fixed amount of messages or pre-recordings, whereas high-tech options (i.e. computer tablets) may have a vast vocabulary, which can be customized for multiple communication environments and purposes (Dell & Newton, 2014: p. 707). Many high-tech AAC devices grow with the increasing demands of communicators and capable of expressing the user's more complex thoughts. Many have options like, "modified keyboards, speech recognition, text-to-speech, scalable fonts, and so forth" (Woodward & Feretti, 2014: p. 741). A drawback of using higher-tech AAC systems relate to high cost of buying and maintaining the technology (i.e. updating software and training to increase user competency). Eye Gaze technology is positioned in the category of high-tech AAC with Tobii Dynavox's first version introduced in 2002 (Tobii Dynavox, 2018).

How AAC is Provided to Students with Disabilities at the TDSB

AAC intervention for non-speaking students occurs when an educator identifies a learning support need, which could benefit from speech and language services in schools, who may provide recommendations to staff and parents or assist in making SEA claims for assistive equipment (TDSB, 2019). SLPs are responsible for assessing existing communication skills and identifying a strategy, which builds on existing strengths (Adaman, Derry, Lenz, Slp, MacCallum, Turner, & Di Gironimo, 2015). AAC assessment practices rely on evaluating the physical mobility of the individual, including hearing, vision as well as using an interprofessional approach to gauge the most appropriate AAC tool(s) to pair with the student (Adaman et al., 2015). In the TDSB, the

AAC assessment process includes information from the student's Individual Education Plan (IEP), school records, as well as interviews with parents/guardians, educators, students and use standardized and informal assessment measures (i.e. measure receptive language as well as writing and reading skills) to form a partial view of the student's AAC strengths and areas of need (TDSB Special Education Plan, 2018).

At the TDSB, learning support is planned in stages: 1) Classroom screening and monitoring, where a learning difficulty is identified and communicated to parents; 2) Referral to in-class support team (IST), where the primary teacher presents gathered information (i.e. diagnostic tests, direct observation, recent work) to plan a strategy for meeting that students learning needs; 3) Referral to school support team (SST), who may comprise psychologists, social workers, attendance counsellors, speech-language pathologists, occupational therapists, physiotherapists, parents or caregivers and students over 16 years of age; and 4) Referral to an Identification, Placement and Review Committee (IPRC), who analyze the collected information and make a decision on the identification of student exceptionality and whether the student should be placed in a regular or special education classroom (TDSB Assessment Referral Process, 2019). Students may be asked to participate in some or all of the steps outlined in the TDSB assessment referral process to access Eye Gaze technology.

Eye Gaze Technology As an AAC Intervention

Tobii Dynavox Eye Gaze technology uses Communicator 5 software in a grid layout (i.e. customizable columns with more or fewer cells, depending on the user's needs). Each time the Communicator 5 software detects a symbol to be chosen by the Eye

Gaze technology user, it adds the choice into a sentence box at the top of the screen, which is then auditorily broadcasted using a computer-generated voice (Tobii Dynavox, 2018). Selecting symbol options on the Eye Gaze technology screen is done by the user blinking or dwelling (for an extended period) on a Communicator 5 symbol choice. Additionally, users can make selections by using the muscles in one hand to operate a hand-held switch (like a mouse click) or through touching the screen with a finger (Tobii Dynavox, 2018). Although Communicator 5 software's dwell time can be customized, Eye Gaze technology users must find a balance between a quick dwell time for faster communication and a comfortable dwell duration. Eye Gaze technology user accuracy is dependent on eye muscle endurance to focus for extended communication sessions and regular Communicator 5 software calibration to ensure proper eye tracking (Tobii Dynavox, 2018). Improper calibration of the Eye Gaze technology infrared trackers will negatively impact the accuracy of the Eye Gaze user's communication choices (Tobii Dynavox, 2018). Eye Gaze technology users have the choice of their Communicator 5 software selections broadcasted in order or a communication partner can read the sentence as it is being assembled on the Eye Gaze technology screen. A newer addition to Tobii Dynavox's Eye Gaze technology is the system's ability to track both light and dark pupils of the user as well as removing the requirement for headgear to be worn, which provides freedom to move one's head while using the technology (Tobii Dynavox, 2018). Previous Eye Gaze technologies require mounted headgear, which was heavy and physically exhausting when worn for long periods of time (Duchowski, 2007). Current Eye Gaze technology from Tobii (2019) requires the Eye Gaze operator's head

orientation to be parallel to the screen, with the center of the device at the user's eye level and approximately 45-60 cm from the screen.

Chapter 3: Theoretical Models of Disability

No unified social consensus regarding the approach or meaning of disability exists, however disability theory can impact how disability is perceived and the development of laws, policies and practices affecting disability (Rioux & Valentine, 2005). Understandings of disability are diverse, however there are two notable approaches to disability which include the individual and social model of disability (i.e. scientific and social understandings of what disability means), with sub categories within each - Biomedical, Functional, Environmental and Human Rights approach (Rioux & Valentine, 2005; Rioux, 2014; Oliver, 1990). A review of disability models within the individual and social paradigm is critical to unpacking the values embedded in laws, policies and educational practices affecting disability and access to assistive communication devices like Eye Gaze technology.

Individual Pathology - Biomedical Approach

The biomedical approach interprets disability as a condition that needs to be prevented through early diagnosis or cured through treatment and rehabilitation (Rioux, 2003) (Massoumeh & Leila, 2012). A biomedical lens would interpret disability as intellectual or physical impairment or deviant behaviour resulting from disorder or disease (Massoumeh & Leila, 2012). Biomedical approaches to disability are prevalent in dominant social policy, such as genetic screening) to identify persons with intellectual

and/or physical disabilities before a fetus is born (Rioux & Valentine, 2005). In schools, the biomedical approach to disability may recommend using medical assessments, diagnosis and interventions to understand students with disabilities. The biomedical model of disability is the most widespread approach to disability, guiding diagnosis and the treatment of children with disabilities in schools, as well as encouraging children with disabilities to adapt to their environment (Massoumeh & Leila, 2012).

Individual Pathology - Functional Approach

A functional approach to disability, also sometimes called an economic approach (see Bickenbach, 1993 and Jongbloed, 2003) is similar to the biomedical approach because it is rooted in the idea of disability as an individual pathology. A key difference between the functional and biomedical approach to disability is the belief in rehabilitation services (functional approach) and treatment through medicine and biotechnology (biomedical approach) with the ultimate goal of individual independence and eventual employability (Rioux, 2003). The functional approach to disability characterizes disability as an individual condition and their inclusion into society as a personal responsibility - an approach that is used to justify limited state intervention in the form of disability policy and policy support programs (Rioux & Valentine, 2005). Within the functional model, environmental modifications may be made for the individual with a disability, however they usually affect the individual's personal spaces, rather than whole social systems or organizations (Rioux, 2003). In schools, a functional approach to disability could take form in physical programming to have a student adapt through learning how to walk up and down stairs, rather than designing schools that are accessible

without stairs. Within the economic model of disability, the primary concern is to distribute and reduce the costs associated with limited productivity. The functional model does not take into account that disability is not located solely within the individual and is a function of the interaction between the individual and their social context (WHO, 2011).

Social Model of Disability - Social Pathology

A social model approach to disability acknowledges that persons with disabilities face challenges in their day-to-day lives from their disability impairment, however, society's systemic failure to adapt physical and social structures or processes to account for their needs are identified as the main sources of disablement, not the individual's impairment (Oliver, 1990). A social model approach is split into both an environmental and a human rights approach to further differentiate social perspectives of disability.

Social Model - Environmental Approach

An environmental approach to disability identifies common social spaces, which are unable to provide access to persons with physical and/or intellectual disabilities as well as in accessible service arrangements (Rioux & Valentine, 2005). For example, a student with a physical disability may be asked by the school board to ride a bus every morning to a school with accessible classroom spaces or extra support staff because their neighborhood school may not be able to provide those accommodations to safely support their involvement in day-to-day routines. An environmental approach lens critically analyzes social systems and assesses structures, identifying systemic barriers to

participation for persons with disabilities, advocating for the elimination of physical obstacles and creating more opportunities for social inclusion (Rioux & Valentine, 2005).

Social Model - Human Rights Approach

A human rights approach to disability focuses on the unequal relationship between disabled individuals and their able-bodied peers in society, suggesting that disablement continues without the appropriate legal infrastructure in place to dissuade disability discrimination (Rioux & Valentine, 2005). Disability exists naturally in society and a human rights approach dictates collective social responsibility to provide social and political rights to persons with disabilities (Rioux & Valentine, 2005). For example, a human rights approach states that persons with disabilities are entitled to rights protecting their inclusion in society (i.e. flexible start times for school or work to accommodate challenges commuting) and right to accommodations (i.e. modified class schedule to accommodate persons who cannot sit for long periods). Ultimately, the human rights model of disability has been understood as an evolution of the social model, prioritizing universal rights principles as an assessment tool of equity (Brown & Parekh, 2013), while drawing attention to the influence wielded by the 'social determinants of disability' (Rioux & Valentine, 2006). A closer examination of social policies is encouraged by the human rights approach to better understand how social and economic systematically disadvantage persons with disabilities.

I Recommend a Social Model Approach to Disability

In selecting an approach to understanding disability, I believe in following Rioux and Valentine's (2005) lead by employing a critical disability theory perspective to

unpack the complex relationship between disablement and equality. Despite the individual pathology approach being the most globally accepted disability paradigm (Mitchell, 2010; Rioux & Valentine, 2005), I believe that a social model approach to disability is the position most closely aligned with human rights of persons with disabilities. Brown & Parekh (2013) suggest

"A shift towards a social model of disability includes greater attention to processes in which disparities occur, and will help to identify opportunities that educators can use to bring about greater equity for all students" (p. 7). If society's ultimate goal is to achieve equality and inclusion for persons with disabilities as full citizens, then a social model approach confronts structural and procedural barriers, which prevent full participation for persons living with a disability (Rioux & Valentine, 2005). For example, the individual pathology approach to disability continues to shape educational policies with the onus on students with disabilities to initiate calls for support, present and process to completion evidence of need for accessing accommodations and supports - these can be significant barriers to students with disabilities (Hibbs, & Pothier, 2006). Human rights approach to disability is integral to creating conditions for Eye Gaze technology users to secure autonomy over developing a personal communication speaking style and voice with their system. A move towards a social model understanding of disability has already begun at the Toronto District School Board (TDSB). The TDSB advocates for greater inclusion of special education students into mainstream classrooms and the school community (TDSB's Futures Conference, Director's Keynote, May 2012; Brown & Parekh, 2013).

Chapter 4: Traditional and Critical Policy Theory Frameworks

Codd (1988) describes policy as a procedure of action or inaction based on a set of goals, accompanied by defined values as well as predefined resources to achieve the overall plan. Levin and Young (1994) describe policy as an approach to social issues, designed to shape behaviour in a country, province or school. Policies trickle down into education, guiding how schools are structured, resources selected for curriculum, the section of educators and how money earmarked for education is distributed (Levin & Young, 1994). Through the creation of policy, an exercise of political power can occur, with accompanied language used to legitimate a particular course of action (Codd, 1988). The field of theoretical frameworks continues to grow beyond traditional policy theory (i.e. cultural perspective, critical policy theory, critical-race perspective, feminist perspective, feminist critical policy analysis, poststructural policy archeology and policy reconstruction), however, a focused examination of traditional and critical policy frameworks is presented as the former continues to shape traditional educational policies (Young, 1999), while the latter questions cultural reproduction through educational institutions and policies as well as resistance to unequal power relations promoted by educational policies (Apple, 1982; Apple, 1992; Bourdieu, 1991).

Traditional Policy Paradigm

A traditional policy framework paradigm draws heavily from positivism, relying on functionalist, rational, and scientific models with most traditional educational policy theorists preferring narrow processes focusing on obvious problems and quantitative facts, (Diem *et al*, 2014). A traditionalistic (i.e. positivist) policy paradigm follows

norms, entrenched assumptions and traditions, which work together to standardize methods of interpreting and disseminating information on educational policy (Young & Diem, 2016). Traditional policy studies are often viewed as unbiased scientific research by policy experts who employ theory with quantitative data to address issues and promote effective change (Young, 1999).

A critique of the traditional policy position is the omission of multi-theoretical perspectives applied to the policy context and problem, an approach that would more comprehensively acknowledge concerns of minority social groups (Young, 1999).

Critical Policy Paradigm

Critical policy analysis emerged as a critical response to the positivist approach to policy analysis (Young & Diem, 2016). Codd (1988) describes policy analysis as a multidisciplinary field that sidesteps enduring specializations to utilize any theoretical or methodological pathway pertinent to the policy issue being investigated. Critical policy analysis draws on recent theoretical developments in its chest of tools to address complex policy making decisions, which have challenged simplistic traditional policy analysis models (Taylor, 1997). Interdisciplinary and multi-theoretical perspectives from "sociology, critical and feminist leadership studies, and qualitative evaluative studies to the investigation of education policy" (p. 273) are used by a critical policy analysis approach (Brewer, 2014). Critical policy theory explores how policies are often presented as norms, functioning largely as political rhetoric; how power, knowledge and social advantages are not distributed equally; how schools reproduce dominant social values; and how individuals respond (i.e. resist or accept) to policies reflecting dominant social

groups (Young, 1999). Over the last 30 years across the globe, theories examining education policy have slowly shifted away from traditional frameworks to critical frameworks by a growing number of educational policy scholars who are dissatisfied with the traditionally narrow scope of study (Diem, Young, Welton, & Cumings, 2014). Critical policy theory aims to include more research, which draws on the experiences of stakeholders of diverse identities (i.e.socioeconomic, racial, cultural, sexual orientation and disabled backgrounds). Young and Diem (2016) have found that critical policy scholars tend to focus their work on these five critical concerns; 1, analyzing the difference between policy rhetoric and practice; 2, the roots and development of a policy and how it has changed in response to dominant culture; 3, making connections between resources, knowledge and power over policy development; 4, effects of social stratification on policy and how privilege or inequality is affected by this relationship; 5, how non-dominant social groups respond to policy and activism around resisting inequitable policy. Critical policy analysis is well suited to analyzing the power relations of policy and how they affect persons with disabilities in accessing financial support, assistive technology and programs to support their inclusion in society.

Critical Policy Analysis Approach to Understanding Policy

Employing a critical policy paradigm analysis helps address key questions around policy and disability: What policy is? How does it affect all populations of people? How does a policy typically reproduce pre-existing social structures of hierarchy and inequality? And which populations of people benefit from the existence of existing social policies? (Levinson, Sutton, Winstead, 2009). I believe a critical theory approach

positions research to consider the historical context that led to past and current disability policies and policy programs overseeing access to Eye Gaze technology. Questions that benefit from a critical policy approach; 1, At the provincial or board level, what policies and policy programs oversee access to Eye Gaze technology? How do current policies enable or disable access to Eye Gaze technology for students who could use the technology to communicate ideas, direct personal care or socially participate in society? What historical conditions led to the current policies and policy programs in place that manage access to Eye Gaze technology? Are current policy and policy programs overseeing Eye Gaze technology embedded with a student centered approach (i.e. mandate access to learning support) or do they force them to conform to institutional standards in order to gain access? Is bias and discrimination embedded in the same policy and policy programs that are supposed to help students gain access to Eye Gaze technology?

Chapter 5: Statements of Methods

This MRP applied a document analysis method to identify articles, books and textbooks with Eye Gaze technology as the subject of study. Eye Gaze technology articles were collected from academic journal databases at York University library and the Toronto Reference Library stacks. Critical disability and critical policy theory approaches were used to explore the relationship between school policies and disability, specifically how they mutually inform and reinforce each other, and their role in perpetuating or mitigating systemic, financial, procedural, and training barriers to Eye

Gaze technology. A critical disability approach is crucial to identifying the dominant disability perspective active in shaping perceptions of disability, while a critical policy theory approach illuminates how persons with disabilities are enabled or disabled through disability policy and policy programs in Canada. A historical review of legislation, policy and programs relating to disability in Canada and Eye Gaze technology is included to provide context for the current state of disability policy in Canada. I recommend dispelling the biomedical approach to disability, which individualizes disability, and, instead, adopting the social model, which is an approach better positioned to identify systemic, financial and training barriers to Eye Gaze technology in schools. The final chapters are split into 3 sections. Chapter 7 consolidates the discussion of current systematic, financial, procedural, and training barriers and Chapter 8 includes 'Recommendations for Barrier Free Access' presents recommendations to help readers identify and remove environmental barriers. Finally, Chapter 9 provides a list of future Eye Gaze technology research topics to better understand how the technology can be adapted for use in a variety of settings to enable social participation.

Research Questions

An overarching research goal is to answer, does the context within which social and education policies are entrenched and administered, contribute to systematic, financial, procedural, and training barriers to Eye Gaze technology access in Canadian classrooms? What dominant disability paradigm has shaped disability policy in Canada and has it enabled rights to access or the perpetuation of bias and discrimination? What are some specific systematic, financial, procedural, and training policy and program

barriers to accessing Eye Gaze technology for prospective users? Are there specific barriers to users for educators, support workers, speech-language therapists, and parents to be aware of when supporting Eye Gaze technology users with their device?

Chapter 6: Production of Biases and Discrimination Through Disability Policy

Access to Eye Gaze technology may be the only opportunity for persons with physical and speaking disabilities to communicate ideas, engage in conversations, direct personal care or express emotions. However, access to Eye Gaze technology is largely dependent on a combination of legislation, public and school policies, which can enable access through provincial support programs or function as barriers for prospective users who fail to qualify for these support programs. Understanding the barriers for prospective students to Eye Gaze technology access requires a cognizance of the relationship between legislation and disability policy in Canada.

Landscape of Disability Laws, Policies and Protections in Canada

Federal Legislation

A total of 38 federal statutes refer to disability and disability specific legislation in each of the 13 provinces and territories, with Municipal governments also contributing to overseeing programs and standards (McColl et al, 2017). The current state of disability legislation and policy in Canada has changed as public perceptions of what it means to have a disability has shifted. Early disability laws and policies in Canada were based on the asylum model of care from 1860 to 1890, which confined persons with disabilities to family homes or within government institutions (Jongbloed, 2003). The Canadian law-

and-order approach through asylum confinement of persons with disabilities continued into the 19th century (Jongbloed, 2003). A turning point for laws and policies shifting from containment of persons with disabilities to disability protection and inclusion occurred with establishment of key Canadian federal legislative laws. The 1970s ushered in the passage of the Canadian Human Rights Act (1977), which prohibits discrimination on the basis of personal characteristics (i.e. physical or mental disability); In 1982, the passage of the Canadian Charter of Rights and Freedoms provided additional protection from physical and mental disability discrimination; and the passage of Canadian Employment Equity Act (1986), which guides Crown corporations and federal employees toward removing employment barriers confronting four designated groups, including people with disabilities (Rioux & Valentine, 2005).

Provincial Legislation

Momentum to protect disability rights continued with the Education Amendment Act, 1980 (Bill 82), which required school boards to include students with disabilities in public schools and provide educational services (Lattanzi, 2013). The Ontario Human Rights Code (OHRC) followed with disability protections for accessible education and 17 other grounds (OHRC, 2019). Included in the OHRC (2019) are legal mechanisms to ensure educational institutions in Ontario's practices align with maintaining discrimination free, inclusive and accessible institutional spaces. Both the Charter and OHRC provide legal frameworks for persons with disabilities to challenge educational policies or institutional decisions that they believe are discriminatory. The Charter and

OHRC are protective legal mechanisms that were historically unavailable to Canadians with disabilities.

Governing all education issues, the Education Amendment Act (1980) (Bill 82) arose as a legislative policy in Ontario, overseeing school boards' provision of educational services to students with disabilities (Lattanzi, 2013). The Education Amendment Act (1980) (Bill 82), now known as the Education Act (1990), is a significant legislative policy overseeing disability education in Ontario. The updated Education Act (1990) provides Ontario school boards with guidelines on support and accommodations for students with disabilities (i.e. Individual Education Plans (IEP), access to specialized equipment to attend school, special education classroom placements without additional fees and a formalized process for special education tribunals to hear appeals by parents who disagree with the placement of their child in a program). The Accessibility for Ontarians with Disability Act (2005)(AODA) is the most recent provincial legislation with definitions of disability discrimination and outlining accessibility standards for public spaces. Unlike the Education Act (1990) and the OHRC, the AODA (2005) does yet outline standards for accessibility in education.

Disability Policies Guide Public Understandings of Disability

Disability and social policy are mutually reinforcing; sometimes enhancing equality, while in other occasions in direct conflict with each other; entrenching values and presenting unintended consequences, which ultimately shape the social perception of disability (Bouck, 2007; Oliver, 1986; Peters, 2007; Zola, 2006). Diem et al (2014) characterize policy as ‘messy’, ‘complex’ and ‘value’ laden. Historically, mainstream

understandings of disability have been shaped through personal experiences with persons with disabilities, media representations, and through social policies representing paradigm approaches (i.e. biomedical, function and social approach) to disability (Darke, 2004; Hahn, 1985; Lang, 2009; Rioux, 2003; Soldactic, 2013). Disability policies in Canada manage and regulate social responses to persons with disabilities covering economic, medical, and social issues such as discrimination as well as accommodation responsibilities for persons with disabilities (Jongbloed, 2003). Canadian disability policies may support persons with disabilities, promoting equality and inclusion or further disability discrimination through systemic barriers to social participation, limiting access to employment opportunities (Vazquez, 2011). For example, during one case in the 1950s, a Supreme Court of Canada judgement forced two students with disabilities to leave a public school because of behaviour and an inability to meet academic goals (Bouchard. v. St. Mathieu de Dixville, [1950] S.C.R. 479). Testimony from classroom peers who described the students as negative presences and a physician's recommendation of institutionalization were prioritized over the two students in question (Bouchard. v. St. Mathieu de Dixville, [1950] S.C.R. 479). The Bouchard. v. St. Mathieu de Dixville, [1950] case publicly conveyed the notion that schools could legally exclude students with disabilities if they didn't meet behavioural or academic standards set out by education policy, thus forcibly placing them in a special education classroom.

The State of Disability Policy in Canada

Disability policy affects 4.3 million people in Canada (McColl et al, 2017) and is made up of a patchwork of legislation, divergent programs and practices forming the

government's responsibilities to persons with disabilities (Prince, 2009). "Traditionally, and still today, most public policy on disability focuses on a person's limitations due to disease, injury, or chronic illness as the cause or a major explanation for relatively low levels of educational attainment, employment, and income" (Prince, 2009: p. 7). While early disability policy focused on restricting persons with disabilities in the social sphere (i.e. institutionalization), contemporary policy has focused on human rights and legislative protections aimed at protecting their inclusion in Canadian society (Stienstra, 2018). Despite the shift in policy focus, "Frustration and disappointment" (p. 58) are the words used to describe Canadian disability policy in the last 20 years as reports by national disability organizations and academics (Prince, 2004). Indigenous groups regularly cite the inaction of Canadian governments on numerous disability issues or adverse effects of policy decisions, which impact persons with disabilities (Prince, 2004). Disability policy in Canada has been described as moving at a frustratingly slow pace with policies not functioning effectively (Brown, 1977; Prince, 2004). Specific criticisms of disability policy identify absences in providing essential services, late referrals to programs, poor transitioning of persons with disabilities from one program to another, and incomplete information systems all contributing to barriers (Prince, 2004). Jongbloed (2003) describes Canadian disability policy as fragmented because policies develop slowly to meet different demands; second, disability policy is part of general welfare policies, which lack cohesion; and third, society is still working towards better understanding what having a disability means and what society's responsibility is to provide support for persons with disabilities. For example, high rates of poverty, low

levels of education and high levels of extra costs associated with living with a disability suggest a failing of disability policies in Canada to successfully integrate into Canadian society - with integration in this context referring to individuals with disabilities achieving the same standard of living as persons without disabilities through social inclusion opportunities (Stienstra, 2018).

Disability Policy in Education

Similar fragmentation and inconsistency in Ontario disability policy is mirrored in education policy. A patchwork of disability policy programs (i.e. ADP and SEA) and internal school policies at the TDSB are accountable to new (i.e. AODA [2005]) and older provincial legislations (i.e. an outdated Education Act [1990], OHRC). The TDSB Accessibility Policy P069 (2017) outlines board responsibility of accessibility, inclusion, equity, the duty to accommodate, inclusive design for barrier free environments and ongoing training for employees to meet accessibility standards established by the AODA (2005), while the TDSB Multi Year Accessibility Plan sets deadlines to meet these goals. The TDSB Equity Policy P037 (2018) outlines a "commitment to eliminating institutional discrimination, promotes fairness, equity, acceptance and inclusion and is governed by the Constitution Act, 1982, Canadian Charter of rights and Freedoms, the Ontario Human Rights Code, the Education Act, as well as the Ontario Ministry of Education's Policy/Program Memoranda PPM 119: Developing and Implementing Equity and Inclusive Education Policies in Ontario Schools, and decisions of the Board of Trustees." (1). The TDSB Special Education Plan (2017) policy draws on the Education Act (1990), providing guidelines for the school board's institutional approach to special

education practices at the board (i.e. placement in special programs, institutional standards for program delivery, and guidance on practices for accessing student learning supports).

Emergence of Neoliberalism's Effect on Educational Policy in Ontario

Neoliberalism in Ontario under the Harris government in the 1990s has had a significant impact on school policy direction, taking form through limiting ongoing reforms of inequitable education structures and instead emphasizing restructuring school boards to remain globally competitive as well as fiscally accountable (Basu, 2004). Neoliberalism is based on the notion of the economic marketplace as the main evaluator of social value for each person, with individuals responsible and accountable for their own actions or well-being (Harvey, 2007). Personal success or failure is attributed to entrepreneurial skills or individual failings (such as not working hard enough or long enough to achieve a goal, which others have achieved) (Harvey, 2007). Proponents of free-market schooling and market-oriented practices believe this system encourages privatized service providers to emerge to set-up businesses, which provide choice for consumers (i.e. parents of students with disabilities) (Anastasiou & Kaufman, 2009). Mitchell and Boyd (1998) understand policy as effective only when all relevant aspects of the education system are taken into consideration, but often instead fall short because studies preceding policy creation are too narrow or limited. Hardy and Woodcock (2015) identify the shortcomings of a neoliberalism approach to education, explaining "Neoliberal practices and principles value and validate individual competition and narrow economistic conceptions of 'success', rather than participation as active and worthwhile

citizens" (p. 143). Basu (2004) describes neoliberalism as a 'one-size fits all' approach to policy, applying techniques and strategies, which influence policies leading to an 'audit culture' - monitoring, standardizing and bookkeeping to account and measure achievement. Parekh, Crawford, & Killoran (2011) suggests neoliberalism is guiding our educational system's policies toward a meritocratic system, reproducing inequalities embedded in Ontario society, with inequity ingrained within the architecture of programs and services throughout the TDSB. An intense individualism is encouraged by neoliberalism, establishing social expectations of all members of society to market themselves and be measured by their economic contributions to society (Apple, 2000). One of the economic tools used by neoliberalism is standardized assessments practices to measure student learning. A critique of standardized assessment practices suggest treating everyone the same, regardless of their strengths and vulnerabilities sometimes increases inequalities, rather than lessening them (Kempf, 2016). Critics of standardized assessment practices believe standardized treatment of students, regardless of their academic skill set can increase inequality, rather than level the field; and assessment success is linked to familiarity with a test context, with particular kinds of learners being advantaged over others (Carpenter, Weber, & Schugurensky., 2012). Students with disabilities are at a disadvantage with standardized testing in Ontario as the narrow testing framework praises speed and vague curriculum standards (Toplak & Wiener, 2000). In Ontario, the Education Quality and Accountability Office (EQAO) was introduced during neoliberal educational policy reform to measure student learning in grades three, six, nine and ten. The EQAO is a standards-referenced assessment, rather

than a standardized test, however, the two share similar problems for students with disabilities. For example, a student with an IEP can be provided with modifications to curriculum expectations during the school year to meet their educational needs (TDSB Special Education Plan, 2019), however, modifications are not permitted on the EQAO (EQAO Administration and Assessment Guide, 2020). Students with disabilities have individual learning needs and styles, which a standards-referenced assessment like the EQAO are not designed to account for. Equality in education recognizes that sometimes fairness requires treating people differently in order to provide all students with an equal opportunity for successful results (Kempf, 2016). Eye Gaze technology users face significant challenges with standardized assessments processes because the format is based on the learner adapting to the assessment format, rather than it being adapted to different types of learners and how they are able to respond.

Students who rely on specialized special education services and funding for assistive equipment or special education programs in schools may not be socially valued under neoliberalism's independent free market competition model, which relies on standardized assessment tools, which are designed to audite students to determine their economic value. Available evidence indicates that students with disabilities often fare poorly in market-based reform, which may be fundamentally incompatible with serving the needs of students with disabilities (Dudley-Marling & Baker, 2012). Roulston, Thomas, and Watson (2012) describe the power policy has in assigning value to certain bodies, while identifying who is not valued and in this way a social mechanism for enabling and disabling at the same time. For example, chromebooks or computers are

provided by the TDSB to mainstream classrooms for daily use without students needing to go through any assessment process. But students with disabilities seeking access to an Eye Gaze technology system must navigate through policy that requires them to prove they can operate the technology before funding for a device is provided. Neoliberalism assigns value to particular bodies in schools, controlling decisions around annual budgets and determining which students' learning needs are prioritized and distributing resources based on those priorities.

Chapter 7: Barriers to Using Eye Gaze Technology

Families and educators agree that there is a need to create communication opportunities for student expression (Sigafoos & Drasgow, 1996), however, Eye Gaze technology users hoping to gain access face systemic, financial, procedural and training barriers. According to the OHRC policy on accessible education for students with disabilities (2018), barriers in education for students with disabilities include, inadequate funding for special education services due to budget constraints delayed or inconsistent accommodations or those that lack individualization; long waiting lists for professional assessments, which are required for access to special education support services; insufficient training for education institutions on disability issues; allowing negative attitudes and stereotypes to direct approaches to students with disabilities.

Systemic Policy Barriers to Accessing Eye Gaze Technology

The TDSB acknowledges the presence of systemic barriers for students with disabilities through their Equity Document P.037 (2018); “The Board recognizes,

however, that certain groups in our society are treated inequitably because of individual and systemic biases related to race, colour, culture, ethnicity, linguistic origin, disability, socio-economic class, age, ancestry, nationality, place of origin, religion, faith, sex, gender, sexual orientation, family status, and marital status….We also acknowledge that such biases exist within our school system" (2018: p. 1). The TDSB acknowledges that individual and systemic bias, oppression and discrimination exist within our school system, and, regardless of intent, may be perpetuated unless we all take focused, explicit, persistent and determined action to identify, challenge and overcome them." (2018: p, 2). Unfortunately, the TDSB Equity Document P.037 (2018) falls short in outlining how to analyze policies, procedures and programs in schools to identify and remove systemic barriers. Instead, a generalized action plan within the TDSB Equity Document P.037 (2018) recommends accommodations built around human rights, targeting adjustments to policies, procedures, programs or practices, and physical spaces to eliminate barriers to equal access and eradicate discrimination (TDSB Equity Document P.037 [2018]). Eye Gaze technology users fall into the category of disability identified in the TDSB Equity Document P.037 (2018) policy, however, less clear is how systemic barriers to accessing the technology at schools can be rooted out using the policy.

Scotch and Berkowitz (1990) believe the key to understanding how current policy directives impact social issues is through connecting current institutional policy with the historical context that led to its creation. An understanding of the historical reasons shaping the formation of protective education policy like the TDSB Equity Document P.037 (2018) would contextualize the historical relationship between schooling policy

and disability, and access to Eye Gaze technology. Scholars have written extensively about how dominant disability paradigms have historically shaped education policy, thus affecting the type of resources and learning experiences for persons with disabilities (Ellis, 2011; Lattanzi, 2013; Massoumeh & Leila, 2012; Rioux, 2003). Levinson *et al* (2009) describes policy as a "practice of power," which creates a social reality, binding people to a purpose, regulating responses to that issue and normalizing the responses that come from this policy. Careful attention needs to focus on the power historically wielded by education policy in constructing the disabled identity, the formation of social attitudes and stereotypes of disability. The OHRC (2018) recognizes the legacy of historical systemic disability barriers in current policy, identifying negative social attitudes and stereotypes embedded in school policies, procedures and programs as significant barriers affecting access to educational services. Social attitudes and perceptions of individuals with disabilities are significant as a determinant of access to Eye Gaze technology because they can influence how prospective users are perceived during assessments for access to policy support programs, which provide government funding for a system.

Operating Eye Gaze technology and the included Communicator 5 software is a challenge for all people, able-bodied or living with disability. Educators, speech language pathologists (SLPs) and parents may not have first-hand experience of what eye access communication using Eye Gaze technology looks and sounds like as it does not always present similarly to verbal communication pathways. An Eye Gaze technology user's physical and/or neurological impairment may also impact the sequencing of their utterances, pace, duration during communication or they may just not be interested in

talking at that moment. A presence of negative attitudes and stereotypes of students with disabilities can impact perceptions of an Eye Gaze technology users' utterance intentionality, which can have a significant impact on access to policy funding programs. I have witnessed a skeptical observer communicating with a student using Eye Gaze continually asking a student to verify their utterance each and every time, unaware of the physical burden on the student to repeat their answer twice each time. Interpretation of communication utterance intentionality by evaluators and perceived user competence is a significant determinant of whether financial support provided through SEA or ADP policy programs is enabled for prospective users.

The TDSB Equity Document P.037 (2018) draws attention to the presence of systemic barriers in TDSB schools, but without an understanding of the historical discrimination embedded in school policies, procedures and policy programs, is more of a symbolic equity policy. In the next section, I will go into more depth about the impact of a fragmented policy approach to accessing Eye Gaze technology and SEA and ADP policy programs.

Financial Barriers to Eye Gaze Technology

An introductory Eye Gaze technology package starts at $1,516, continuing all the way up to $17,624 CDN; six device access to choose from (i.e. i-12+, i-15+, EyeMobile Plus, EyeMobile Mini, PCEye Plus, PCEye Mini), with each differentiated by screen size and the presence of a built-in or an external USB attached infrared sensor bar - using an external infrared bar requires a compatible computer tablet (Tobii Dynavox, 2018). The immense cost of purchasing Tobii Eye Gaze technology equipment is a financial barrier

to families unable to afford it. The Assistive Devices Program (ADP) and Special Education Amount (SEA) are provincial government programs established through Ontario disability policy, which manage the distribution of assistive devices like Eye Gaze technology funding.

Procedural Barriers to Eye Gaze Technology

While ADP and SEA can enable students to get an Eye Gaze technology device, they are embedded with systemic barriers that take form in an eligibility criteria, which is extremely challenging to navigate, while providing limited student centered support throughout the process. Understanding the limitations of access to Eye Gaze technology through ADP and SEA policy program funding requires a brief review of the influence of neoliberalism and the individual model understanding of disability on education policy and policy programs access in Ontario. Neoliberalism has significantly influenced contemporary education policy in recent decades (Parker, 2017; Parekh et al, 2011), reorienting education policy towards inequitable reforms valuing narrow economic conceptions of success and reproducing biases embedded in Ontario society (Hardy & Woodcock, 2015; Basu, 2004; Parekh et al, 2011). Part of the Ontario government's reorientation of policies to a neoliberalist agenda in the 1990s led to medically oriented criteria for public policies and programs, which characterize disability as an individual pathology (Rioux & Valentine, 2005). Characterizing disability as an individual pathology and treating persons with disability with medical intervention approaches is one of the characteristics of an individual model approach to disability. The individual model approach to disability entrusts experts in disability fields (i.e. physicians) to

evaluate individuals with disabilities, who are viewed as the main point of intervention and units of analysis for research (Rioux, 2003). ADP and SEA policy programs both approach individuals with disabilities as the main point of intervention, utilizing medically oriented criteria as key criteria for access to Eye Gaze technology and draw on experts in the field of disability to perform assessments. For example, ADP relies on a medically oriented criteria, requiring a medical specialist or general practitioner to provide a disability diagnosis, followed by an 'authorizer,' who assesses the prospective user's needs and proscribes equipment (Ontario Ministry of Long-Term Care, 2019).

ADP's designated 'authorizer' for assessing prospective users is Holland Bloorview Kids Rehabilitation Hospital. SEA follows a similar approach relying on qualified professionals to administer assessments for the school board (Special Education Plan, 2019). Students are first evaluated and assessed by occupational and physiotherapy services (OT/PT), SLP, an educator, psychologists, social workers, physiotherapists, who determine as a group whether the prospective student can operate technology (i.e. Eye Gaze technology) - evaluative data is compiled from school records, classroom observations, medical history, affiliated medical agencies i.e. rehabilitation centres, hospitals, observation of motor abilities and interviews with staff who work with the student (Special Education Plan, 2019) (TDSB Assessment Referral Process, 2019).

A criticism of designing access to support programs using an individual model approach to disability is that successful admittance is often contingent on the ability of persons with disabilities to assimilate into pre-existing institutional structures and practices (Rioux, 2003). Assimilation into pre-existing institutional structures, practices,

and standards to gain access to policy programs may not be possible for Eye Gaze technology users given their disability or multiple disabilities, which have led them to the technology as a last resort. Rioux & Valentine (2005) draw attention to social pressures on individuals to ameliorate their disability independently, which are exacerbated by policy requirements to continually provide evidence of a disability to meet policy criteria when accessing necessary government support programs. The individual model approach to disability narrowly focuses on individuals with disabilities as the primary point of intervention, failing to consider how systemic barriers can exist in policies, policy programs or institutional practices. For example, Eye Gaze technology is not listed in any government SEA, ADP or TDSB policy documents by name and there is no mention of assessment tools or rubrics in ADP or SEA designed exclusively for Eye Gaze assessment. Through experiences observing assessments, I have watched ADP and SEA appointed evaluators gather evidence using pictures, video, as well as through observation notes from watching the user perform on an Eye Gaze technology system. Less transparent throughout ADP and SEA assessment practices is how decisions on eligibility are made without a criteria designed specifically for Eye Gaze technology. A specific Eye Gaze technology designed assessment criteria would lead to more transparency over ADP and SEA funding eligibility decisions, rather than relying on a criteria that may have been assembled for a different AAC assessment technology. Eye Gaze technology is operated differently then direct access AAC technologies (i.e. using fingers to make selections).Without specific assessment criteria for Eye Gaze technology, an increased risk exists for students to go into assessments unprepared and for

inconsistent assessment expectations from ADP and SEA evaluators tasked to determine funding eligibility. Students with disabilities could better prepare for the ADP and SEA assessment process if there was a criteria outlining they are expected to demonstrate to be given funding.

The neolioberal agenda approach adopted by the Ontario government to ADP and SEA policy programs funding is an additional systemic barrier for Eye Gaze technology users, who often have more expensive healthcare and assistive technology needs then able bodied individuals. Parker (2017) describes neoliberalism's prioritization of fiscal accountability over social responsibility, as valuing quantitative achievements over public responsibilities to provide necessities for all persons in society. Structuring ADP and SEA policy programs to prioritize being accountable to an eligibility criteria (i.e. medical documentation and measuring performance during assessments) illustrates the Ontario government's strict adherence to fiscal accountability, at the cost of public responsibilities to ensure essentials, like access to assistive technology are provided. Parker (2017) goes on to say that valuing responsibility over accountability is an approach, which encourages listening to others and considering their perspective. For Eye Gaze technology users, valuing public responsibility over accountability means recognizing their precarious position of needing AAC to self-advocate, as well as acknowledging the social value of their voice through this technology.

Ontario's individual model approach to disability and accountability to a neoliberal agenda have influenced ADP and SEA disability policy programs with multiple layers of systemic barriers, which contract each's mandate "to provide access to

personalized Assistive Devices appropriate for the individual's basic needs" (ADP, 2016, p.11) and provide students with accommodations that are directly required and essential to access the Ontario curriculum and/or a board- determined alternative program and/or course and/or to attend school." (SEA, 2018, p. 2).

Training Barriers to Eye Gaze Technology

The significance of access to ongoing Eye Gaze technology training for prospective users cannot be overstated as proficiency in navigating included software is a crucial component of ADP and SEA funding criteria. Studies on Eye Gaze technology in the classroom have concluded a minimum of 15-30 hours (Ball et al, 2010) and between 15-20 months of access before proficiency operating the technology was achieved (Borgestig et al, 2016). Despite research pointing to the importance of access to training for Eye Gaze technology users, a number of barriers impede access to training. One, the high retail cost of purchasing Eye Gaze technology devices has limited their availability in schools, making it challenging to find an available system to train on. Students can receive a one month loan from Holland Bloorview Kids Hospital CWAS program, but they have a very limited number of devices available. Eye Gaze technology is only available at a select group of TDSB schools. School boards cannot access ADP and SEA funding for Eye Gaze technology because both programs are designed to provide devices for individuals. Recent significant cutbacks to special education budgets (Draaisma & Brown, 2018) have increased pressures on school boards to cut costs and limit large financial purchases, making Eye Gaze technology scarce.

The second issue facing students and their families is access to additional training from Eye Gaze technology manufacturers to augment teacher support. Absent from ADP, SEA and TDSB policies (i.e. PR606 [2012], TDSB Special Education Plan 2019) are standards for supporting students and families, such as a number of minimum training support sessions or additional training opportunities from Eye Gaze manufacturers to support student success using the technology or ongoing training for their families if the device is funded. Considering eligibility for Eye Gaze technology funding through ADP and SEA is contingent on meeting assessment requirements, it is concerning that neither policies (i.e. PR606 [2012], TDSB Special Education Plan 2019), nor policy programs (i.e. ADP, SEA) outline training guidelines to support student learning using the technology. Instead, SEA's commitment to training is "Boards are expected to make cost effective choices about acquiring appropriate equipment and will ensure that students (where appropriate), teachers and board staff who work with the student have received training in order to make the best use of the equipment." (2019, p. 8). SEA's training focus is on educators, who are responsible for educating students on how to use their Eye Gaze technology device. Another policy, TDSB's policy PR606 Use of Assistive Devices By the General Public (2012) directs training towards support workers, specifically on how to interact with people using assistive devices, while omitting training for the technical use. Similar to policy PR606 (2012), SEA guidelines focus narrowly on training access for staff working with students, failing to mandate that families should also have access to training. ADP does not list any training guidelines for an individual receiving assistive technology, their families or support workers. My experience has been that the

TDSB offers limited Eye Gaze technology training for the primary educator, who is expected to then teach support workers, students and their families. In two years, I have received 1.5 days of training and am expected to continue with self-directed learning on my own time.

When questioned about important resources for learning AAC, parents of children with disabilities identified that access to training, provided by device manufacturers, was one of the most important resources for both families and children (McNaughton, Rackensperger, Benedek-Wood, Krezman, Williams, & Light, 2008). McNaughton et al (2008) also reported that some parental attitudes toward AAC technology were directly related to their lack of confidence with computer technology, with learning to program AAC devices posing a major challenge. Given the technical complexity of operating and maintaining Eye Gaze technology, existing policies (i.e. PR606 (2012), TDSB Special Education Plan 2019) and policy programs (i.e. SEA/ADP) need to be amended to mandate access to training from device manufacturers for students and their families. The absence of mandated access to ongoing training opportunities for family members of students receiving Eye Gaze technology is a significant barrier to ensuring students are properly prepared for ADP/SEA funding assessments and that they are able to successfully operate their devices.

Chapter 8: Recommendations for Barrier Free Access

Positioning Support To Be Flexible to User Needs

This list of recommended Eye Gaze technology practices draws on literature research from others in the field and my own experiences with students using Eye Gaze technology in the classroom. I would like to recommend two guiding practices for educators, which are based on a social model approach to disability: 1. self-reflection to ensure historical discrimination is not reproduced, 2. self-evaluation of our hierarchical positionality in the process and consciousness of the barriers that exist because of this structuring of the teacher-student relationship.

Supporting users equitably requires educators to understand their role as supporters and refrain from their professional background as a justification to control all outcomes and processes. Educators, speech-language therapists, parents as well as researchers and advocates should engage with the notion that when given the opportunity, Eye Gaze technology users can communicate how they want to be supported. For example, Eye Gaze technology users should be included in all decisions around how their system is edited or modified to ensure it reflects their communication needs and preferences. Efforts to support individuals with disabilities inclusion should not be conditional on their ability to assimilate into mainstream society's ableist practices (Erevelles, 2018). Eye Gaze technology users may develop new preferable methods of communication, which are essential to enabling expressed communication on their device and reflect their personal communication preferences. For example, QWERTY keyboards are ubiquitous for typing, however, this keyboard layout may not be accessible for users to type with their eye gaze. Future research focused on Eye Gaze technology typing may suggest visually clustering letters for on-screen keyboards (i.e. square clusters of left,

middle and right section) to make writing frequency words more eye-gaze accessible. The only reasonable expectation educators, speech-language therapists and parents should have of Eye Gaze technology users for on-screen keyboard typing is that a standardized keyboard layout may not work for every user. It is important for support workers to be open to adapting to these preferences, rather than imposing dominant social communication norms, which reflect and prioritize able-bodied experiences of writing.

Below, I present ten recommendations of support practices to readers based on the social model approach to disability, which prioritize equitable Eye Gaze technology communication opportunities, and barrier-free access. The list should be considered a work in progress and readers are encouraged to contribute from their own experiences using Eye Gaze technology.

1. Regular Training and Practices are Essential for Success

The first recommendation when setting Eye Gaze technology users up for success is to schedule regular training and practice time for new and existing users. Many studies (Allen, 2016) (Ball et al., 2010) (Van Niekerk & Tönsing, 2015) did not record time practice periods suggesting that not all Eye Gaze technology users are provided with planned specialized or individualized training programs. But, studies that did include training opportunities recommended a minimum of 15-30 hours (Ball et al., 2010) and up to 15-20 months before significant improvements with user accuracy were recorded (Borgestig et al., 2016). Both studies underline the importance of extended training periods for Eye Gaze technology proficiency. (Borgestig et al., 2016) (Ball et al., 2010). Access to ongoing training for Eye Gaze technology users also offers support workers

more opportunities to observe and make adjustments to a user's physical positioning from the device. Support workers should focus their attention on making notes of comfortable body or head positioning to ensure Eye Gaze technology users can comfortably see their screen without physical strain. Users may have individual physical impairments, affecting their head position or their ability to gaze for extended periods at the screen. A one-size-fits-all approach to Eye Gaze technology does not account for individual differences. Tobii Dynavox's Eye Gaze technology has an adjustable "dwell" period, so each user can have their settings modified to their "dwell" preferences[1]. Training times are crucial opportunities to tailor dwell times to fit the communication preferences of users. For example, a student I work with expressed frustration and unwillingness to continue during sessions until I decreased their Eye Gaze technology systems' dwell time, which enabled them to respond faster. Most students I have worked with have individual dwell times as part of their Eye Gaze technology profiles.

If educators, speech-language therapists, parents as well as researchers and advocates are to assess Eye Gaze technology users operating these systems as a communication aid, then access to training better positions them for success. A shared anonymous database of this information, accessed internationally could help the manufacturer with planned revisions to their software and better understand how their devices are being used in real world settings.

2. Learning Eye Gaze Technology Requires Communication Modelling

[1] Dwell is the term used to describe the amount of time the user looks at an icon on the screen before the sensor triggers it

Using AAC modeling as a teaching strategy has shown positive long-term effects for emerging communicators learning new AAC systems (Binger and Light, 2007). AAC modelling is the process of teaching AAC through combining verbal prompts with a visual physical prompt (i.e. pointing a finger at a symbol) to demonstrate how an AAC system can be used to express a message (Binger and Light, 2007). Eye Gaze technology facilitators ~~E~~ have a responsibility to model how to communicate using the technology if they are to expect users to use their devices. In my own practice, I begin by broadcasting my thinking as I am communicating, starting with, "I have something to say," then following with both a verbal prompt, "I....want….drink," and physical prompt (i.e. I push each symbol on the touch screen as I verbalize each word). The benefit to modeling Eye Gaze technology is users are walked through a communication pathway to phrase completion in a real conversation. I do not expect the user to adopt an identical communication path, however, it is important for developing users to have a working example. Another consideration in adopting this approach is Eye Gaze technology facilitators can observe whether the technology system communication layout is accessible for the user. If persons supporting Eye Gaze technology users are unable to use the technology accurately or effectively, then it is unreasonable to expect users to.

A concern with modelling is, does the practice interfere or prevent an owner Eye Gaze technology from communicating via their device as they wait for their communication partner to finish modeling? I believe that communication partners should ensure Eye Gaze technology users are provided sufficient time to think through and respond to the communication, drawing on what they know about that user's response

times - I have waited up to 15 seconds. Modeling communication using Eye Gaze technology demonstrates turn taking between the user and their communication partner. It is a social interaction that is reflective of real-world communication.

3. Personal Energy Level Determines Willingness to use Eye Gaze Technology

Third, plan for intentional Eye Gaze technology use and communication opportunities that suit the user's energy level and opportunities throughout the day when they feel most comfortable to socialize. I use the word ‘intentional' to indicate periods within the day that educators have planned to evaluate users on their device or activities where their responses are being assessed. For example, studies on optimal periods of the day for Eye Gaze technology usage have found that users more accurately control their eye gaze earlier in the day when they are rested (Ball, 2010; Walker, 2016). Knowing when Eye Gaze technology users are most accurate and feeling their best is critical information when planning any assessments. Eye Gaze technology users may have episodic illnesses that cause physical pain or fatigue, resulting in less energy to communicate. Familiarity in reading body language (i.e. visible disinterest may mean fatigue or physical care need that is distracting their attention - need to use the washroom) are essential for identifying barriers for users while communicating via Eye Gaze technology. Ultimately, ongoing tracking of these opportunities by support workers should result in individualized observations of the times where the user is most actively communicating. This provides valuable information about when to expect communication. All new physical skills associated with the Eye Gaze technology require

a period of development, where the body develops endurance and the tasks associated with these new skills become easier to manage.

Another teacher I work with intentionally uses snack periods on the schedule to try and encourage conversation with their students. These snack periods create conditions where everyone is sitting together and the presence of food allows for conversation to occur naturalistically. I also recommend making the Eye Gaze technology available at all times for users which allows for their communication to occur as they desire. Ensuring communicative opportunities are present at all times reflects educators desire to have the voice of their students present at all times.

4. Check Eye Gaze Technology Calibration and Tracking for Accuracy

Fourth, educators, speech-language therapists, parents, researchers, and advocates should assess the Eye Gaze technology device calibration regularly to ensure it is properly functioning and customized to the user. Calibration has three different components, which are integral to the accuracy of the Eye Gaze technology infrared trackers. The first component of calibration is user head positioning, which needs to be parallel and at eye level to the center of the device (If the user's head is more comfortable at a tilted position then the device needs to be tilted to match that position) (Tobii Dynavox, 2018). The eye-tracker must scan the user's eyes and build a profile based on the how ambient light is reflected off their eye-gaze (Tobii Dynavox, 2018). Finally, Eye Gaze technology user's head position should be at a distance of 18-24 inches (45-60 cm) for the device's infrared trackers to accurately read one's eye-gaze(Tobii Dynavox, 2018). The calibration of Eye Gaze technology is delicate and significantly alters the

accuracy, which is a frustrating barrier for users who depend on these systems for communication. In a study of eight participants, improper gaze calibration of the Eye Gaze technology affected two of the children's accuracy and results (Borgestig et al. 2016). None of the other articles listed in the reference section specifically mentioned improper calibration as a barrier, however, I have personally witnessed users verbalize frustration or disinterest in using their system when it does not respond accurately to their eye-gaze.

5. Personalizing a Visual Communication Layout

The individuality of each Eye Gaze technology user should be a priority when supporting users in designing the visual organization and layout of their communication software, rather than a standardized, one-design-fits-all approach. Hansen et al. (2004) recommend more research on the Eye Gaze technology needs to focus on the icon/symbols, their colour, and their layout on the screen. Eye Gaze technology comes pre-programmed with Communicator 5, equipped with a standard layout to begin with, but can be customized. I encourage working closely with Eye Gaze technology users to identify a visual layout they feel comfortable using. For example, if the user is physically more comfortable gazing to the left side of the screen, as this suits their resting position when communicating, then important on-screen buttons should be placed in that area. If users respond more accurately to buttons organized by colour codes on their Eye Gaze technology display, then partner with users in organizing the visual layout by colour, selecting colours they can easily differentiate. Symbol literacy should also be investigated to determine whether Eye Gaze technology users understand their meaning (Allen, 2016).

No universal standard for AAC symbols exists, however, each software company often has their own database they use, which are unique. For example, when I worked abroad in Australia, I found pictures from the Boardmaker software were assigned to a specific set of words, while in Canada, those same symbols were attached to another set of words. Eye Gaze technology users who are part of multiple communities, in Canada and internationally, may encounter software symbols used differently in each social context. During the initial introduction to Eye Gaze technology software, educators should plan to discuss symbol meanings as well as reviewing meanings regularly. Where possible, it may even help the user to use images that represent their personal lived experiences. For example, instead of relying on the Eye Gaze technology software's generic image for visiting the park, it may be more literate and meaningful to the user to pick an image of their local park. This image will have features that are unique to their local park. This may require more time and effort to initially set up, but is more personally relatable as a visual layout for emerging communicators.

6. Partner Equitably To Customize Eye Gaze Technology Communication

As emerging communicators' proficiency in Eye Gaze technology advances past introduction to the system, prioritizing user involvement in all decisions regarding their system’s operation should be a goal for everyone who is involved with supporting users. To collaborate equitably with Eye Gaze technology users, an ongoing working relationship should exist, which would help support workers to better understand likes, dislikes, gestural communication and develop a yes/no communication routine. For example, one colleague involves their students in all decisions regarding the

customization of the system, relying on both a student's Eye Gaze technology responses or "yes," "no" head movements to respond to questions - communicating through head movements was a strategy that both student and teacher established to communicate together for this process. Through a yes/no communication routine, the teacher was able to customize the system based on the wishes of the student, with opportunities to customize their system.

7. Participatory Approach to User's Eye Gaze Technology Screen Layout And Design

Seventh, a participatory approach to designing the user's screen layout may increase the usability of their Eye Gaze technology device in multiple social communities inside the classroom and at home with family. Communication can be guided by personal experiences and cultural norms, as conversations are culturally situated. Attention to Eye Gaze technology users' social communities provides a well-rounded perspective of the social and cultural communities that their device will need to be designed for. This approach would benefit from involving families, who can suggest communication symbols choices or languages that make the device usable at home. A participatory design approach allows others to have experiences, which challenge dominant paradigms on disability and can be perception changing. For example, a participatory design approach introducing an AAC system to a family was adopted in rural Kenya, leading to the unexpected positive result of increasing the parent's personal perception of their child's intellectual capacity (Bunning, Gona, Newton, & Hartley, 2014). Their involvement in the process led to specific communication experiences with their child,

which made them reconsider their initial negative perceptions of their child's disability. The inclusion of families through participatory design encourages the inclusion of cultural experiences only an insider within that community would be able to identify and suggest.

8. Environmental Conditions Affect Eye Gaze Technology's Infrared Sensors

Eighth, environmental conditions relating to sunlight will negatively affect tracking a user's pupils accurately on a Eye Gaze technology device. One example of ambient lighting affecting usability is "when you start to get sunlight and "false" reflections in your eyes, tracking performance may be affected." (TobiiDynavox.com, 2018, para, Eye Tracking FAQ). A user's screens should be set-up away from intense sunlight coming in from windows, which would otherwise run the risk of flooding infrared sensors on a device and disrupting the ability to accurately respond to a user's eye gaze. In my own experience, a simple adjustment to overcome midday sun coming through the window is to position a user's screen away from this light source. Unfortunately, when outside for a field trip, communication via Eye Gaze technology on a bright sunny day is limited to shaded areas.

Another potential environmental barrier is wearing eyeglasses. Earlier Eye Gaze technology had difficulty tracking the eye movement of users with eyeglasses (Duchowski, A. 2007), however, Tobii Dynavox claims this is not a problem for their system (2018). None of the studies in the reference section have mentioned this issue as a barrier, however, it was present in earlier technology and so consider that this can affect the user's ability to use the device should be kept in mind.

9. Plan For Expressive and Spontaneous Eye Gaze Technology Communication

Typical communication throughout a routine school day is often instructional between teachers and students, rather than conversational (Chung & Carter, 2012). Positive interactions for AAC users to meet their complex communication needs are dependent on the skill of their communication partner (Kent-Walsh & McNaughton, 2005). Some communication partners have been criticized for not effectively supporting communication, by dominating communication interactions, taking a majority of turns and frequently interrupting the utterances of persons using AAC (Kent-Walsh & McNaughton, 2005). If an overarching goal is to structure classroom learning around Eye Gaze technology as a personal voice, social participation, and expression, then classrooms need to model these communication opportunities. For AAC users to experience effective communication interactions, their communication partner must be able to send and receive messages to model conversation (Kent-Walsh & McNaughton, 2005). Educators, support workers, and SLPs should intentionally structure activities that are open ended and include options where the student can pose questions or suggest the direction of the conversation. Another approach is to discuss with the student the inclusion of an onscreen button that reads, "I would like to talk about…," which they could use to transition to the topic of their choice. I have also seen student's Eye Gaze technology displayed with a button that reads, "That is all I have to say," to clearly finish a conversation without their partners continually prompting them when they had no desire to continue. Spontaneous communication can be promoted through scheduling opportunities for students to socialize with each other without educators dictating the

conversation direction. Similar to recess breaks throughout the day in mainstream schools, educators need to consider how classroom routines could further enable users to develop their own voice through the Eye Gaze technology.

10. Research Should Focus on Enabling Easier Eye Gaze Technology Writing Tools

The last recommendation is to focus additional research on how to enable writing opportunities for Eye Gaze technology users so the technology can advance past simple utterances. Earlier research has focused on using Eye Gaze technology for typing in two languages with some success, however the participants in the studies did not report having a disability (Itoh, 2006) (Hansen et al., 2004). One of the biggest barriers I have seen students using Eye Gaze technology encounter is underdeveloped on screen keyboards, which require users to exhaust energy gazing at each letter to form basic words and only some have a predictive text function. More research into the design of a comfortable onscreen keyboard for Eye Gaze technology users would hopefully alleviate the laborious and time-consuming experiences of eye gaze typing. There is great potential for Eye Gaze technology users to one day rely on the device for writing books, creative writing, poetry or email communication to friends.

Chapter 9: The Future of Eye Gaze Research and Technology

Research On The History of Eye Gaze Technology

One of the challenges with this MRP was finding published academic research, which comprehensively details the historical development of Eye Gaze technology. I found one article describing Eye Gaze technology's initial design and testing throughout World War

II. There are a number of informal websites and blogs (i.e. groups in Facebook) that have discussion forums about the origins of Eye Gaze technology tracking, however, the authenticity of the information is challenging to verify and must be cautiously integrated into research. I suspect the lack of published, academically verifiable text on historical development is linked to its use in the military and private sector; two industries that may not want to share information publicly. For example, Tobii Dynavox's website (2018) only goes as far back as 2001, with the company describing their realization of adapting this technology for use as a communicative device for persons unable to speak and with physical impairments. Other research on Eye Gaze technology shows that users without impairments also trailed the technology in the military (Mohamed et al., 2007) and in an office for typing (Morimoto & Mimica, 2005). Additional research on how the technology has been repurposed for different industries would help in understanding the contexts shaping design decisions of Eye Gaze technology.

Research On Using Eye Gaze Technology For Communicative Typing

Another absence noted while conducting research is there are no studies focused on persons with disabilities using the Eye Gaze technology for communicative typing (or the user experience). For example, individuals who have developed physical impairments later in life, but have a foundation in writing would be able to use the system to transmit complex thoughts or writing through the system. Software support for these users should also include predictive text to augment the speed of their typing. More research on using onscreen gaze activated typing could help software developers at Tobii Dynavox better understand their user's experiences moving from simple symbol communication to text

messaging. I have observed the limitations of current onscreen gaze activated typing keyboards and consider them to be a significant barrier with their current design. Current smartphones have a predictive text feature, which correctly suggests words before you finish typing and frequently typed names, making the whole typing process quicker for the users, with less typing. Software for Eye Gaze technology would benefit from implementing some of the features found in smartphones.

Research On Eye Gaze Technology Calibration And User Positioning

Another area of research that requires a closer examination is the impact of improper calibration on users. Borgestig et al (2016) were the only study to mention the calibration as a barrier to users. My own experiences constantly recalibrating student's Eye Gaze technology have led me to believe more research on how calibration impacts the user's experience is needed. I find it deeply concerning that calibration was not an issue that came up regularly in Eye Gaze technology research. For example, I observed one student who struggled with making accurate selections on an Eye Gaze technology system (I could see the student's cursor target moving around a symbol, but not on it), only for the system's sensors to appear to fail to track - the student eventually lost interest and looked away. At other times, when moving students with their Eye Gaze technology mounted to their wheelchairs, the jostling causes the device to positionally shift and the device must be calibrated when the user stops moving. Even a readjustment of the user's seated position could result in the infrared trackers miscalculating where their eye gaze is directed. The calibration of Eye Gaze technology is integral to the usability of the system and when left unchecked is one significant barrier for users.

Long-term Studies Tracking The Usability Of Eye Gaze Technology

One glaring absence in academic writing regarding Eye Gaze technology is continuous studies over a number of years that track the lived experiences of users and how the technology has been used in social settings (i.e. using them at work or settings with new communication partners unfamiliar with the technology). Borgestig et al (2016) documented the longest study, lasting 20 months, but this focused on tracking the usability of the system within a contained setting, rather than in social participation situations (i.e. parties, larger social events with more than one communication partner). Extended studies could assess the effect of Eye Gaze technology on users' personal lives, documenting the impact of the technology, both positive and negative. Despite absences in academic research on Eye Gaze technology in the community, online communities of parents and teachers exist. Members actively share their experiences with the device through online forums and Facebook groups. Members also share qualitative experiences of supporting students and family members with the Eye Gaze technology and how to increase its usability for users with specific physical or lifestyle requirements. One question I was able to investigate through these groups was how to position the device for a user that moves around on the floor or lays down with their head at a specific angle. Access to more long-term studies on Eye Gaze technology being used in social communities outside of classrooms would help understand how users make the systems a part of their lives.

Research On How The Technology Can Support Participation in Art

There is no academic research on using Eye Gaze technology for artistic expression and participation in theatre or film. Supporting the participation of Eye Gaze technology users in all aspects of society should include art as a crucial component that enhances the quality of life for the user. Humans express themselves in different forms (i.e. writing, making images, painting, making music) beyond communication and so the representation of expression through multiple artistic forms needs to be included in the discussion of Eye Gaze technology. Keeping academic research narrowly focused on AAC, prioritizes one need over opportunities for others to decide how they want to use Eye Gaze technology to express themselves.

Qualitative Research From Eye Gaze Technology Users

Finally, I believe research on the Eye Gaze technology would benefit from users partnering with researchers to develop qualitative research on day-to-day life with Eye Gaze technology. Collaborating with an Eye Gaze technology user on a qualitative research project using the technology to respond would be a powerful symbol of the importance of having access to this technology to express personal identity, ideas and make connections with others. Alternatively, being unable to respond using Eye Gaze technology would demonstrate that the technology required may be unable to meet the expressive demands of users.

Chapter 10: Conclusion

Eye Gaze technology provides crucial opportunities for individuals with disabilities to communicate feelings, thoughts or ideas that otherwise may not be

possible. Despite the communication benefits of Eye Gaze technology for individuals with speaking and physical disabilities (Ball et al., 2010; Borgestig et al., 2016; Walker, 2016), financial, systemic and training barriers exist for prospective users.

The high retail cost of Eye Gaze technology is a financial barrier for some individuals and their families. By establishing ADP and SEA policy programs, the Ontario government has acknowledged a social responsibility to provide individuals with disabilities with financial funding assistance for technologies like Eye Gaze. ADP is mandated to provide a personalized device for basic needs (ADP, 2016, p. 11), and SEA to provide accommodations to enable students with disabilities to participate in school and access the curriculum (SEA, 2018, p. 2). However, ADP and SEA's eligibility requirements are systemic barriers to following through with their mandates to provide funding support services for individuals with disabilities. The disconnect between ADP and SEA policy programs mandate and the fragmented way policy programs provide access to their support funding is representative of the provincial government's theoretical and economic approaches to disability policy.

A significant influence on public policies programs was the Ontario government's reorientation to a neoliberal agenda and commitment to the individual model approach to disability in the 1990s, which outlined a medically oriented criteria requirement to access public policy programs (Rioux & Valentine, 2005). ADP follows a medically oriented criteria, requiring a medical specialist or general practitioner to provide a disability diagnosis, followed by an 'authorizer,' who assesses the prospective user's needs and proscribes equipment (Ontario Ministry of Long-Term Care, 2019). SEA relies on a

combination of assessments from outside professionals (i.e. physicians, psychologists, optometrists) and their OT/PT and SLPs to perform evaluations (Special Education Plan, 2019). The challenge for individuals with disabilities to successfully navigate ADP and SEA's eligibility processes are exacerbated by a failure of these policy programs and policies managing assistive technologies (i.e. TDSB Special Education Plan 2019, PR606 Use of Assistive Devices By the General Public) to prescribe student and rights centered learning support guidelines (i.e. access to Eye Gaze technology and ongoing training provided for that device). With research suggesting a minimum of 15-30 hours (Ball et al, 2010) or up to 15-20 months to proficiently operate Eye Gaze technology (Borgestig et al, 2016), it is clear that individuals need regular access to a device and ongoing training to be successful using the technology.

Reorienting to the Social Model Approach for Disability Policy and Policy Programs

Disability theory is important as it can impact how disability is perceived and the development of laws, policies and practices affecting disability (Rioux & Valentine, 2005). Students who come to Eye Gaze technology for communication are some of our most vulnerable members of society and their access to a voice through Eye Gaze technology needs to be prioritized and enabled by our policies and policy programs. Frustratingly, the Ontario government's neoliberal agenda and individual model approach to disability policy significantly influence how access to assistive technologies, like Eye Gaze technology are managed. Policy programs (i.e. ADP and SEA) managing Eye Gaze technology access and schooling policy (i.e. TDSB Special Education Plan 2019, PR606

Use of Assistive Devices By the General Public) fail to recognize that eligibility requirements and assessment practices as barriers are access barriers to the technology.

If society's ultimate goal is to achieve equality and inclusion for persons with disabilities as full citizens, then a social model approach confronts structural and procedural barriers, which prevent full participation for persons living with a disability (Rioux & Valentine, 2005). It is imperative that the disability theory guiding the implementation of disability policy and access to policy funding programs view barrier free access to AAC technology as a basic human need for social inclusion prioritize barrier free access to AAC technology. A reorientation to the social model approach to policy and policy program access in Ontario would help both ADP and SEA to fulfill their mandates of providing a personalized device for basic needs (ADP, 2016, p. 11), and for SEA to provide accommodations to enable students with disabilities to participate in school and access the curriculum (SEA, 2018, p. 2).

Future Eye Gaze Technology Research

Identifying and removing systemic, financial, procedural, and training barriers to Eye Gaze technology is an important step towards making the technology available for individuals with disabilities. But, equally important to barrier free access to Eye Gaze technology is further academic scholarship that focuses on equitably supporting students once the technology is funded. Chapter 9 included suggestions of areas for future Eye Gaze technology research.

Crucial to future scholarship on Eye Gaze technology is that it is guided by a critical policy, social model and human rights approach; paradigms best positioned to ensure the

rights of individuals with disabilities rights are prioritized and protected. Future academic research is an opportunity to examine ways to make Eye Gaze technology easier to use, while continuing to identify and advocate for removing barriers to this technology.

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