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Eye Gaze Technology for Nonverbal Students with Cortical Visual Impairment

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Walden University
2020

Abstract

Eye Gaze Technology for Nonverbal Students with Cortical Visual Impairment

by

Hannah Sykes

MA, Wilmington University, 2010

BS, Holy Family University, 2006

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

The problem that this study addressed was the use of eye gaze technology (EGT) for nonverbal students with cortical visual impairment (CVI). There are no studies examining educators' viewpoints on the usefulness of EGT for communication and language development of nonverbal students with CVI. The purpose of this basic qualitative study was to explore what educators think about the usefulness of EGT on communication and language development for nonverbal students with CVI. The conceptual frameworks were Venkatesh unified theory of acceptance and use of technology and Dewey's pragmatism theory. The data were collected from six special education teachers and six speech therapists through semi structured, interviews. Data were hand coded to identify codes, patterns, and themes. The results of this study revealed that the participants had a positive attitude toward the use of EGT for nonverbal students with CVI because it improved the communication and language development, which, in turn, influenced students' motivation, self-efficacy, and academic performance. The participants also noted concerns with technical issues. The results of this study might affect social change for students with CVI as special education teachers and speech therapists could use EGT as an accommodation that allows the students to improve communication and develop language skills. Improved communication and language skills through the use of EGT gives students with CVI the tools that are needed to participate more fully and creates the potential for students to become full members of society.

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Dedication

In dedication to Jeffrey Billups who provided coffee, love, and support throughout this entire journey. He stood by me through health issues being supportive and encouraging through the tough times. To my children and their spouses who were always supportive. More importantly, to my grandchildren who are the future and will contribute greatness in their lifetime. Thank God, for guidance and healing so I could follow through and complete this study.

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I would like to thank Dr. Jennifer Courduff and Dr. Asoka Jayasena who worked diligently with me every step of the way. Dr. Courduff provided resources for networking and her positivity was contagious. There were many times I wanted to quit but her “Rock on!” comments kept me going. Dr. Jayasena was very critical of my work and I was unhappy about it most of the time before I realized she was building a scholar practitioner. I have grown tremendously throughout this journey and it would not be possible without Dr. Courduff and Dr. Jayasena. Thank you. You Rock!

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Chapter 1: Introduction

Eye-gaze, used to control a computer to communicate, is a fast-growing field that has promising implications for students with severe disabilities. Sievers, Trembath and Westerveld (2018) addressed the use of devices that assist students with physical or intellectual impairments in adapting to a standard classroom environment. Eye gaze technology is currently used to reduce limitations in education, play, and communication (Hemmingsson, Ahlsten, Wandin, Rytterstrom, & Borgestig, 2018). Researchers examined the effectiveness of eye gaze technology on assistive functions and remediation where the technologies range from simple tasks completion to complex educational software and speech recognition (Hemmingsson et al., 2018).

The problem was that there is a lack of information on the usefulness of eye gaze technology for nonverbal students with cortical visual impairment (CVI). Eye gaze tracking was used to assess how a student's visual behaviors change in response to the complexity of the alternative augmentative communication (AAC) display but there was very little research to support guiding or examining the value of it. More studies were needed to identify challenges and investigate accommodations to improve communication and language development. I addressed a gap in the literature by gaining a deeper understanding of educators' viewpoints on the usefulness of eye gaze technology for nonverbal students with CVI.

Sievers et al. (2018) addressed the use of devices that assist students with physical or intellectual impairments in adapting to a standard classroom environment. Researchers examined the effectiveness of eye gaze technology on assistive functions and remediation

where the technologies range from simple tasks completion to complex educational software and speech recognition (Hemmingsson et al., 2018). Pua, Ball, Adamson, Bowden, and Seal (2018) discussed the value of how visual processing differences need to be accommodated when students with severe disabilities use eye gaze technology (Townend, Marschik, Smeets, Van de Berg, Van den Berg & Curfs, 2015). Pua et al. (2018) reported that many students with moderate and severe disabilities are at high-risk for CVI and may even experience sensitivity to specific colors, brightness, and contrast. Eye gaze technology has been used to assess how a student's visual behaviors change in response to the complexity of the alternative augmentative communication (AAC) display, but there was very little research to support guiding or examining the value of it. More studies were needed to provide insight into challenges with visual processing differences and accommodations.

Background

What follows contains a brief summary of the use of eye gaze or eye tracking technologies to support and facilitate communicative skills and language development for nonverbal students with CVI. Eye-gaze technology used to control a computer to communicate is a fast-growing field that has promising implications for students with severe disabilities. Alzrayer, Banda, and Koul (2017) tested four nonverbal children in the classroom setting using Proloquo2Go software to determine the effectiveness of systemic instruction when teaching multistep requesting skills. The participants met the requirements of age range (8 to 10 years old), diagnosis of autism spectrum disorder, nonverbal and no prior history of using the iPad with Proloquo2Go. Alzrayer et al. (2017)

used a multi-probe design approach that included baseline sessions, intervention, and generalizations. Alzrayer et al. (2017) quantitative study revealed that all participants were successful at varying degrees with combining symbols to request preferred items and navigating across pages. The intervention was effective when using multistep requests with the iPad and the participants demonstrated the newly acquired skill of using icons to communicate. Some of the limitations of the study were that it included participants who were provided with verbal cues and participants who displayed challenging behaviors during the study. This supports my study as it emphasizes the need for improvement on communication skills and language development for nonverbal students with CVI using eye gaze technology.

Biggs, Carter, and Gilson (2018) examined several experimental research studies that involved aided AAC demonstration to endorse expressive communication from children with complex communication needs (CCNs). In their review, they addressed the instructive framework used to describe the main differences in aided AAC modeling and the interventions that had a positive impact on students with CCN. The findings revealed that modeling was a prominent aspect among the packaged interventions and students communicated frequently with increased vocabulary. This review supports the need for improvement in communicative skills for nonverbal students with cortical visual impairment, using eye gaze technology with a focus on linguistic targets.

Dindar, Korkiakangas, Laitila, and Karna (2017) discussed increased use of eye gaze technology to study gaze behaviors in individuals with autism spectrum disorders (ASDs). Dindar et al. focused on the gaze behaviors of three children, ages 11, 8 and 6

years old, diagnosed with ASD, using an educational game. Dindar et al. (2017) hypothesized that combining quantitative eye tracking with a qualitative video-based approach would provide an accurate measure of the usefulness of eye gaze technology in social situations. Data collected measured gaze habits away from the game and toward others in the room. The conversation analysis (CA) approach involved the collection of audio-visual recordings in a normal everyday school setting using the qualitative method. Dindar et al. (2017) confirmed that children with ASD are active social participants instead of passive observers. My research related to this study as it discussed the gaze behaviors of nonverbal children with disabilities as they communicated to play a video game. In my study, I addressed the gap of improving communication partner behaviors of nonverbal students with cortical visual impairment using eye gaze technology.

Lund, Quach, Weissling, McKelvey & Dietz, A. (2017) used a qualitative study to explore how speech-language pathologists (SLPs) who are also augmentative and alternative communication (AAC) specialists, assess one student with cerebral palsy and another student with ASD. The goal was to focus on the approach by clinicians when assessing children with developmental delays, and motor and social deficits. Participants of this study included eight English-speaking certified SLPs. The findings provided some similarities and emerging themes from the data within the area of focus, the method of assessment, parent education and evaluative criteria. The results of the study provided a formal assessment procedure for children with CCN.

Robillard, Roy-Charland & Cazabon (2018) studied the role cognition played within the directional progression of speech-generating devices (SGDs) amongst students

with ASD. The main goal was to study the role of cognitive factors on 20 students aged 5 to 20 years using the Leiter International Scale (LIS) and Working Memory Assessment (WMA). Students used the iPad 4 to complete navigational tasks, which revealed an important connection between the ability to navigate the SGD and cognitive ability. Robillard et al. (2018) further discovered that cognitive flexibility predicted the navigational skills of students with ASD. This relates to my research by supporting the need for accommodations for nonverbal students with cortical visual impairment who use eye gaze technology.

Rytterstrom, Borgestig & Hemmingsson (2016) studied the use of eye-gaze technology by nonverbal students with severe motor impairment from a teacher and parent perspective. Eleven different schools participated in the study where teachers and assistants were interviewed on students' abilities when using eye-gaze computers in an educational setting. Parents were also interviewed on the implementation and effectiveness of gaze technology in the home setting. From a teacher's perspective, the results of the study indicated that the effectiveness of the eye-gaze computer was based on the teacher understanding the relationship of what the student does with the computer and what they wish to express. The study proved that students with severe disabilities were able to control the computer and express themselves.

Problem Statement

The problem was that there is a lack of information on the usefulness of eye gaze technology for nonverbal students with CVI. There are five existing studies on the usefulness of eye gaze technology for nonverbal students (see: Alzrayer et al. 2017,

Biggs et al. 2018, Dindar et al 2017, Lund et al. 2017 & Rytterstrom et al. 2016). However, educators' viewpoints on the usefulness of eye gaze technology for nonverbal students with CVI need to be explored. Compelling empirical evidence exists to support eye gaze technology as an effective and innovative intervention to improve communication and language development for nonverbal students, but little was known about nonverbal students with CVI. Eye gaze technology is currently used to reduce limitations in education, play, and communication (Hemmingsson, Ahlsten, Wandin, Rytterström, & Borgestig, 2018). In this study, I addressed one of the missing gaps in the literature by gaining a deeper understanding of educators' viewpoints on the usefulness of eye gaze technology for nonverbal students with CVI. The research findings could promote positive social change as students with CVI are provided with opportunities to improve communication and language skills.

Purpose

The purpose of this basic qualitative study was to discover the viewpoints of educators on the usefulness of eye gaze technology for nonverbal students with CVI. Understanding educators' viewpoints on the usefulness of eye gaze technology for communication and language development for nonverbal students with CVI filled a gap in the literature. This could enable educators to identify challenges and investigate accommodations to improve communication skills. The research findings promote positive social change as students with CVI were provided with opportunities using eye gaze technology to improve communication and language skills using innovative technology.

Research Question(s)

I used the following questions to guide this study:

Main research question: What are the viewpoints of educators about the usefulness of eye gaze technology for communication and language development of nonverbal students with cortical visual impairment?

Subquestion 1: What are the opinions of educators about the ease of use and complexity related to the use of eye gaze technology for communication and language development of nonverbal students with cortical visual impairment?

Subquestion 2: How do educators feel about the social, cultural and interpersonal factors that may affect their use of eye gaze technology for communication and language development of nonverbal students with cortical visual impairment?

Subquestion 3: What challenges do educators face when using eye gaze technology for improving communication and language development of nonverbal students with cortical visual impairment?

Subquestion 4: What additional supports and facilitations do educators think would improve the usefulness of eye gaze technology for communication and language development of nonverbal students with cortical visual impairment?

Conceptual Framework

The conceptual framework for this basic qualitative study was based on the unified theory of acceptance and use of technology (UTAUT) model (Venkatesh et al., 2003), and John Dewey's (1938) pragmatism theory. This research study was designed upon a frame of the unique combination of these theories. I used a basic qualitative

design approach including recorded interviews to determine educators' viewpoints on the usefulness of eye gaze technology on language development and communication for nonverbal students with CVI.

UTAUT was a framework first introduced by Venkatesh, Morris, Davis, and Davis (2003) to provide researchers with more insight into the area of technology acceptance and adaptation. I used UTAUT (Venkatesh et al., 2003) to identify challenges and investigate accommodations to improve communication and language skills, together with John Dewey's (1938) pragmatism theory to design interview questions and guide data collection. Technology holds great promise for nonverbal students with CVI. Appropriate integration of eye gaze technology can potentially be a great equalizer in a special education classroom or during speech therapy sessions. I used these theories to examine educators' perceptions of eye gaze technology on communication and language development for nonverbal students with CVI. A more detailed analysis and guidance for this study to examine educators' viewpoints of eye gaze technology on language development and communication for nonverbal students with CVI will be provided in Chapters two and three.

Nature of the Study

I used a basic qualitative design to explore educators 'viewpoints on the usefulness of eye gaze technology for nonverbal students with CVI. Researchers use the basic qualitative research design to learn about the experiences of participants and the meaning they form from their experiences (Bradshaw, Atkinson & Doody, 2017). The purpose of this basic qualitative study was to discover the viewpoints of educators on the

usefulness of eye gaze technology for nonverbal students with CVI. I gathered the data through face-to-face semi structured interviews as they can result in the development of shared meaning and deeper understanding of the topic between the interviewer and the interviewees (Thorne, 2016).

I conducted a qualitative study with 12 participants. The interview questions were semi structured in nature and based on emerging themes that I found in my review of the literature. I examined the transcripts for themes and coded the initial data using common themes. I created a baseline to understand educators' viewpoints on improvement of communicative skills and language development of nonverbal students with cortical visual impairment using eye gaze technology. I cross-referenced the data to provide an in depth understanding of educators' viewpoints on the usefulness of eye gaze technology for nonverbal students with CVI.

Operational Definitions

Augmentative and Alternative Communication (AAC): Any form of communication other than oral speech (American Speech-Language-Hearing Association (ASHA, 2013). Communication which includes gestures, sign language, pictures, speech generating devices, or written communication (ASHA, 2013).

Autism Spectrum Disorder (ASD): ASD and autism are both general terms for disorders of brain development (American Psychiatric Association, 2013). These disorders vary in different degrees, with weaknesses in verbal and nonverbal communication, social interactions, and repetitive behaviors (American Psychiatric Association, 2013). Autism spectrum disorders were combined into one umbrella

diagnosis of ASD in the DSM-5 diagnostic manual (2013). In the past, autistic disorder, childhood disintegrative disorder, pervasive developmental disorder-not, otherwise specified (PDD-NOS) and Asperger syndrome were considered subtypes of autism. American Psychiatric Association, 2013).

Communication Disorder (CD): is an impairment of communication abilities, which may involve voice, speech, language, hearing, and/or cognition (Kishner, 2018)

Cortical Visual Impairment (CVI): is a prevalent cause of visual loss in children. It encompasses a wide range of visual disabilities from no light reception to normal visual acuity with cognitive visual dysfunction (Edmond & Faroozan, 2006)

Dysarthria: is a generic term for any speech disorder caused by an alteration of strength and control of speech muscles due to damage to the brain or nerves. Dysarthria may indicate increased posterior fossa pressure on the brainstem/medulla oblongata. Common causes of dysarthria include nervous system (neurological) disorders such as stroke, brain injury, brain tumors, and conditions that cause facial paralysis or tongue or throat muscle weakness (Mayo Clinic, Nd).

Eye Gaze Technology: is a communication and control system for people with complex physical disabilities. The eye gaze system is a direct-select vision-controlled communication and control system (Romano, 2014).

Functional Communication: Any behavior including personalized movements, gestures, verbalizations, signs, pictures, words, and augmentative and alternative communication devices that express an individual's needs, wants, feelings, and

preferences that others can understand regardless of context or familiarity with the speaker ASHA, 2013)

Assumptions

I assumed that the participants would be open and honest during the interview process and provide valid answers to the interview questions. I also assumed that the participants' in this study had positive experiences while using assistive technology with students. Since the nature of the studies (software, features of the devices, etc.) have changed over time, where various forms of AAC devices are used, I hoped that participants improved knowledge and skills with continuous professional development. I assumed the interviews would provide the best method for collecting data. Finally, I assumed that results provided potential insight to guide future research in the usefulness of eye gaze technology for communication and language development of nonverbal students with CVI.

Scope

The scope of this qualitative study extended to six speech therapists and six special education teachers who work with nonverbal students with CVI. Participants were teachers and therapists who have utilized eye gaze technology when working with nonverbal students with CVI in this voluntary study. I solicited participants by posting an invitation on social media platforms (Facebook, QIAT Listserv, Instagram, and LinkedIn). The purposeful sampling included those participants who met the criteria of being a teacher or speech therapist for at least 3 years and used eye gaze technology with nonverbal students who had CVI. I interviewed a list of the eligible participants based on the criteria. Afterwards, I accepted a random sample from those who applied to be participants. The process continued until data saturation was achieved.

Delimitations

I selected the participants through purposeful sampling and limited participation to those recruited through social media platforms. Due to the COVID-19 pandemic, reaching out to school districts for participants and conducting in person interviews was discouraged. Data of a personal nature irrelevant to the study was not be reviewed in order to make the selections. I eliminated personal bias through reflective journaling and using preplanned dialogue during the interview process. I refrained from making personal interpretations in the data since this was important to minimize bias. Interviews were conducted via Zoom and I took steps to protect the identity of participants. During the interview process, I refrained from making comments external to the realm of the

interview questions. I recorded all interview sessions to ensure accuracy and decrease bias.

Limitations

There are limitations in every study. One limitation in this study was that I selected participants through purposive sampling, and even though they volunteered, their commitment through the data collection process was hindered because of work obligations. Teachers and therapists were required to serve students remotely due to the pandemic COVID-19 and because this was a new process, educators were stressed. Because I collected data from participants recruited from my social media platforms such as LinkedIn, QIAT Listserv, Twitter, and Instagram, the invitation may not have reached participants who do not have access to these platforms. One strategy that I used to address this matter was to increase the transferability of the study through keeping reflective journals and memos as well as recording every step taken in the process of the research in order to help other researchers replicate it in different contexts.

Another factor that could have affected the outcome of my study was my bias. To avoid my bias affecting participants responses, I designed the interview questions precisely and allowed the participants to express their opinions freely. As the interviewer, I encouraged the participants to answer the questions honestly and elaborate when necessary. However, I was very cautious about allowing my personal opinions to interfere with their experiences and viewpoints.

Significance

This research was significant because it addressed a gap in the research literature by gaining a deeper understanding of educators' viewpoints on the usefulness of eye gaze technology for nonverbal students with CVI. Eye gaze tracking is used to assess how a student's visual behaviors change in response to the complexity of an augmentative communication device (Goldstein & Olswang, 2017). Chazin, Barton, Ledford, and Pokorski (2018) discussed planning instruction with the incorporation of eye gaze technology to promote engagement in activities for all students with diverse needs and varying abilities. Chazin et. al. (2018) stated that educators must consider presenting materials in such a way to ensure that all students have access to both core curriculum and expanded core curriculum activities. Most nonverbal students with autism are at high-risk for cortical visual impairment and may be sensitive to specific colors, brightness, contrast, complexity, novel vs familiar images, and movement (Kaldy et al., 2016). The findings of this study may promote positive social change by providing educators with additional tools to assist students with improvement in communication and language skills.

Summary

Chapter 1 began with an introduction to the study using the background to explain a brief summary of the use of eye gaze technologies to support and facilitate communication skills and language development of nonverbal students with CVI. I used a basic qualitative approach for this study, including recorded interviews to determine

educators' viewpoints on the usefulness of eye gaze technology of language development and communication for nonverbal students with CVI.

In the problem statement section, I explained the lack of information on the usefulness of eye gaze technology for nonverbal students with CVI and the need for accommodations. I designed the research questions to gather insight on the viewpoints of educators on the topic. The conceptual framework for this study was based on UTAUT (Venkatesh et al., 2003) and John Dewey's (1938) pragmatism theories. Chapter 2 contains the literature review, which I used to establish the gap in the research literature. The literature review consisted of peer-reviewed journal articles on subject matter related to the dissertation topic. All articles were published within the past 5 years at the writing of my study.

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Chapter 2: Literature Review

Introduction

In this study, I examined the lack of information on the usefulness of eye gaze technology for nonverbal students with CVI. The purpose of this basic qualitative study was to discover the viewpoints of educators on the usefulness of eye gaze technology for nonverbal students with CVI.

This chapter includes a literature review of related research and the conceptual framework that I used to investigate the topic, research questions, and the methodology that I used in this study. This study was conducted on the foundation of UTAUT (Venkatesh et al., 2003), and John Dewey's (1938) pragmatism theories. The unique combination of these theories were used to provide a frame upon which the study was designed. I used a basic qualitative design approach including recorded interviews to understand educators' viewpoints on the usefulness of eye gaze technology on language development and communication for nonverbal students with CVI. This chapter will include the literature search strategy, conceptual framework, a literature review related to key concepts and conclusion.

Literature Search Strategy

The research studies chosen for this literature review focused on visual processing differences and eye gaze technology. Eye gaze technology has been used in this way for many years in the research field, but it is only now educators are able to use this technology in the classroom (Dawson, 2006). Teachers and therapists can analyze students' eye gaze behaviors and provide objective and functional feedback. With the

right tools, educators can observe what students see, attend to and track on screen, what they notice and do not notice, what they prefer to look at and what sense they make of what they see. These are fundamental skills that most educators have not had the tools to assess or look at in detail before now. Such understanding of the most complex students could lead to changes in teaching practice and provide wider opportunities for students who are visually weak, to interact and engage.

Databases were used to conduct current and relevant research. I used Walden University's Library portal as one gateway for accessing Academic Search Complete, ERIC, Education Resource Complete, SAGE, ProQuest, the Dissertation and Theses databases, and the Thoreau Multiple Databases tool. Additionally, I used Google Scholar to cross-reference articles and search for more current literature. I also used online libraries to locate journals, texts, and articles pertaining to the viewpoints of educators on the usefulness of eye gaze technology for nonverbal students with CVI.

In order to establish and maintain academic rigor in the literature review, all articles were limited to those refereed or peer reviewed. Dawidowicz (2010) advised that researchers needed to construct a series of questions to find relevant articles and sufficiently narrow the topic. My exploration of research literature was guided by the research questions and relevance to the topic. During the literature search process, it was necessary to revise search terms and limiters to find current articles.

I used the following keywords in the literature review of this study: *complex communication needs (CCNs), augmentative and alternative communication (AAC), technology acceptance, Dewey pragmatism theory, unified theory of acceptance and use*

of technology (UTAUT), Brain-computer interfaces (BCIs), augmentative and alternative communication (AAC), communicative skills and language development, visual processing differences, cortical visual impairment (CVI), speech generating device (SGD), and *autism spectrum disorder (ASD).*

Conceptual Framework

The conceptual framework for this basic qualitative study was based on the UTAUT model (Venkatesh et al., 2003), and John Dewey's (1938) pragmatism theory. The unique combination of these theories were used to provide a frame upon which the study could be designed. I used a basic qualitative design approach including recorded interviews to determine educators' viewpoints on the usefulness of eye gaze technology for communication and language development of nonverbal students with CVI.

UTAUT was a framework first introduced by Venkatesh et al. (2003) to provide researchers with more insight into the area of technology acceptance and adaptation. I used UTAUT (Venkatesh et al., 2003) to identify challenges and investigate accommodations to improve communication and language skills, together with John Dewey's (1938) pragmatism theory, which I used to create the structure of the interview questions and data collection.

Technology holds promise for nonverbal students with CVI. Appropriate integration of eye gaze technology can potentially be an equalizer in a special education classroom or during speech therapy sessions. These theories offered insight and guidance for my study to examine educators' perceptions of eye gaze technology on communication and language development for nonverbal students with CVI.

Unified Theory of Acceptance and Use of Technology

The technology acceptance model (TAM) has its root in social psychology and information technology. TAM was introduced as one of the first theories to explore and understand the behavioral intentions of users (Davis, 1989). However, various technology acceptance models with some differences and similarities were identified addressing the needs and intentions of diverse users. Hence, a new unified model was proposed to merge with the existing models and theories of technology acceptance that can address the integration of various forms of technology in individuals' lives and their level of satisfaction with them at the same time. Therefore, the UTAUT model was introduced (Wingo, Ivankova, & Moss, 2017; Venkatesh et al., 2003).

The UTAUT model was constructed on eight leading theories in various disciplines (Venkatesh et al. 2003). UTAUT was a framework first introduced by Venkatesh et al. (2003) to provide researchers with more information on the area of technology acceptance and adaptation (Parameswarn et al., 2015). Venkatesh et al. (2003) focused on performance expectancy, effort expectancy, social influence, and facilitating conditions as the four core constructs determining behavior intention and use behavior derived from the empirical comparison of the eight prominent theories of the UTAUT model (Venkatesh et al., 2003) .

Individuals have different beliefs and levels of confidence when it comes to the utilization of various forms of technology. Some people believe that using technologies could do more harm than good, and others think that using technological tools could help them make advancements in their daily tasks (Parameswarn et al., 2015). Performance

expectancy (PE) is defined as the degree to which individuals assume that the utilization of technology might be productive and enhancing their daily lives (Venkatesh et al. 2003). Perceived usefulness, extrinsic motivation, job-fit, relative advantage, and outcome expectations are five significant elements derived from PE (Maruping, Bala, Venkatesh, & Brown, 2017). Different forms of technologies are continually being invented to maximize the job performances of employees and multi-million-dollar companies adopt technical tools to improve their organizations' environment and short and long-term turnovers (Carlson, Carlson, Zivnuska, Harris, & Harris, 2017). Accordingly, employees and employers should develop an understanding of whether using a particular technological tool could assist them in making professional advancement. Perceived usefulness (PU) refers to the degree to which individuals find technologies influential in achieving improvements and enhancing their job performance (Venkatesh et al. 2013). Extrinsic motivation in psychology is a form of motivation that arises from outside sources and external rewards aiming at helping an individual achieve an objective (Kuvaas, Buch, Weibel, Dysvik, & Nerstad, 2017). Extrinsic motivation in UTAUT (Venkatesh et al., 2003) is defined as a degree to which people are willing to use technology as an outside source because it might help them obtain a particularly desirable outcome (Kucukusta, Law, Besbes, & Legoherel, 2015). Even though using various forms of technologies can have a positive impact on individuals' personal, professional, educational, and social lives, it might also create some challenges and consequences (Abbasi, Tarhini, Elyas, & Shah, 2015). Outcome expectation is the last influential

factors in performance expectancy that is defined as the possible consequence that individuals may face when using technologies in their everyday lives (Workman, 2014).

Effort expectancy (EE) is another core construct of UTAUT (Venkatesh et al., 2003). EE is defined as the degree to which individuals can easily use various forms of technologies. Perceived ease of use, complexity, and ease of use are known as the key constructs of effort expectancy (Venkatesh et al. 2003). Most people are willing to utilize technology because they think that using different types of technologies could make the fulfillment of their daily tasks easier, and it can bring more practicality to their everyday lives. Perceived ease of use is the extent to which individuals believe that they can utilize technologies without facing difficulties (Venkatesh et al. 2003). However, some forms of technologies are more frequently used than others because they are less complicated in design and learning to work with them is easier. These types of technologies are known to have less complexity. Complexity is defined as the degree to which a technology is seen as difficult to use and understand (Venkatesh et al. 2003). . Even though some technologies are thought to be easy to use, when individuals try to actually utilize them in their real life, they face many challenges. Therefore, a distinction has to be made between perceived ease of use and ease of use. Ease of use is defined as the degree to which an innovation is simple to use, whereas perceived ease of use refers to an individual's speculations about the difficulty of utilizing a system. (Alalwan, Dwivedi, Rana, & Williams, 2016; Elkaseh, Wong, & Fung, 2016).

Social influence is another significant core construct of the UTAUT (Venkatesh et al., 2003). Social influence is the degree to which individuals' use of technology depends

on the perception of the people around them and their environment (Dwivedi et al., 2017). Subjective norm, social factors, and image are the three influential factors in the development of social influence as one of the UTAUT key constructs (Venkatesh et al. 2003). Individuals' actions and thoughts are affected by their society, environment, and people close to them. Therefore, some decisions that these individuals make even when it comes to using certain forms of technologies are influenced by the perceptions and judgments of others. A subjective norm is the understanding of individuals about the perception of people around them on technology use. Social factors are the social, cultural, and interpersonal agreements that individuals have formed with their peers on the utilization of technology in a specific social context (Venkatesh et al., 2014). Finally, the last key element of social influence is image that refers to the degree to which users believe that utilization of specific innovations might enhance their socio-cultural status (Cimperman, Brencic, & Turkman, 2016).

Facilitating condition is the last core construct of the UTAUT model (Venkatesh et al., 2003). Facilitating condition is the degree to which individuals who use certain technologies believe that a reliable and well-funded support system was established to help them with the technology (Venkatesh et al. 2003). . The findings suggest that the stronger the system of support or customer service of a particular form of technology is, there would be a higher chance that people may use this technology or find it easy to use (Venkatesh et al., 2014).. Perceived behavioral control, facilitating conditions, and compatibility are derived from facilitating conditions. Perceived behavioral control refers to the extent to which individuals think that the availability of recourses might help them

with the utilization of a certain technological tool (Venkatesh et al. 2003). . The other influential factor is facilitating conditions. Facilitating conditions are the environmental factors and behaviors that individuals think that might affect the accomplishment of their tasks and daily activities positively. Lastly, compatibility is the last conditional factor of the UTAUT (Venkatesh et al., 2003) and is the degree to which individuals find a system or a technological tool consistent with their social norms, values, and experiences (Maillet, Mathieu, & Sicotte, 2015).

The UTAUT theory (Venkatesh et al., 2003) focuses on examining the intentions of individuals to use a specific form of technology and identify influential factors on acceptance in different contexts in a real-world environment (Williams, Rana, & Dwivedi, 2015). Accordingly, a questionnaire was designed to measure individuals' technology acceptance through four constructs. The above-mentioned questionnaire also identified gender, age, experience, and voluntariness of use as mediating factors. The age and experience factors can moderate the connection between facilitating conditions and intention to use. When the experience of users increases, the relationship between facilitating conditions and intention to use also increases, and the relationship can be best found in the older ages.

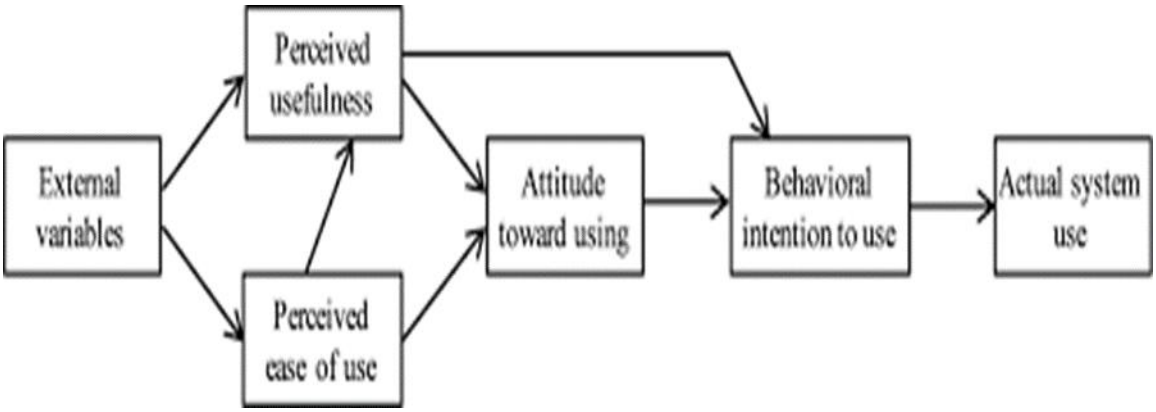
Celik, (2016); Bervell and Umar, (2017) and Jewer (2018) conducted studies focusing on the UTAUT model (Venkatesh et al., 2003) and various factors influencing it and stemming from it. Attitudes, anxiety, and self-efficacy as new mediating elements and age, experience, gender, and voluntariness as old parameters have been identified as the significant factors having an impact on the formation of the UTAUT model (Celik,

2016; Bervell, & Umar, 2017; Jewer, 2018). Researchers started conducting new research in academic environments and using various forms of technologies as educational tools utilizing the UTAUT model (Venkatesh et al., 2003). The results of these studies supported the findings of previous works about the effectiveness of performance expectancy, effort expectancy, facilitating conditions, and attitude toward using technology on technology acceptance among users as core constructs of the UTAUT (Chan, Gong, Xu, & Thong, 2008; Burton-Jones & Sraub, 2006). Gender and age were also confirmed as main moderating factors of the UTAUT model. The results of studies revealed that adolescents and youth showed more interest in utilizing different forms of technologies in their daily lives (Abu-Shanab & Pearson, 2009). Other findings suggested that performance expectancy positively affected men's willingness to use different types of technology in comparison to women (Afonso, Roldan Salgueiro, Sanchez Franco, & González, 2012). Their discoveries also suggested that some other factors such as motivation might have an influence on individuals' intentions of technology use.

Further studies resulted in looking for extensions to the UTAUT model and suggested that even though the UTAUT model can be influential in educational environments, certain modifications have to be made to it to make it appropriately fit educational settings (Brown & Venkatesh, 2005; Bagozzi, 2007).

Figure 1

The UTAUT Model



Modified from Wingo, N. P., Ivankova, N. V., & Moss, J. A. (2017) Faculty perceptions about teaching online: exploring the literature using the technology acceptance model as an organizing framework, Online Learning 21(1), 15-35. doi: 10.10.24059/olj. v21i1.761

Dewey's Pragmatism Theory

Dewey (1938) believed in pragmatic philosophy where human beings adapt to their environment and their actions are a direct result of that adaptation. Therefore, the experiences of human beings within their environments are the basis of Dewey's pragmatic and constructivist theories. According to Dewey, human experiences within an environment can change the course of action and the effects of various factors within the environment which can directly influence outcomes (Dewey, 1938). Human activities within an environment can bring about a reaction that is either favorable or unfavorable creating the theory that life goes on through interaction with the environment. In Dewey's pragmatic, cognitive thought processes he believed that environmental experiences create a basis for, and influence, learning outcomes.

Literature Review and Related Concepts

Abilities and Types of Communication

Typically, developing children have the ability to concurrently learn multiple communication skills (Chazin, 2018) Such skills include joint attention and social interaction. However, children with ASD do not have this ability, and are known to develop such skills sequentially (Chazin, 2018). They often make their intentions known with motions of their hands and body to compensate for their inadequacies in other forms of communication such as eye contact and gestures (Chazin, 2018). Joint attention skills should be promoted in children with ASD if they are to reach their full potential in relation to social interaction skills (Biggs, 2018). Limited intentionality is a critical deficit in children with ASD (Chazin, 2018). Alzrayer (2017) found that children with ASD

exhibited lower levels of intentional communication compared to their typically developing counterparts. The types of communications that were examined included gestures and eye gaze. Similarly, Dindar (2017) found deficits in joint attention skills in children with ASD compared to their typically developing peers. Konst et al. (2014) examined nonverbal communication skills in infants and toddlers with both comorbid ASD and cerebral palsy, and infants and toddlers with Down syndrome or cerebral palsy alone. The study found that children with both cerebral palsy and ASD had more deficits in nonverbal communication skills than those with either cerebral palsy or Down syndrome alone.

In their longitudinal study with twelve 3-6-year-old preschool children with ASD, Kaldy (2016) investigated deficits in relation to difficulties with making nonverbal expressions such as imitations, postures, gestures, facial expressions, and eye contact. They found that only two children had adequate ability to make eye contact, another five children had limited ability, while the other five had no ability to make eye contact. Similarly, the children had difficulty in making facial expressions and expression of gestures. Only two children had adequate ability to make facial expressions, while the rest either had limited ability or no ability at all. With regard to expression of gestures, only one child had adequate ability; the majority of the remainder had no ability at all. These results are not surprising because parents of children with ASD are often able to detect what may be regarded as ASD specific symptoms as early as the first year. These symptoms include inability to make facial expressions, and retention or initiation of eye contact in their children.

Nonverbal Nonverbal Communication and ASD

The area of nonverbal communication in children with ASD is an important research subject especially in the area of special education (Robillard, 2018). The shifting of another person's gaze to an object, thereby making a connection that shifting of the gaze to the object is intended to convey meaning is incredible. In typically developing children, the development of nonverbal attention is evident at 9-12 months of age, but this same behavior is severely lacking in children with ASD (Pau, 2018). Sievers (2018) used mechanical toys as a prompt for children with ASD to follow an adult's gaze. After a number of training sessions with three 4-year old children with ASD, the mechanical prompt was deliberately delayed in a progressive manner and eventually done away with altogether after the children had successfully learned gaze following and even located objects with the gaze alone. Success in delayed cue training meant that the stimulus to shift the gaze was switched from the cue of the mechanical toy to the cue from the adult's shifting gaze.

Chazin (2018) similarly argued that children with ASD who are nonverbal share experiences: gestures such as showing, coordinated looks between people and objects, and pointing. There are also nonverbal gestures for requesting instead of sharing, such as pointing, offering, and reaching to solicit help. Nevertheless, such deficiencies are not uniform in this constituency of children. There are research studies that have found similarities between children with ASD and their typically developing peers in relation to how they make requests (Hemmingsson, 2018), but other studies show deficits among children with ASD compared to their typically developing peers (Robillard, 2018). The

divergence of opinion noted above thus formed the reason for a study to investigate when nonverbal skills emerge in children with ASD (12-60 months of age) and in typically developing children of the same age (Sievers, 2017). Interestingly, requesting skills in both children with ASD and typically developing children emerged at the same time, but the sequence with which joint attention skills emerged in children with ASD deviated from the normative model, especially response skills in showing and following gaze. These results resemble those of Robillard (2018) who found lower levels of intentional communication in children with ASD compared to their typically developing counterparts.

Assessment of the Nonverbal Communication Profile

Lund (2017) used a qualitative study to explore how speech-language pathologists (SLPs) who are also augmentative and alternative communication (AAC) specialists, assess one student with cerebral palsy and another student with autism spectrum disorder (ASD). The goal was to focus on the approach by clinicians when assessing children with developmental delays, motor and social deficits. Participants of this study included eight English-speaking certified SLPs. The findings provided some similarities and emerging themes from the data within the area of focus, the method of assessment, parent education and evaluative criteria. Sievers (2018) examined nonverbal communication skills in children with ASD. There were 23 children with ASD with a chronological age (CA) of 32.79 months and another 22 typically developing children with a mental age (MA) of 18-20 months. There was also a group of 23 children whose mental and chronological age was matched; all of them had developmental delay. Another group of participants

were 22 typically developing 13-15-month-old toddlers and infants. Nonverbal communication skills including social interaction, requesting, and joint attention were assessed for developmental timelines.

The nonverbal communication profile of the children with ASD was different from children in the other groups. The children with ASD showed deviant patterns in how they used nonverbal communication. The variation could not be attributed to their mental ages. Joint attention deficits in children with ASD were higher when compared to the delayed comparison group as well as the typically developing infants and toddlers. In addition, a dyadic interaction such as turn taking skill was found to be impaired among the children with ASD (Sievers, 2018).

Language Development

The ability to use language for communication is critical for developmental, academic, and social success for young children. Yew and O'Kearney (2015) stated that when preschool-aged children exhibit delays in language, they are more likely to exhibit behavioral challenges, and difficulties involving academic work, and social exchanges later in life. Furthermore, their ability to use verbal language contributes to their early reading, writing and mathematics skill development (Yew & O'Kearney, 2015). Yew and O'Kearney (2015) also revealed that when a child is referred for an autism diagnosis, parents often express their concerns with speech delays and communication, and express that they would like their child to verbally communicate. Hence, exploring the specific interventions that promote expressive, verbal

communication for preschool children with autism is essential (Yew & O'Kearney, 2015).

For most individuals, verbal communication is the most efficient and most widely understood way to communicate. The speaker does not need to rely on pictures, symbols, or gestures to supplement their communication, and it is considered more efficient than other pre-verbal or non-speech communication (Romski, Seycik, Barton-Hulsey and Whitmore, 2015). Under the Verbal Behavior approach, children can learn how to make a request using a variety of different tools or AAC aids, e.g. gestures, sign language, pictures, Speech Generated Devices (SGD), or iPads. AAC aids and tools are effective for increasing functional communication (Brady, Bruce, Goldman, Erickson, Mineo, Ogletree & Wilkinson, 2016).

However, the literature provides inconsistent evidence concerning the development of verbal communication while using AAC for preschool-aged children with autism (Ganz, 2014). Further, compared to interventions that directly target verbal communication, speech takes longer to develop when using an AAC intervention (Romski et al., 2015). Looking specifically at the use of the Picture Exchange Communication System (PECS), preschool participants did not begin to use verbal communication until the fourth PECS phase, after 20 or more intervention sessions (Brady et al., 2016).

Principles of Cortical Visual Impairment (CVI)

Children with CVI and CCN, complex communication needs, are at high risk for cognitive, sensory motor, social, language, literacy, communication, and participation

(Hadid, 2017). They need targeted interventions to develop functional vision, engage in meaningful interactions, and have consistent learning opportunities. Nonverbal children with CVI need access to a range of assisted AAC strategies, tools and technologies in order to participate actively in family, school, and community, and communicate effectively (Hadid, 2017).

Challenges

After examining the literature, there are questions related to educators' ability meeting the unique needs of children with CVI. The concerns include communications specialist willingness to make accommodations for students with CVI. If educators do not collaborate, a student with CVI who uses AAC may have difficulty gaining access to this critical thing of language communication and learning, their education. In addition, there is a chance that many of the students who have CVI in classrooms today may not be diagnosed with the CVI. This means that AAC professionals have to be particularly cognizant of the possibility that the child may have CVI and accommodate accordingly.

CVI and AAC

Educators should be aware of how CVI affects development, learning, communication, and participation across domains (Bracher & Matta, 2017). A student's functional vision assessment is linked to the ability to learn. It is critical to understand that accommodation strategies should be based on valid and reliable assessment data and longitudinal measures of outcomes for those intervention strategies that support children with CVI who use AAC. They are not separate entities in this process.

Meeting the Needs

The main purpose of my study is to increase availability to relevant content for communication, leisure and learning in a way that is time effective, reasonably easy technically, and that helps the child to learn and develop (Cudd, 2017). Gaze controlled technology is perceived as a beneficial tool for children with severe multiple disabilities. The children may learn to participate in activities not previously possible, and research indicates that the opportunity to experience new things and discover new abilities lead to increased possibilities to learn and develop (Chazin, 2018). Cudd (2017) stated that it has also been proven that gaze controlled technology can provide children with language to communicate. However, the work that needs to be put in to make gaze control usable in an efficient way is perceived as difficult and time-consuming by both parents and professionals (Cudd, 2017).

Robillard (2018) discovered that in order to meet the needs of as many children as possible, software grids were developed for nine different combination of needs. This solution was beneficial because a caregiver or a professional could easily select the content suited for a particular child. To ensure maximum outcome of these target profiles, it is of great importance that the profiles are detailed, yet easy to understand (Robillard, 2018). Even if the project aims to provide pedagogical support in those software grids, it will be too much of a challenge to cater to every curriculum. The project has instead created templates for teachers to use in their lessons, in the hope of facilitating the everyday pedagogical tasks (Sievers, 2017).

Evidence-Based Interventions and Practices

Dukhovny and Kelly, (2015) revealed that the problem is to know how visual therapies can target residual visual abilities when neurophysiological correlates are so divergent between patients. A review explained how combined rehabilitation tools using visual training can enhance blindsight by targeting an inefficient global framework (Dukhovny & Kelly, 2015). Blindsight, defined as an unconscious residual visual ability, can come with or without awareness, but except in rare cases, does not elicit visual awareness (Hadid, 2017). The reason why some patients may not present residual vision or awareness could include an inability to allocate sufficient attention to the information presented in the blind hemi field and to access their own state of consciousness. By understanding blind sight within the global workspace theory (Hadid, 2017), discussed the lack of visual awareness as a lack of neuronal synchrony and global availability between inefficient workspaces of attention, perception and consciousness that can be targeted and optimized with rehabilitation tools. Therefore, it would be possible to pass from a state of no awareness to a state of awareness to a state of visual awareness (alternative visual abilities) by moving the thresholds of attention, perception and consciousness via stimulation of the pathways and creating connections between different processors (Hadid, 2017). By doing so, we could target higher visual areas, induce loops with higher cognitive areas, synchronization of neuronal activity and global availability, and potentially it would lead to visual consciousness (Hadid, 2017).

Augmentative and Alternative Communication

Pitt (2018) stated that Brain-Computer Interfaces (BCIs) could provide access to augmentative and alternative communication (AAC) devices using neurological activity alone without voluntary movements. As with traditional AAC access methods, BCI performance may be influenced by the cognitive-sensory-motor and motor imagery profiles of those who use these devices (Brumberg, Mantie-Kozlowski & Burnison, 2018).

Brumberg et al (2018) proposed a person-centered, feature-matching framework consistent with clinical AAC best practices to ensure selection of the most appropriate BCI technology to meet individuals' communication needs. The proposed feature matching procedure was based on the current state of the art in BCI technology and published reports on cognitive, sensory, motor, and motor imagery factors important for successful operation of BCI devices (Brumberg et al., 2018). This resulted in a successful selection of BCI for accessing AAC. The set of features that support each BCI option are discussed in a hypothetical case format to model possible transition of BCI research from the laboratory into clinical AAC applications (Brumberg et al., 2018). This procedure is an initial step toward consideration of feature matching assessment for the full range of BCI devices. Future investigations are needed to fully examine how person-centered factors influence BCI performance across devices (Pitt, 2018).

Alzrayer, Banda & Koul (2017) used a multi-probe design approach that included a baseline sessions, intervention and generalizations. This quantitative study revealed that all participants were successful at varying degrees with combining symbols to request

preferred items and navigating across pages. The intervention was effective when using multistep requests with the iPad and the participants demonstrated the newly acquired skill of using icons to communicate. Some of the limitations with this study included participants who were provided with verbal cues and participants who displayed challenging behaviors during the study. My study emphasizes the need for improvement on communicative skills for nonverbal students with cortical visual impairment using eye gaze technology.

Biggs, Carter and Gilson (2018) examined several experimental research studies that involved aided alternative augmentative communication (AAC) demonstration to endorse expressive communication from children with complex communication needs (CCN). This review addressed the instructive framework used to describe the main differences in aided AAC modeling and the interventions that had a positive impact on students with CCN. The findings revealed that modeling was a prominent aspect amongst the packaged interventions and students communicated frequently with increased vocabulary. My research will involve supporting the need for improvement on communicative skills for nonverbal students with cortical visual impairment, using eye gaze technology with a focus on linguistic targets.

Dindar, Korkiakangas, Laitila and Karna (2017) discussed increased use of eye tracking technology to study gaze behaviors in individuals with autism spectrum disorders (ASD). The research study focused on the gaze behaviors of three children, ages eleven, eight and six, diagnosed with ASD, using an educational game. Dindar et al. (2017) hypothesized that combining quantitative eye tracking with a qualitative video-

based approach will provide an accurate measure of the usefulness of eye gaze technology in social situations. Data collected measured gaze habits away from the game and toward others in the room.

The conversation analysis (CA) approach that involved the collection of audio-visual recordings in a normal everyday school setting was analyzed using the qualitative method. Dindar et al. (2017) confirmed that children with ASD are active social participants instead of passive observers. This relates to my research by discussing the gaze behaviors of nonverbal children with disabilities as they communicated to play a video game. The gap of improving communication partner behaviors of nonverbal students with cortical visual impairment using eye gaze technology will be addressed with my research study.

Lund, Quach, Weissling, McKelvey & Dietz, A. (2017) used a qualitative study to explore how SLPs who are also augmentative and alternative communication (AAC) specialists, assess one student with cerebral palsy and another student with autism spectrum disorder (ASD). The goal was to focus on the approach by clinicians when assessing children with developmental delays, motor and social deficits. Participants of this study included eight English-speaking certified SLPs. The findings provided some similarities and emerging themes from the data within the area of focus, the method of assessment, parent education and evaluative criteria. In the end, the results of the study provided a formal assessment procedure for children with CCN. This relates to my study because it was based on therapists' perceptions.

Robillard, Roy-Charland & Cazabon (2018) studied the role cognition played within the directional progression of speech-generating devices (SGD) amongst students with autism spectrum disorders (ASD). The main goal was to study the role of cognitive factors on 20 students ages 5 to 20 years old using the Leiter International Scale (LIS) and Working Memory Assessment (WMA). The iPad 4 was also used to complete navigational tasks, which revealed an important connection between the ability to navigate the SGD and cognitive ability. Robillard et al. (2018) further discovered that cognitive flexibility predicted the navigational skills of students with ASD. This relates to my research by supporting the need for accommodations for nonverbal students with cortical visual impairment who use eye gaze technology.

Rytterstrom, Borgestig & Hemmingsson (2016) studied the use of eye-gaze technology by nonverbal students with severe motor impairment from a teacher and parent perspective. Eleven different schools participated in the study where teachers and assistants were interviewed on students' abilities when using eye-gaze computers in an educational setting. Parents were also interviewed on the implementation and effectiveness of gaze technology in the home setting. From a teacher's perspective, the results of the study indicated that the effectiveness of the eye-gaze computer was based on the teacher understanding the relationship of what the student does with the computer and what they wish to express. The study proved that students with severe disabilities were able to control the computer and express themselves. My study will explore accommodations for nonverbal students with cortical visual impairment who use eye gaze technology.

Gaps in the Literature

Based on the review of the literature, it was discovered that there were discrepancies on the ability of visual therapies targeting residual visual abilities. Communication deficits are a defining feature of Autism Spectrum Disorder (ASD), manifested during social interactions (Wadge, 2019). Previous studies investigating communicative deficits have largely focused on the perceptual biases, social motivation, cognitive flexibility, or mentalizing abilities of isolated individuals. Wadge (2019) stated that by embedding autistic individuals in live nonverbal interactions, we characterized a novel cause for their communication deficits. Future studies should analyze the tools and indicators regarding the assessment process of assistive technologies for nonverbal students with CVI.

After examining the literature, there was very little evidence supporting educators' viewpoints related to the usefulness of eye gaze technology for nonverbal students with CVI. There were some barriers identified in the current research that affected implementation of eye gaze technology. Understanding educators' viewpoints on the usefulness of eye gaze technology for communication and language development for nonverbal students with CVI filled a gap in the research literature. This could enable educators to identify challenges and investigate accommodations to improve communication skills. The research findings could promote positive social change as students with CVI are provided with opportunities using eye gaze technology to improve communication and language skills using innovative technology. As a result, this topic was explored further.

Summary and Conclusions

The literature review in chapter two presented studies related to the use of eye gaze technology for communication and language development of students with CVI. Even though the equipment is costly, school districts are able to solicit funds to offset the high cost. Eye gaze technology is used for educational purposes, communication and language development. There are only a few studies that researched the use of eye gaze technology linked to CVI for communications and no studies exploring educator's perception on the usefulness of eye gaze technology with communication and language development for nonverbal students with CVI. The methodology for this study will be presented in chapter three. Research design and questions, ethical procedures, the role of the researcher, data collection and analysis will be discussed.

Chapter 3: Research Method

Introduction

The purpose of this basic qualitative study was to discover the viewpoints of educators on the usefulness of eye gaze technology for nonverbal students with CVI. Understanding educators' viewpoints on the usefulness of eye gaze technology for communication and language development of nonverbal students with CVI filled a gap in the literature and research. This may enable educators to identify challenges and investigate accommodations to improve communication and language skills. The research findings could promote positive social change as students with CVI are provided with opportunities using eye gaze technology to improve communication and language development using innovative technology.

I selected a basic qualitative design to find answers to the research question, subquestions, and to collect data (Merriam & Tisdell. In this chapter, I will present one main research questions and four subquestions. The research design and a rationale on why this approach was selected will be discussed. The role of the researcher and the strategies I utilized to face any possible biases and challenges during all stages were addressed. In the methodology section, the participant recruitment procedure, the instruments used in the research and, the interview questions as well as the data collection procedure and analysis plan will be presented. Finally, the credibility, transferability, dependability, and conformity of the research together with the ethical procedures of the study, will be discussed.

This section includes the rationale for the selection of participants for the study, instrumentation, procedures for the recruitment of participants, and issues of trustworthiness. Each section includes supporting information in sufficient detail to provide the reader with the procedures and processes necessary to recreate or extend the study. The section will conclude with a comprehensive data analysis plan.

Research Design and Rationale

In order to gain a deeper understanding of what educators' viewpoints are about the usefulness of eye gaze technology on communication and language development for nonverbal students with cortical visual impairment, one main research question and four subquestions were designed.

Main research question: What are the viewpoints of educators about the usefulness of eye gaze technology for communication and language development of nonverbal students with cortical visual impairment?

Subquestion 1: What are the opinions of educators about the ease of use and complexity related to the use of eye gaze technology for communication and language development of nonverbal students with cortical visual impairment?

Subquestion 2: How do educators feel about the social, cultural and interpersonal factors that may affect their use of eye gaze technology for communication and language development of nonverbal students with cortical visual impairment?

Subquestion 3: What challenges do educators face when using eye gaze technology for improving communication and language development of nonverbal students with cortical visual impairment?

Sub question 4: What additional supports and facilitations do educators think would improve the usefulness of eye gaze technology for communication and language development of nonverbal students with cortical visual impairment?

The central concepts for this study include Dewey's (1938) theories of pragmatism and the UTAUT model (Venkatesh et al., 2003). The foundation of this qualitative study was developed on the UTAUT model (Venkatesh et al., 2003), and John Dewey's (1938) pragmatism theory, to find answers to the research question and learn about participants' ideas. I also used AAC as a more general concept that can assist in gaining more knowledge about what educators think about the utilization of eye gaze technology for communication and language development.

According to the purpose of the study and the questions, I sought answers by selecting a research design that could have been quantitative, qualitative or mixed methods. In a quantitative design, researchers formulate hypotheses and assumptions based on their prior knowledge and expectations of the result by designing every step carefully in advance (McCusker & Gunaydin, 2015). In a qualitative design, researchers have no prior knowledge about the topic and they aim to gain a deeper understanding about individuals' experiences and perceptions utilizing a more flexible design and paying more attention to contextual details (Patton, 2015). The purpose of this study was to find out the views of educators about the usefulness of eye gaze technology on communication and language development for nonverbal students with cortical visual impairment. I have no prior knowledge of what their opinions and the result of study might be. Therefore, I intend to select a qualitative design to be able to learn more about

educators' personal feelings, and thoughts about eye gaze technology on communication and language development of nonverbal students with CVI. Mixed methods, which uses a combination of both quantitative and qualitative methods, was not be suitable for my study because my goal is to gather details about the feelings and viewpoints of the participants. Hence the decision to use a generic qualitative framework.

The basic qualitative research design helps the researcher to learn more about what the participants think (Merriam & Tisdell, 2015). Throughout the meaning-making process of their experiences, participants become able to express their beliefs, opinions, and feelings toward the subject being studied (Patton, 2015). Merriam and Tisdell (2015) stated that basic qualitative design best fits educational research and help the researchers find in-depth information regarding the most effective teaching and learning processes. In this study I provided descriptive insight about participants' ideas and viewpoints on the utilization of eye gaze technology that is used to design an innovative pedagogy. Hence, a qualitative basic design was utilized as the most appropriate research design.

Role of the Researcher

The most significant instrument in a qualitative study is the researcher who must gain meaningful and authentic data that results in conducting valid and reliable research (Marshall & Rossman, 2015). My role as the researcher was to collect data, analyze, and synthesize it to find appropriate answers to research questions as well as reporting the outcome precisely and with no bias. Another critical role for me as the researcher in this study was to provide participants with consent forms and ensure that they were willing to

take part in the study. I also established a good rapport with them by creating a friendly, respectful, and a safe environment.

My responsibility as the qualitative researcher was to address the gap in the literature through gaining in-depth understanding of the topic. The findings of this study assisted me with fulfilling my duties as a researcher and filling a part of the gap in literature on the topic of the usefulness of eye gaze technology on communication and language development for nonverbal students with CVI. I provided other researchers and educators with more in-depth knowledge on the utilization of eye gaze technology as an effective tool. This can lead to innovative techniques and strategies that could accommodate visual processing differences. However, my enthusiasm for using eye gaze technology as an effective communication tool and my personal belief that eye gaze technology can improve communication and language development, could lead to bias. In order to control my biases as the researcher, I kept reflective journals and made precise notes during the entire process.

Participation Selection Logic

Participants of this study were six speech therapists and six special education teachers recruited via an invitation posted on social media platforms (Facebook, QIAT Listserv, Instagram, and LinkedIn). The guidelines for each of these platforms were adhered to when posting the invitation. Once the participants responded to the invitation, the ethical procedure of verifying eligibility through asking questions related to the specific population and providing a consent form was required. The criteria for participant selection were that the participants were currently using eye gaze technology

with nonverbal students who have CVI and the participants had 3 years prior experience working with students who use eye gaze technology. The determination of selected participants for the initial interviews was based upon the first 12 eligible participants to respond to the invitation. This correlates to Patton (2015), who suggested that saturation can occur between six and 12 participants.

In order to ensure that all the participants met the criteria of participation of this study, I contacted the possible candidates prior to the interview and informally inquired about their viewpoints of using eye gaze technology with nonverbal students who have CVI. Participants responded to the social media invitation and the following preliminary questions confirmed eligibility:

- How long have you been teaching/providing speech therapy to students?
- Do you work with nonverbal students who use eye gaze technology?
- How many years of experience do you have working with students who use eye gaze technology?

Participants met all criteria previously stated and completed a signed consent form. The interviews began with the first 12 participants whose consent forms reached me. Another four participants were on a reserve list to be interviewed if saturation did not occur during the first 12 interviews. If saturation had not been achieved after exhausting the 12 interviews, a second round of interviews would have been initiated focusing on what was missing after a careful analysis of the collected information.

I conducted interviews via Zoom due to COVID-19 and the current social distancing situation. Each interview was recorded and transcribed. The findings of Hagaman and Amber Wutich (2017) together with the discoveries of Guest, Bunce, and Johnson (2006), suggested that the first stage of identification of themes usually emerge within the first six interviews and the second and third stages of theme identification occur between the first 10 to 16 interviews. The authors have concluded that data saturation usually takes place within six to 12 interviews. Accordingly, a sample size of eight to 12 can be sufficient before the researcher arrives at the point of saturation of data (Pietkiewicz & Smith, 2014; Patton, 2015). In this study, I achieved a wide range of participants' viewpoints and reflections on the utilization of eye gaze technology as an effective tool for communication and language development for nonverbal students with CVI. Palinkas, Horwitz, Green, Wisdom, Duan, and Hoagwood (2015) stated that data saturation occurs when the acquired patterns and themes from the collected data become redundant, and that is when no further data is needed to be gathered. After categorizing and analyzing the data acquired from 12 participants, I believed that saturation occurred. The selected participants were from two different categories. There was no repetitive pattern and no new themes emerged. I understood that saturation had taken place and no more data needed to be collected.

Instrumentation

The instrumentation for my study was semi structured interviews that were directly related to the research question and sub questions. I used UTAUT (Venkatesh et al., 2003) to identify challenges and investigate accommodations to improve

communication and language skills, together with John Dewey's (1938) pragmatism theory, which provided the structure to guide the interview questions and data collection. In this study, I aimed to elicit information about the ideas and viewpoints of educators on the utilization of eye gaze technology as a communication tool when working with nonverbal students with CVI, through the designed interview questions. The background and summary questions included was used to introduce and conclude the interview. They were general inquiry questions to introduce the study and to help the participant feel more comfortable. I asked the participants about how they feel and what their thoughts were on using eye gaze technology with nonverbal students and their perceptions about the effectiveness of the utilization of eye gaze technology in their communicative process. The primary purpose was to ask questions that would help me to collect data about the usefulness of eye gaze technology on communication and language development for nonverbal students with CVI.

I collected data through face-to-face semi structured interviews via Zoom. This resulted in the development of shared meaning and deeper understanding of the topic between the interviewer and the interviewees. The interview questions were open-ended and aligned with the conceptual frameworks. It was not necessary to add questions related subjects and themes that emerged during the interview. Some of the advantages of conducting face-to-face interviews are to enable the interviewer to establish a better rapport with the participants and consequently, ask for further information and elicit more accurate and truthful data (Patton, 2015; Whiting, 2008). I interviewed the participants individually via Zoom and all the interviews were recorded. The data were coded,

categorized in themes, and analyzed. I kept reflective journals and took notes throughout all stages of design and data collection to ensure that my biases did not affect the results.

Interview Questions

In order to gain a deeper understanding of what educators think about the usefulness of eye gaze technology on communication and language development for nonverbal students with cortical visual impairment, 23 interview questions were designed that aligned with the theoretical frameworks and the research questions of this study. The designed preliminary interview questions and their alignment with the theoretical frameworks, research questions, subquestions, and interview questions. The background and summary questions were used to introduce and conclude the interviews. There were general inquiry questions to introduce the study and to help the participant feel more comfortable.

The background and summary questions were used to introduce and conclude the interviews. The pragmatism aspect of the questions were designed from readings about the theorist, Dewey, and were derived to gain insight into the perceptions of the participants (Dewey, 1938). The UTAUT aspect of the questions were based on information on the area of technology acceptance and adaptation (Venkatesh et al., 2003). These questions were not copied from any one source but was created by the researcher from a culmination of readings and research. The interview process provided an opportunity for conversational questioning which assisted with probing more deeply into the participants' perceptions. Rubin and Rubin (2012) indicated that conducting interviews can provide a deeper understanding and shared meaning about a topic. Patton

(2015) also suggested that face-to-face interviews provide opportunities to build a better rapport with the participants. An online platform with a face-to-face video component was used to help create a more comfortable environment for participants and build opportunities for a more in-depth interview experience. The close correlation of each interview question with the conceptual framework and wording of the corresponding research question confirmed adequacy of data collection.

The following is a summary of the interview questions and the connection to each research question:

- Interview questions 1-7 correlate to RQ1 (Pragmatism and UTAUT)
- Interview questions 8-10 correlate to SQ1 (Pragmatism and UTAUT)
- Interview questions 11-15 correlate to SQ2 (Pragmatism and UTAUT)
- Interview questions 16-20 correlate to SQ3 (Pragmatism and UTAUT)
- Interview questions 21-23 correlate to SQ4 (Pragmatism and UTAUT)

Table 1

Research and Interview Questions, Data Needs and Sources Alignment

Conceptual Framework/Theorists	**Research Question**	**Interview Question (IQ)/Data Needs**	**Data Sources**
Dewey-Pragmatism UTAUT	RQ1: Viewpoints of educators, usefulness of eye gaze technology for communication and	IQ1.Examples of educators' opinion on the use of eye gaze technology.	Interview and Probing Question Responses

	language development	IQ2. Examples of participant familiarity with all aspects of eye gaze technology IQ3. Examples of educator comparing other technologies to eye gaze technology for communication	
Dewey-Pragmatism UTAUT	RQ1: Viewpoints of educators, usefulness of eye gaze technology for communication and language development	IQ 4. Examples of educator comparing other technologies to eye gaze technology for language development IQ 5. Examples of changes noted while using eye gaze technology for communication in	Interview and Probing Question Responses

		teaching/providing therapy to students IQ 6. Examples of changes noted while using eye gaze technology for language development in teaching/providing therapy to students IQ 7. Examples of changes noted since education went online due to COVID-19.	
Dewey-Pragmatism UTAUT	SQ1: Opinions of educators about the ease of use, complexity related to the use of eye gaze technology for communication and language	IQ8. Examples of students able to use eye gaze technology to meet their needs, express their feelings, interact with adults and peers	Interview and Probing Question Responses

	development of nonverbal students with CVI	IQ9. Examples of changes in instructional practice as eye gaze technology is integrated in instruction/therapy session. IQ10. Examples of the need for acquiring additional knowledge and skills to better implement eye gaze technology	
Dewey-Pragmatism UTAUT	SQ2: Social, cultural and interpersonal factors that affect the use of eye gaze technology for communication and language development of	IQ11. Examples of student motivation and engagement as eye gaze technology is used for communication IQ12. Examples of student motivation	Interview and Probing Question Responses

	nonverbal students with CVI	and engagement as eye gaze technology is used for language development. IQ13. Examples of eye gaze technology opening up possibilities to understand more deeply the student's inner thoughts. IQ14. Examples of student using eye gaze technology for social competence IQ15. Examples of student using eye gaze technology for sociorelational skills

Dewey-Pragmatism UTAUT	SQ3: Challenges educators face when using eye gaze technology for improving communication and language development of students with CVI	IQ16. Examples of the effects of students' performance with language development IQ17. Examples of the effects of students' performance with communication. IQ18. Examples of the influence on communication skills IQ19. Examples of problems, concerns when using eye gaze technology with students IQ20. Examples of negative aspects of	Interview and Probing Question Responses

		using eye gaze technology.	
Dewey-Pragmatism UTAUT	SQ4: Additional supports and facilitations to improve the usefulness of eye gaze technology for communication and language development of students with CVI	IQ21. Examples of more effective ways to implement eye gaze technology IQ22. Examples of resources that have helped with the effective use of eye gaze technology IQ23. Examples of the need for additional knowledge and skills for improved implementation	Interview and Probing Question Responses

Procedures for Recruitment, Participation, and Data Collection

The purpose of this study was to gain a deeper understanding of what educators think about the usefulness of eye gaze technology for communication and language development of nonverbal students with cortical visual impairment. In order to fulfil that

purpose, I as the researcher and the person who collected the data and did the interviews, contacted participants via invitation posted on social media platforms (Facebook, QIAT Listserv, Instagram, and LinkedIn). The guidelines for each of these platforms were adhered to when posting the invitation. Once the participants responded to the invitation, the ethical procedure of verifying eligibility through asking questions related to the specific population and providing a consent form was required. The other criteria for participant selection was that the participants should be currently serving nonverbal students with CVI. I conducted interviews via Zoom due to COVID-19 and the current social distancing situation.

Each interview was recorded and transcribed by the researcher. Depending on the open-ended responses to the initial interview questions, the researcher probed for more in-depth responses and I had the option to ask for clarification from the participants. IRB approval for collecting data was obtained. Before the interview began, a hard copy of the consent form was provided to participants via email and any other possible questions were answered. The participants were assured that the interview process will be completed voluntarily, and they had the option of stopping the process at any time. After the consent form was signed, it was reviewed with participants and they informed that the interview was being recorded.

The first couple of minutes of the interview were spent building a friendly rapport with participants and after that, they were asked if they were still willing to do the rest of the interview. The full interview took up to 60 minutes. After the interview, I thanked the participants for their interviews and gave them an opportunity to withdraw their consent

and the data from the study. The participants were also informed that a transcript of their interview was emailed to them within a week of the interviews and after reviewing it, they had the opportunity to ask the researcher to withdraw their provided answers and data from the study.

Even though the participants already have the contact information of the researcher, she made sure that they have all the information needed to contact the her should they have any further inquiries or follow-up questions. The participants were informed that I might contact them within a few weeks of the initial interview for some follow-up questions if required and their further cooperation will be highly appreciated. They were also informed that the findings of the study will be announced after the dissertation is defended and approved. Notes and memos were taken during the interviews and was reviewed immediately after the interviews. The interviews were transcribed within three days of each interview, and the notes and memos were used to complement the transcripts. Finally, the collected data was organized for hand-coding and analysis. Furthermore, saturation occurred after the primary interviews and there was no need to collect more data or conduct a second interview.

Data Analysis Plan

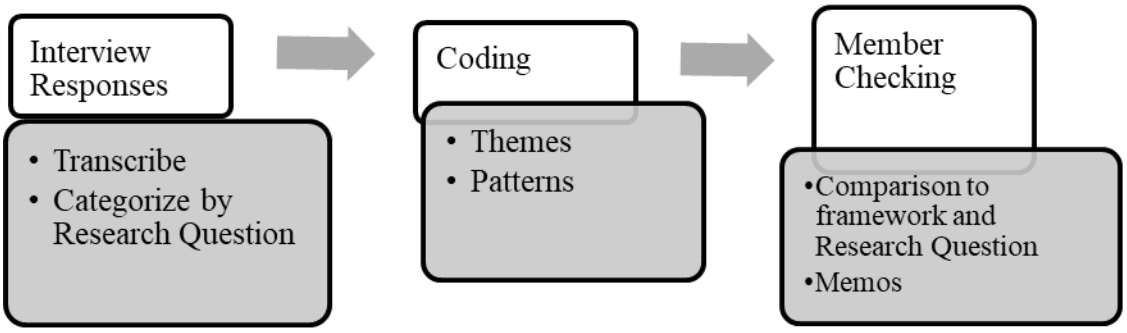
Basic qualitative inquiry is defined as a qualitative approach to help the researcher gain more in-depth understanding of the different way individuals interpret their real-world experiences focusing on forming relevant themes (Ravitech & Carl, 2016). In order to obtain a deeper understanding of what educators think about the usefulness of eye gaze technology for communication and language development of nonverbal students with

CVI, I utilized thematic inductive analysis to analyze the collected data. According to Nowell, Norris, White & Moules (2017) searching through the data to find certain and repeated patterns within the data set is the process researchers need to follow in conducting thematic analysis. Categorizing the information gained from the participants into classes as well as themes and sub-themes for comparison are the most significant aspects of thematic inductive analysis (Nowell, Norris, White & Moules, 2017).

The coding method that was selected for analyzing and coding the interviews was hand coding. I transcribed the interviews within one week of the interview and kept memos before and after the interviews. Notes were taken during the interviews, and I kept a reflective journal to be able to gain a deeper understanding and meaning of the transcripts of the interviews. I coded the unit of meaning, and then organized similar codes to categories, patterns, and themes. Then reviewed and revised all themes and created a matrix that represented all the acquired code, patterns, and themes. Finally, I developed comprehensive themes that were aligned with my frameworks and research questions.

Figure 2

Data Analysis and Coding Process



The preliminary coding was determined based on hand coding of the individual interview responses. I coded across participants for each interview question and cross-referenced the data by looking at the analysis for each interview response. The responses were compared to the research question and subquestions categories for developing themes. I achieved member checking as I examined areas for personal bias and isolate. The memos contained insights and outliers as they emerged. The analysis process continued until saturation was achieved with the absence of new emerging themes or patterns.

In case of confronting a discrepant case, I went back and listened to the original interview conducted with each participant, read the transcript as well as reviewed my memos and reflective journal to learn whether any misunderstanding or miscommunication occurred in the process. If I realized that the discrepancy occurred due to lack of mutual understanding between the interviewer and the interviewee, I contacted the participant and asked for further explanation and clarification on the issue.

However, if I learned that misapprehension had taken place, I will report the discrepant case truthfully and try to analyze and synthesize it in a manner aligned with the study's theoretical frameworks. There were no misapprehensions during the interview process.

Issues of Trustworthiness

In order to establish trustworthiness, four significant criteria of credibility, transferability, dependability, and conformity were addressed (Saldana, 2016). As stated by Kivunja & Kuyini (2017) credibility refers to the link that exists between the finding of the study and the world reality and how it can be demonstrated in real-world settings. In order to achieve credibility, I used multiple approaches to collect and analyze data such as conducting interviews, keeping reflective journals, taking detailed notes during the entire process of design and data collection, and receiving peer-reviewed feedback from my colleagues.

The other factor that has to be considered is transferability that refers to the extent to which the findings are properly recorded and can be used in other contexts, situations, times, and populations (Kivunja & Kuyini, 2017). Using multiple sources to gather and record data during and after the interview, such as different technological devices and recording the data in multiple locations may add to the transferability of the study.

Dependability is defined as the degree to which data can remain stable over time and conditions and whether it can be repeated in different contexts (Kivunja & Kuyini, 2017). In this study, the data was collected from educators from different disciplines. Memos, notes, and reflective journals were kept and examined by the mentor, methodologist, URR, and the IRB. This process created an external audit. Confirmability

is to ensure that the narrative of participants was reported and the study was not affected by the researcher's bias. I kept a reflective journal and took precise notes before, during, and after the process of interviews, analyzing, and synthesizing data in an attempt to report the authentic results and keep it bias-free.

Ethical Procedures

The participants of this study were be six speech therapists and six special education teachers who work with nonverbal students. The first procedure was to compose an invitation and post it on social media platforms (Facebook, QIAT Listserv, Instagram, and LinkedIn). The guidelines for each of these platforms were adhered to when posting the invitation. Once the participants responded to the invitation, the ethical procedure of verifying eligibility through asking questions related to the specific population and providing a consent form was required. There was a time frame allotted from the time the participant consented to participate and the actual interview.

Once the participant was ready to be interviewed, a password protected online platform that provided a safe environment was used (Patton, 2015; Rubin & Rubin, 2012). The agreed upon format was presented and explained to the participants in detail and all questions were answered to ensure clarification (Patton, 2015). If there was a low number of participants and data saturation was not reached in the initial interviews, a second round of interviews would have been initiated focusing on what is missing after a careful analysis of the collected information. It was not necessary to do a second round of interviews. Adverse events that could have occurred like withdrawal from participants would have been addressed on a case-by-case scenario. There was no incidence of

adverse events. If data saturation was obtained without the withdrawal affecting the study, the process will continue. If several participants withdrew, the interview process would have been repeated with more selected participants. There were no withdrawals from the interview process. The plan to continue the study over a maximum of 10 weeks could become a concern. The duration of the study was seven weeks. If data saturation was not reached in that period, a plan was put in place to continue the research for the future, and if necessary, recruitment of more participants could be required. However, data saturation was reached within the period.

The potential ethical issues that were considered in this study might be misusing the participants, completing consent forms by the participants, researchers' biases and confidentiality of the participants. Therefore, appropriate measures were taken to manage such possible ethical considerations. It is also worth mentioning that the nature of this study did not cause any physical or mental harm to the participants. I recruited participants with different educational backgrounds (teachers and therapists) with at least 3 years' experience of working with nonverbal students with CVI who use eye gaze technology. I confirmed that I have no prior contact and familiarity with the participants neither professionally nor personally. The participants were treated in accordance to the procedures identified by Psychological Associations' Code of Ethics (APA, 2017).

I provided the participants with the Informed Consent Form and ensured that the participants willingly sign the forms. I spent needed time to answer any possible concerns or questions that participants had. The participants were also be informed that the entire process was voluntary and they can withdraw at any time. Moreover, the participants

were ensured that their names will remain confidential and that pseudonyms were used in the study through utilization of an alphanumeric system (P1, P2) of coding. The real identities of the participants is only be available to the researcher, committee, and the IRB. All forms of data that include audio-recorded interviews, notes, journals, and memos has being preserved in a secured place in the researcher's personal office and will be only available to the researcher herself. The data will be shredded and disposed of properly after 5 years.

Summary

The study aimed at exploring educators' viewpoints on the usefulness of eye gaze technology for communication skills and language development of nonverbal students with cortical visual impairment. In order to find appropriate answers to the research questions, a basic qualitative approach was utilized. The conceptual framework chosen for this study has its foundation in Dewey's pragmatism theory and UTAUT (Venkatesh et al., 2003). The data was collected through semi structured interviews for the researcher to find more in-depth knowledge about the experiences and perceptions of the participants. A homogeneous purposive sampling to recruit participants by composing an invitation and posting it on social media platforms (Facebook, QIAT Listserv, Instagram, LinkedIn). The acquired data was coded and analyzed in this chapter, and the results will be discussed thoroughly and synthesized in the next chapter of this study.

Chapter 4: Results

Introduction

The purpose of this study was to discover the viewpoints of educators on the usefulness of eye gaze technology for nonverbal students with CVI. I used one primary question and four subquestions to guide this study:

The main question was "What are the viewpoints of educators about the usefulness of eye gaze technology for communication and language development of nonverbal students with cortical visual impairment?" The study also addressed four subquestions:

Subquestion 1: What are the opinions of educators about the ease of use and complexity related to the use of eye gaze technology for communication and language development of nonverbal students with cortical visual impairment?

Subquestion 2: How do educators feel about the social, cultural and interpersonal factors that may affect their use of eye gaze technology for communication and language development of nonverbal students with cortical visual impairment?

Subquestion 3: What challenges do educators face when using eye gaze technology for improving communication and language development of nonverbal students with cortical visual impairment?

Subquestion 4: What additional supports and facilitations do educators think would improve the usefulness of eye gaze technology for communication and language development of nonverbal students with cortical visual impairment?

The data collected from twelve participants through semi structured interview questions, focused on the research questions of the study. The themes that emerged from the literature review facilitated the formulation of the interview protocol. The data thus collected were transcribed, coded and categorized. The themes were identified following the procedure recommended when analyzing qualitative data. In this chapter, I will discuss the research setting and demographics followed by a description of the data collection process and data analysis. Evidence of trustworthiness will be addressed in a separate section. I will also provide a report based on the analysis of the collected data and the findings that align with the research questions.

Setting

I recruited participants through posting invitations on my Twitter, Facebook, Linked In, and QIAT listserv accounts from August 1 to September 25, 2020. Fifteen candidates initially contacted me, and I selected six teachers and six speech therapists who met the criteria of this study. The candidates contacted me through the email information from the invitation post or responded via direct messages on my social media accounts. During an initial email contact, I provided more information and sent the consent form where the participant responded, "I consent" if they agreed to participate. Afterwards, I scheduled interview sessions based on the availability of the participant. I conducted 12 semi structured, interviews via Zoom in my personal office at my residence. At least three of my participants rescheduled a couple of times but all interviews went smoothly.

The average time for interviews was about 30 minutes, where the shortest was 20 minutes and the longest 55 minutes. The entire data collection process took 7 weeks. I discussed the interview process with each participant and reviewed the contents of the consent form. At the end of each interview, I thanked the participants for participating in the interview and told them that I would send them a copy of the transcript of their interviews and asked them to confirm the accuracy of the content. I also informed them that I would provide them with a copy of the study after it was approved. The participants seemed passionate about this study and were all very eager to share their knowledge, experience, and expertise.

Demographics

The 12 participants had between 10 to 40 years of experience in their field and all served nonverbal students with cortical visual impairment. The number of years participants used eye gaze technology with students ranged from 8 to 20 years. All the participants had the experience of using eye gaze technology with nonverbal students with CVI. Table 2 displays the demographic information of the participants. The two categories referred to teacher participants as P1 and the speech therapists are referred to as participant therapists by using PT 1 and so on.

Table 2

Demographics

Pseudonym	# of years' experience	Serving nonverbal students with CVI	# of years' experience using eye gaze technology with students
P1	25	Yes	10
P2	21	Yes	18
P3	20	Yes	12
P4	27	Yes	20
P5	30	Yes	18
P6	33	Yes	15
PT 1	10	Yes	10
PT 2	33	Yes	15
PT 3	35	Yes	18
PT 4	40	Yes	10
PT 5	10	Yes	8
PT 6	30	Yes	14

Participants' Profile Narratives

The participants of this study were teachers and speech therapists. The criteria for participant selection were that the participants should be currently using eye gaze

technology with nonverbal students who have CVI and should have 3 years prior experience. The participants provided information about their viewpoints on the usefulness of eye gaze technology for nonverbal students with CVI. The following sections provide a brief description of each participant's history in using eye gaze technology and other communication devices.

P1

P1 has been teaching for 25 years and felt very positive toward using AAC devices. Some communications tools used by her students were Big Macs, Dynavox, Language Acquisition through Motor Planning (LAMP) and Eye Gaze. For the past 10 years, P1 has used eye gaze technology including low-, mid- and high-tech tools. Some of these tools included a prerecorded big Mac to a sequencer all the way up to, LAMP core vocabulary.

P2

P2 has worked with assistive technology for 21 years and spent 10 years in a classroom. She was the first teachers in her district to pilot eye gaze technology 18 years ago. Her student had Gateway to Learning from Dynavox, which was designed specifically for her student. P2 used AAC devices when it was in its early stages. She stated that her style is unlike a traditional teacher who does just the vowels and training: She specializes in implementation. Whenever a school district hires her to do assistive technology, they are hiring her to come in for a specific amount of days per week to work with their teachers regardless if they are special education or general education. Some communication tools P2 has used in the past range from low tech, mid tech to high tech

and include static boards, Go Talk, Tech Talk, PRC devices and all Dynavox devices. She has also used iPads, touch chats and been a co -writer for the individuals that do not need a symbol support.

P3

P3 has been teaching for 20 years. Some of the communication tools she has used with students in the past range anywhere from low-tech to systematic high-tech, like an eye gaze or an iPad communication device. She has used eye gaze technology with students for the past 12 years.

P4

P4 has been teaching for 12 years and was an assistive technology specialist 15 years prior. She has used low-tech to high-tech tools ranging from a language board up to auditory scanning and dynavox devices including Big Mac, step by step and iPads with various language systems applications such as LAMP. P4 has also used eye gaze device, Tobii, and Access 1400. She has used eye gaze technology with her students for the past 20 years.

P5

P5 has been teaching for the past 30 years and using eye gaze technology with students for 18 years. She uses the Toby eye gaze almost daily with her students in the classroom. The students are nonverbal and cognitively delayed, so they are not able to use switches or the computer for a communication device. P5 has used big mac switches, the iPad with various communication apps like Verbal Me and Lamp. However, her students have experienced more success with Tobii eye gaze.

P6

P6 has been teaching for 33 years and using eye gaze technology with students for the past 15 years. She has used picture exchange, switches, IPad with LAMP, and Dynavox. Over the years, any type of nonverbal communication using pictures, touch, and verbal recording on the Big Mac.

PT1

PT1 is also an assistive technology professional (ATP) certified has been a speech and language pathologist (SLP), for 10 years. She has used eye gaze technology with students for the past 10 years along with other communication tools that include different major high tech companies, PRC, Saltillo, Tobii Dynavox, and all of their different access methods had tracking eye tracking, switch scanning and direct touch joystick. In addition, low tech and no tech devices such as big macs, go talk and picture exchange system (PECS). PT 1 reported that more than 75% of her students use high tech AAC.

PT2

PT2 has practiced in this field for 33 years and used technology in her practice even earlier in her career. Other communications tools include tape recorders, big macs, PECs, go talk, IPads with apps such as LAMP. She has been using eye gaze technology with students for the past 15 years.

PT3

PT3 has been providing therapy for the past thirty-five years. During that time, she has used low-tech and high-tech communication tools with students. Some of these tools include Low-tech visual symbols, both concrete objects, symbols, tactile symbols,

high tech, abstract symbols. She has used eye gaze technology with students for the past 18 years along with lots of different high-tech devices, IPads with apps such as LAMP.

PT4

PT4 has been providing therapy for the past 40 years but has only used eye gaze technology for the past 10 years. She feels that including high tech in her therapy sessions is a fantastic breakthrough. During her early years of providing therapy, she used paper and drew pictures on picture boards. Other tech tools she used include Go Talk, PECs, and LAMP.

PT5

PT5 has been providing speech therapy for the past 10 years and using eye gaze technology with students for the past 8 years. She feels eye gaze technology is a "game changer" for many nonverbal students. PT5 has used other communication devices with students such as big mac switches, Go Talk, PECs, LAMP, eye gaze technology, and PRoloquo2Go. She feels students using devices to communicate is better than sign language because all parties are not required to understand sign language in order to communicate effectively with the student.

PT6

PT 6 had been providing speech therapy for the past 30 years and using eye gaze technology with students for 14 years. She has used the simple, very basic communication boards, very simple switches, pictures, symbols, and photographs. She also used simple eye gaze, like see-through boards that you would put pictures on or picture communication symbols. She has worked with some lever and joysticks to give

kids better access, Big Macs switches, which are just big one-hit buttons that you can play recorded messages on. Twin Talks is another step up, you could put two messages on them, like a yes or no, or like, and I do not like. The sequencers are similar to the size of a big Mac, but you can record multiple messages on them. This allowed a student to hold a simple conversation, say the pledge of allegiance, or make a bunch of funny comments. She has also used cheap talks that has four to eight cells in a setting, IPads with LAMP and eye gaze technology.

Data Collection

Six speech therapists (PTs) and six teachers (Ps) who use eye gaze technology with nonverbal students with CVI were recruited for this study. The criteria for recruitment was teachers and therapists must have at least 3 years' experience and use eye gaze technology with their students. I recruited participants through posting invitations on my Twitter, Facebook LinkedIn, and QIAT Listserv accounts. As described above the interviews with selected participants were conducted within a period of 7 weeks. I discussed the interview process with each participant and reviewed the content of the consent form. I informed the participants that the interview was being recorded on Zoom and I will only save the audio recording. I asked the initial questions to create a friendly atmosphere. I conducted a semi structured interview virtually with 23 open-ended questions about the usefulness of eye gaze technology for nonverbal students with CVI. At the end of each interview, I thanked the participants for their contribution to my study and told them that I would send them a copy of the transcript of the interview and ask them to confirm the accuracy of the content. I also informed them that I would

provide a copy of the study after it was approved. The participants seemed passionate about this study and were all very eager to share their knowledge, experience and expertise. I transcribed all interviews within 2 days of the interview process. I did not need to contact any of the participants to ask any further questions. I emailed each participant the transcripts of their interviews and asked for confirmation. After receiving confirmation, I began data analysis.

To ensure confidentiality and safety of the participants' identity and the data collected from them, all participants were assigned pseudonyms as indicated above and the recordings were secured in a safe in my home. I did not encounter any unusual circumstances while conducting the interviews or processing the data. There was no significant variation in the data collection process as discussed in Chapter 3. I continued to hand code the data.

Data Analysis

This study is a basic qualitative study, so I collected the data through conducting interviews and then analyzing the gathered data. In order to obtain a deeper understanding of what educators think about the usefulness of eye gaze technology for communication and language development of nonverbal students with CVI, I utilized thematic inductive analysis to analyze the collected data. According to Nowell, Norris, White & Moules (2017) searching through the data to find certain and repeated patterns within the data set is the process researchers need to follow in conducting thematic analysis. Categorizing the information gained from the participants into classes as well as

themes and sub-themes for comparison are the most significant aspects of thematic inductive analysis (Nowell, Norris, White & Moules, 2017).

After conducting the interviews and transcribing them, I used the thematic inductive analysis model introduced by Braun and Clarke (2006) to analyze the data. I coded the unit of meaning, and then organized similar codes to categories, patterns and themes. I reviewed and revised all themes and created a matrix that represents all the acquired code, patterns, and themes. Finally, I developed comprehensive themes that aligned with my frameworks and research questions. Table 3 displays initial code count from the initial coding phase.

Table 3

Initial Code Count

	Phrase count
Opinion	16
Education	13
Independence	5
Communication	106
Appropriate	20
Nonverbal	16
AAC devices	10.
Low Tech	12
High Tech	14
Problem	11
Troubleshoot	9
IPad	12
Possibilities	5
Beneficial	10
Motivating	9
CVI	9
Dynavox	14

Technologies	94
Literacy	13
Language	99
Development	66
Equipment	6
Change	52
Opportunity	18
Familiar	18
Setting	57
Comparing	14
Resources	21
COVID-19	14
Online	13
Calibrate	38
Instruction	7
Integrated	9
Implement	11
Disability	10
Performance	7
Influence	12
Positive	15

Patterns

After reviewing the initial codes, I combined these codes into patterns. I identified seven patterns that are in general alignment with my research questions and conceptual framework. Table 4 shows the patterns that emerged from the initial codes.

Table 4

Patterns from Initial Code Count

Patterns	Initial Codes
Educators' Opinion	Beneficial Education Literacy Disability Opportunity
Familiarity with all aspects	Equipment Troubleshoot Comparing Familiar
Effectiveness of eye gaze technology and CVI	Communication Integrated Instruction

	Performance
	Language
	Appropriate
Comparing other devices	IPad
	CVI
	High Tech
	Low Tech
	Change
Ease of Use	Positive
	Independent
	Possibilities
	COVID-19
Functional Benefits	Calibrate
	Troubleshoot
	Motivate
	Development
	Problem

More ways to implement effectively	Setting
	Resources
	Technology
	Online

The identified patterns emerged from educators' viewpoints on the usefulness of eye gaze technology for communication and language development of nonverbal students with CVI.

Educators' Opinion on the Use of Eye Gaze Technology

P1, 3, 4, and 5, use eye gaze technology in their classrooms daily and said it was very beneficial to students for communication and language development. P2 and P5 agreed that nonverbal students need communication tools. However, they did not feel it had to be high tech. P2 reported that she has a student who prefer to use a static board even though he had access to any high tech device. All six therapists agreed that eye gaze technology was a *game changer* where nonverbal students have the opportunity to respond to their teachers and interact with their classmates during instructional time. This could also be beneficial in assisting teachers to evaluate their learning process. PT 4 and 5 said that eye gaze technology for students with CVI was amazing because it is an untapped commodity. The perception about student with CVI is that someone with impaired vision could not possibly use his or her eyes to communicate. PT 4 stated that many nonverbal students with CVI have good visual skills that should be explored. She said educators need to be trained and may even require several years of training. All

therapists and teachers who were interviewed agreed that eye gaze technology is an untapped commodity and we are fortunate to have access.

Familiarity with all Aspects of Eye Gaze Technology

Almost 75% of teacher participants who were interviewed felt that they were familiar with all aspects of eye gaze technology. However, continuous updates mean that they must network with other professionals who are using eye gaze technology and keep up with research and development. Trouble shooting Eye gaze calibration seem to be a challenge for all educators but like any type of technology, it has its challenges. PT1stated that she has been through several masterclasses on, adjusting tracking pointers, cursors, smoothing, jitters and doing snap versus stream. PT3 said the challenge for her was that her school district has two units. PT2 said her challenge does not involve familiarity but constantly having to figure out how to program when there is an issue with connection. In addition, trying to understand language therapy on top of this very complex communicator can be intimidating.

P1said she is familiar with all aspects related to eye gaze technology. She is familiar with accessing and setting up. She said setting up to the appropriate height and appropriate distance from the students so that they can access it, has been a bit of a challenge this year. P1 is familiar with where to find different pages, the colors, comments, the pledge of allegiance and the date. She also stated that one of the major tips is to keep the device charged always. Having the knowledge to know what to do when there is a problem and how to problem solve is also very important. She stated further

that she was knowledgeable about troubleshooting and would reach out for technical support if needed.

Effectiveness of Eye Gaze Technology for Students with CVI

When responding about the effectiveness of eye gaze technology for students with CVI, P2 stated, that it depends because cortical visual impairment is not about the movement of the eyes or the ability to see. She said-

> CVI is a condition where the brain does not process the information the eyes are seeing. Someone with CVI sees the picture and gets the idea of what it is supposed to be, but when it gets to the area of the brain, where you say, "oh this is what it is, but it's not what I thought it was." With cortical visual impairment on eye gaze technology, we have to be mindful of how we are presenting information. I know they are outlining the shapes, doing high contrast. Those things make a difference. The question I always have anytime I am working with someone with CVI, is making sure there is enough space between the device to give their eyes a chance to relax in between before they move onto the next one because when you get too many together, all of those colors blend and become like a blob.

PT1, 3, and 5 agreed that when you are working with someone with CVI, you must consider the distance from the device but there is no reason why eye gaze technology could not be used because of CVI. PT1 said that there is a myth that it is not effective but communication on the device is similar to chords on a keyboard. She explained that it does not matter which chord you hit, your fingers know where to go.

When a student with CVI uses eye gaze technology, as long as the device is stable, the brain will adjust.

Comparison of other Communication Devices to Eye Gaze Technology

When I presented questions related to comparing other devices to eye gaze technology, the six teacher participants (Ps) were unanimous about compatibility based on the needs and abilities of the students. Since teachers spend most of the school day with the student, they reported that they observed students as they attended to tasks. Eye gaze technology worked very well for some students but Big Mac switches, PECs or LAMP may work best for others. PT 1, 4 and 5 stated that the type of device a student uses depends on the cognitive level before any AAC device is used. PT1 stated that for someone who had the capacity to work on language, using eye gaze technology would be easier than trying to fight his or her motor system to do something like a picture card or a touch system. PT3 felt that it is obvious that we have many students with *dysarthria* whose attempts to communicate verbally are not successful. She went on to say that, there are some instances, where the student understand the cause and effect of playing a game on an eye tracking device, but the language development aspect is much more difficult. As a result, most therapists used a device that is suitable for the student based on ability and it may not always be eye gaze technology.

Eye Gaze Technology Ease of Use

PT6 stated that there were difficulties when education and therapies went remote during COVID-19. She said it became difficult because these are expensive high tech systems and the students themselves, a lot of them were not proficient. In addition,

parents at home working with their child did not have the skills to provide proper support. The most important thing when using eye gaze technology is being knowledgeable about operating the systems and positioning the student appropriately for the eye gaze access. PT 6 went on to say COVID-19 hindered a lot of the progress during remote learning.

P3 and P4 were the only participants whose students did not use eye gaze technology remotely because their students did not have access to the device at home. P3 said she got creative with a speech therapist and sent home duplicates of the pages the students used with the device. They were core vocabulary pictures that were extra-large. P3 directed the parents to position the pages accordingly so that the student was able to mimic using eye gaze technology. She said it was not a perfect substitution but somewhat effective.

P1 commented about ease of use in relation to calibration. She stated that she does not think eye gaze technology is easier or difficult but there are technology related issues that can present challenges. P1commented:

> For example, the calibration piece of it can be problematic. If you have a child that who depends on eye gaze technology as their main form of communication and calibration is off, it can be frustrating to the student and the teacher. I have worked with two students who experienced calibration issues. As far as ease of use, my answer is always going to be when it is appropriate and when it is successful. However, I do think there are technology pieces related to eye gaze that do make it slightly more difficult.

Functional Benefits of Eye Gaze Technology

Participants discussed the functional benefits of eye gaze technology for nonverbal students with CVI. P1stated:

> One of the main functional benefits of eye gaze technology is language development because; you can use it in such a way where you can start small and still grow the language and vocabulary you use. As the teacher, you present simple words such a “go”, “stop” or “yes”, “no” or go as far as controlling the entire device by having a keyboard on the screen and using a space bar and spell check. It can range from the smallest bit of language to higher-level communication.

PT6 said students were motivated when they started developing different relationships. People were responding to them appropriately, they had the ability to express an opinion, and people were respecting it and responding. PT2 stated eye gaze technology has just given individuals a lot more, possibilities so they can show us all that potential. Eye gaze technology is a total *game changer* for so many students that do not have access any other way.

Effective Implementation of Eye Gaze Technology

All teachers and therapists agreed that they would benefit from more training to implement eye gaze technology effectively. PT3 stated she is familiar with a vast amount of knowledge. However, she would like to get a bit deeper into learning how to expand her knowledge to use it more effectively. P1said there are ways to use eye gaze technology more effectively in lessons rather than just setting up the boards. She is

interested in becoming more advanced because she could help the student during instruction instead of waiting on the AAC specialist to provide support.

Evidence of Trustworthiness

Credibility

After the interview process, I achieved triangulation by interviewing 12 participants, saving the audio recording of the interviews on two different media, journaling and taking notes while collecting and analyzing the data. Patton (2015) stated that triangulation is the most effective approach to achieve credibility that occurs when multiple ways are used to collect data. In order to gain a deeper understanding of what educators think about the usefulness of eye gaze technology for communication and language development of nonverbal students with CVI, I posted the invitation on social media platforms Facebook, QIAt Listserv, Instagram, and LinkedIn. The guidelines for each of these platforms were adhered to when posting the invitation. Once the participants respond to the invitation, the ethical procedure of verifying eligibility through asking questions related to the specific population and providing a consent form was required. The other criteria for participant selection are that the participants should be currently serving nonverbal students with CVI.

After IRB approval, I conducted interviews via Zoom due to COVID-19 and the current social distancing situation. Each interviewee's response was recorded, saved on two different media then transcribed. Depending on the open-ended responses to the initial interview questions, I probed for a more in-depth response and asked for clarification from the participants. Asking 23 questions relevant to my study assisted me

with gaining a deeper understanding of educators' viewpoints on the usefulness of eye gaze technology for nonverbal students with CVI.

Transferability

I saved the audio recording on two different media to ensure safe storage of the data. After transcribing the interviews, I double-checked them for accuracy against the recordings before sending them to the participants for confirmation. . This process increased the accuracy of by data collection and contributed to my research study's transferability.

Dependability

I kept reflective journals and notes throughout the data collection and data analysis process in order to record every stage of this research accurately, so that the study could be replicated in the future. Walden University IRB along with my committee provided valuable feedback during all stages of this process. Dependability of this research was supported by the internal audit of my committee and the IRB.

Confirmability

In order to achieve confirmability and prevent personal biases, I used open-ended questions during the interview process, where participants could easily express their opinions and feelings without influence from my feelings or potential bias. I also kept a reflective journal and took accurate notes before, during, and after the interview process, during analysis and synthesizing the data in an effort to report the accurate results and obtaining confirmability.

Results

In this study, I designed one research question followed by four sub questions exploring educators' viewpoints on the usefulness of eye gaze technology for communication skills and language development for nonverbal nonverbal students with cortical visual impairment. I identified opinions of educators about the ease of use, social, cultural and interpersonal factors that affect the use of eye gaze technology, challenges educators face when using eye gaze technology and additional supports and facilitations to improve the usefulness of eye gaze technology. These four major themes provided deeper insight in supporting the main research question and related subquestions.

Main Research Question

What are the viewpoints of educators about the usefulness of eye gaze technology for communication and language development of nonverbal students with cortical visual impairment?

The three main identified themes in this study provided valuable information about the usefulness of eye gaze technology for communication and language development of nonverbal students with cortical visual impairment. The effectiveness of eye gaze technology, ease of use and functional benefits were identified as main factors influencing educators' viewpoints on the usefulness of eye gaze technology. Below, I will discuss the alignment of each theme to educators' perception on the usefulness of eye gaze technology for students with CVI.

The Effectiveness of Eye Gaze Technology

A user operates the eye gaze system by looking at *keys* that are displayed on the control screen. To *press* a key, the user looks at the key for a specified period. The gaze duration required to activate a key, can be adjusted. An array of menu keys and exit keys allow the user to navigate the eye gaze programs independently. Communication, integrated, instruction, performance, language and appropriate, were the main descriptors used to discuss the effectiveness of eye gaze technology for students with CVI. PT1 said, "CVI gets tossed out there as a diagnosis for some of the kids, and someone says, "Oh, they have CVI, they're blind". They cannot do eye gaze and you put them in front of a system and you would never know if they had any kind of visual diagnosis." She went on to say some students may not have a diagnosis of CVI but are unable to attend visually. Eight out of the twelve educators mentioned the benefits of getting a black frame instead of a colored frame in order to avoid the student being distracted. They recommend using something that is going to draw the student's eyes to the center of the screen. PRC (a leading manufacturer of speech generating devices) created high contrast icons that have no research behind them but seem to work.

PT3 talked about teachers from the commission of the blind attending sessions with her students and being amazed at the performance. She said that we have to be open-minded because people think students with CVI are unable to access eye gaze technology. PT3 said, "I have observed the staff from the commission standing there watching the child's eyes and looking at what they activate on the screen." She stated that they were shocked the first time they visited. They stared in amazement at the systems

with dark backgrounds. Many of the pages are dark with bright colors to attract the student's gaze. PT 3said further that many of the earlier games were not communication based, but just early games meant for kids to have fun and get used to the system.

Ease of Use of Eye Gaze Technology

Positive, independence and possibilities were used in response to the opinion of ease of use from all 12 participants. Of course, they observed that it was on a case-by-case basis. PT2said that in her opinion there are all kinds of factors to consider with ease of use. She said if a student had the option to use touch on a device it would probably be better than using the eyes. PT6 said, "I would say eye gaze would certainly be the way to go versus another body part. Because instead of talking, you would take away the whole scanning and waiting piece and you can just look and control it yourself with your own eyes." The six teachers (Ps) were unanimous in their opinion about ease of use depending on the level of cognition of the students.

PT6 indicated "that it is easier for someone who has the capacity to work on language, that it is certainly easier than trying to fight their motor system to do something like a picture card or, a touch system". She said that it was obvious that there are many students with dysarthria whose attempts to communicate verbally was unsuccessful. Two of the teachers and PT6 felt that most people can learn language developmentally but they have the cognitive capacity to be able to learn language, it may not matter which access method is used.

Using eye gaze technology for communication is easier for nonverbal students with CVI, than other technologies according to 85% of the participants. Even though it is

very individualized, the therapists find that programing eye gaze technology for communication is easier than language development. PT 3 stated, “The technology changes so fast, and it can be difficult to stay on top of that.” All participants agreed that being able to individualize is what allows you to see the student’s potential and maximize it with them.

Functional Benefits of Eye Gaze Technology

Calibrate, troubleshoot and motivation were used to discuss functional benefits. During the interview process, I learned that all participants believe using eye gaze technology enabled them to unlock students’ potential. P4 stated that she realized a long time ago that we should not set limits on our students. She has worked with many students who did not have great motor capabilities or ability to access technology. Eventually, they learned how to become somewhat passive and pretend to be asleep or sick. However, once they saw the eye gaze technology, they were motivated to see that they could have an effect by looking at the screen. They understood that their eyes just by looking had some sort of effect on the screen that was in front of them. Then, they started to develop the cause and effect and being able to see things that they enjoyed. This was a way to use eye gaze technology to build that cause and effect, in them and motivate them then to see *what else I can do?*

Sub Question 1

What are the opinions of educators about the ease of use and complexity related to the use of eye gaze technology for communication and language development of nonverbal students with cortical visual impairment?

The effectiveness of eye gaze technology, ease of use and functional benefits are relevant themes that align to educators' opinion on the use of eye gaze technology for communication and language development. . Although eye gaze technology as an alternative access method for AAC is promising for many students with both complex communication disabilities, knowledge and skills of the educator in gathering evidence to decide an eye gaze access is critical to achieve the desired outcome of effective communication and language development.

Ease of Use of Eye Gaze Technology. The teachers agreed that integrating eye gaze technology in the classroom was not difficult and they made functional adjustments as needed. P3 said that it was more than getting the number page out. They did not get only the number page out when they were doing math or the pledge of allegiance page out when we were doing the pledge. The teacher participants were unanimous about the key to ease of use was having the device accessible to students at all times and planning for the students. This was the students' voice throughout the day and that they interact with the other students during group projects, making choices, giving an opinion and participating. Techers usually reach out to the therapist to load additional boards on the device that is relevant to instruction such as art projects with Popsicle sticks, a textured paper or sandpaper. Planning increases the usability of eye gaze technology.

Functional Benefits of Eye Gaze Technology. Two of the teacher educators shared that using eye gaze technology in the classroom has made their classroom more inclusive. They tailor the environment and instruction so the student can participate, using eye gaze technology throughout the curriculum and socially on a daily basis. Some

of the things students are able to do in a classroom setting are the date, the pledge of allegiance, choosing art materials, making comments, to friends and asking questions. PT 1 said, “During remote learning, I was able to connect with speech therapists so that I could learn how to use eye gaze online with my students. I was successful and the relationship with the students and parents was great. The mother was able to assist the student and she was engaged also.” The mom said, “This really works and it gives her a voice to participate in the class the online class as well.”

Sub Question 2

How do educators feel about the social, cultural and interpersonal factors that may affect their use of eye gaze technology for communication and language development of nonverbal students with cortical visual impairment?

The Effectiveness of Eye Gaze Technology. All participants agreed that students’ motivation and engagement increased with the use of eye gaze technology. It seemed as though other students in the classroom began to pay attention and listen as their classmate responded using eye gaze technology. Then the students would respond and become reciprocal. The student using eye gaze technology became focused on the lesson activities. Speech therapists always encourage teachers to integrate eye gaze technology into all classroom activities throughout the day. Their recommendations have always been “the more they use it, the more they will become motivated and engaged”. As far as opening up possibilities for student, both groups of participants agree that it is phenomenal. One of our basic human needs is the need to communicate and to express who we are as people. Teacher participants stated the integration of social competence

and pragmatics are weaved into health or social studies where games are played and the students can direct the play. The students can also answer relevant questions initiate an activity and make choices. These activities promotes independence and a positive self-image for students.

Ease of Use of Eye Gaze Technology. A special eye-tracking camera mounted below the screen observes one of the user's eyes. Sophisticated image processing software analyzes the camera's images 60 times each second and determines where the user is looking on the screen. The device is not attached to the user's head or body. A less than 15 second calibration procedure is required to set up the system for the individual user. The user looks at a small calibration point as it moves around the screen. . Six teacher participants stated that it is beneficial to choose highly motivating targets for calibration with younger students or those with cognitive delays. There is no need to recalibrate if the user moves away from the screen and returns later.

For students with CVI, it is beneficial to use their personal visual strategies to make the calibration screen and target most visually accessible. P3 said, "For example, many of our students with CVI achieve visual attention best with a black screen and high contrast image or familiar video." An increased motivation to communicate aligns with additional vocabulary, faster skills and a willingness to participate. Teacher educators agreed that the positive influence with language development affects their performance. Increased social and emotional activities have a positive impact on a student who knows that she is being heard and valued as a communicator. The eye gaze device can be linked

to a cellular device where speech is generated by typing a message or selecting pre-programmed phrases.

Functional Benefits of Eye Gaze Technology. All participants agreed that eye gaze technology could be the most direct form of access and communication. Eye gaze technology opened up a world of possibilities for students with complex instructional needs due to communication, sensory, cognitive and visual impairments such as CVI. Teacher participants shared that in a classroom, eye gaze technology can offer new opportunities for communication and language development. Eye gaze is a great benefit to students who are *trapped in their own bodies* and have physical limitations where they cannot use a touch system to communicate. Both groups of participants stated that they continue to be amazed as to what is possible and how quickly their students could progress. They also suggested that eye gaze technology might not be beneficial to all nonverbal students with CVI and students who can use eye gaze for an early learning activity may not go on to use eye gaze technology all the time to communicate and learn.

Sub Question 3

What challenges do educators face when using eye gaze technology for improving communication and language development of nonverbal students with cortical visual impairment?

PT 1and 3 revealed that although eye gaze technology access to SGD is exciting, there are some situations when it is simply not the best choice. There are some challenges with using eye gaze on a high tech device that educators need to consider during the evaluative process. There are issues that may negatively affect the ability to

use eye gaze access such as movement disorders, certain medications including antidepressants and Baclofen. Students with CVI may have difficulty with visual recognition of symbols and may need highly individualized modifications of the appearance of boards/symbols.

The Effectiveness of Eye Gaze Technology. All participants agreed that it is important to bear in mind that the social functions of eye gaze technology are only meaningful during face-to-face interactions, where both communicators can see each other. It is only in this context that eye gaze has a dual function and both agents can perceive and signal information. Furthermore, eye gaze technology signals are not isolated. This means the speakers need to shift their gaze toward or away from the listener at specific intervals during speech. Listeners need to coordinate gaze direction with facial expressions to indicate preference or reduce arousal, and speakers and listeners need to engage in brief mutual eye gaze periods to exchange turns. This means that communicative encounters with social signals need to be coordinated within and across conversation partners over time.

Ease of Use of Eye Gaze Technology. All therapists stressed on the importance of the environment. The effect of lights both natural and artificial, reflecting on the eyes and potentially interfering with the cameras reading ability could be an issue. Also, consider visual distraction for students with CVI. PT 5 said, she has had the most success using lamp lighting behind the student with curtains blocking windows for initial evaluation. For students with CVI, she has taken darkening the room to a science with

very limited lighting except the device. She further stated that she only has evidence from her own experience to support this, but has had excellent success with this technique.

Functional Benefits of Eye Gaze Technology. PT 6 stated that there could be issues that affect functionality. It could range from the lighting to the calibration. There could be all kinds of lighting issues because the lighting can affect the calibration. In most school buildings, the light can vary from one room to another. Then there are issues staff might face with a fear of breaking the expensive equipment. Sometimes it can be difficult to convince paraprofessionals to use eye gaze technology with students. Teacher participants also feel that having technical support on site to troubleshoot the equipment can be a challenge. P3 reported the frustration of the student when the internet freezes or the calibration is off. Therapists complained of either parents of teachers forgetting to charge the device and then it is not ready for use. Another functional issue is the mount. Either the mount was at school or the student has a new wheelchair that does not accommodate the mount. These are the challenges but it relates to the equipment rather than the usage.

Sub Question 4

What additional supports and facilitations do educators think would improve the usefulness of eye gaze technology for communication and language development of nonverbal students with cortical visual impairment?

Eye gaze technology is a hallmark technological achievement in the world of speech generating devices (SGDs).

The Effectiveness of Eye Gaze Technology. Participants agreed that additional training is always helpful because of the technological improvements over time. Speech therapists and webinars with demonstration modeling have been helpful. PT2 stated, "Because the technology is limitless. Is it different for students with CVI? Yeah. I mean, because there are more settings and available changes." She went on to say that, a lot could be done with proper and continuous training.

Ease of Use of Eye Gaze Technology. PT1 stated that it would be great to have one universal platform for calibration. Presently, everyone has his or her own patent, specialty and that makes it difficult. Financial support could make it possible for a standardized calibration system. Teacher participants felt it would be easier if students had access to eye gaze technology at home and school without transporting back and forth. It seems as a bit of a barrier if it is not accessible and families are not using it at home. This means that a piece of the puzzle is lost with a lack of continued usage. Teacher participants also stated it was necessary to have access to the speech therapists when additional words need to be included on the device. All participants agreed that continuous training and additional technical support would enhance the services provided to students.

Functional Benefits of Eye Gaze Technology. All participants stated that additional research on how to best teach and implement eye gaze technology would enhance the services they provide. Technology is ever-changing and further research and access to this technology could have far-reaching implications for students with CVI. P3 said she struggled with figuring out individual plans where she could address everyone at

a different level. She said there are many different programs you can use and so many different symbols that can be used in so many different ways. Networking and learning from other educators who use eye gaze technology with nonverbal students who have CVI, would be valuable.

Summary

The findings of this study revealed that all of the twelve participants agreed that eye gaze technology for communication and language development of nonverbal students with cortical visual impairment is useful. Educators' overall belief on the usefulness of eye gaze technology was viewed as a positive approach to supporting students with CVI for communication and language development. There were no limitations with students who had CVI or delayed cognitive abilities. Participants stated they believed that the utilization of eye gaze technology as a teaching and learning tool was beneficial and contributed to their learning process. Most of the participants stated the ultimate goal of teachers and therapists is for students to focus their attention on learning the content of activities or be able to communicate and participate. Usually, the focus is not on the physical access of the device. Practice so far has demonstrated a short learning curve for many students who use eye gaze technology, particularly when compared to students mastering good switch access skills.

In the next chapter, I will compare the significance of the findings of this study to the peer-reviewed studies discussed in chapter 2 and explain how the findings of this study are aligned with the conceptual frameworks. I will also discuss the limitations of this study and state recommendations for further research within the scope of this study.

Finally, I will explore the social change aspect of my research and state how the findings could contribute to positive social change.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

The purpose of this basic qualitative study was to explore the viewpoints of educators about the usefulness of eye gaze technology for communication and language development of nonverbal students with cortical visual impairment (CVI). I recruited participants through Twitter, LinkedIn, QIAT listserv, and Instagram. The participants of this study were six speech therapists and six teachers who use eye gaze technology with nonverbal students who have CVI. I conducted semi structured, interviews via Zoom. Afterwards, I transcribed and hand-coded the gathered data. Then, I translated the identified codes, patterns, themes, and selected quotes from the participants to report and discuss the findings of the study.

The findings of this study suggested that all participants agreed on the usefulness of eye gaze technology for communication and language development of nonverbal students with CVI. Most of them believed that the utilization of the device had a positive influence on students' motivation, communication and language skills. The participants stated that eye gaze technology could affect students' performance with communication and language. Eye gaze technology gave voices to many students who would have a voice for the first time in their lives. Most students' nonverbal communication has always been there, but it is not always recognized. All participants believed by using eye gaze, students with CVI become empowered. Once students have that voice, they have access to words that matches whatever anyone else says. They begin to realize that there is power in communication and that is intrinsically motivating. Whenever those factors

connect, it seems as though the students feel the power and start to realize that their opinions do matter and their ability to express themselves increase.

Interpretation of the Findings

Interpretation of the Findings in Relation to the Literature

The results of this study have varying alignment with the literature. For example, children with CVI and complex communication needs (CCNs), are at high risk for cognitive, sensory motor, social, language, literacy, communication, and participation deficiencies (Hadid, 2017). They need targeted interventions to develop functional vision, engage in meaningful interactions, and have consistent learning opportunities. Nonverbal children with CVI need access to a range of assisted AAC strategies, tools, and technologies in order to participate actively in family, school, and community, and communicate effectively (Hadid, 2017). The results of my research indicated eye gaze technology is useful for nonverbal students with CVI. Participants felt as though they have many available resources and are confident in using it. The most important thing is that students have a voice. Bracher and Matta (2017) recommended more research on the how CVI affects development, learning, communication, and participation across domains. The findings of my study revealed even though there are multiple aspects of the vision of individuals with CVI that would be thought to be detrimental when using the eye gaze technology, students are able to access the whole screen when it was placed just left of the midline.

The findings of my study aligned with Chazin's (2018) study about students having the ability to concurrently learn multiple communication skills. Researchers indicated that the opportunity to experience new things and discover new abilities lead to increased possibilities to learn and develop language skills (Chazin, 2018). Cudd (2017) stated that proof exists to support that eye gaze technology can provide children with language to communicate. However, the work that needs to be added in order to make eye gaze technology usable in an efficient way is perceived as difficult and time-consuming by some parents and professionals (Cudd, 2017). The findings of my study revealed that requiring nonverbal students with CVI to communicate by struggling to activate a switch using a head movement or being unable to control a pointing device with use of their hands are in the past. Participants reported that eye gaze technology is highly successful. The manufacturers of eye gaze technology invested over 30 years in ongoing research and development to create an accurate, easy-to-use eye-operated speech-generating device that is changing the lives of nonverbal students around the world. The findings of my study uncovered the usual technical internet issues or calibration difficulties but professionals had available resources and were skilled at providing services to students with CVI.

Dindar et al. (2017) confirmed that nonverbal children with CVI are active social participants instead of passive observers. The results of my research study supported the gap of improving communication partner behaviors of nonverbal students with CVI using eye gaze technology. The participants unanimously agreed that the use of eye gaze technology enhanced students' performance with communication and language

development. Participants revealed when students with CVI understood the symbolic representation and responded to the aid and language stimulation, they thrive and do extremely well. As a result, when they are with typically-developing peers at that cognitive capacity, they are fully capable of working together.

The findings of my study also differed from other researchers on educators' feelings toward using eye gaze technology with students who have CVI. Robillard et al. (2018) believed that cognitive flexibility predicted the navigational skills of students with CVI. My findings support the need for accommodations and technical support for nonverbal students with CVI who use eye gaze technology. CVI is a prevalent cause of visual loss in children. It encompasses a wide range of visual disabilities from no light reception to normal visual acuity with cognitive visual dysfunction. The findings of my research revealed that while there are more settings, time and changes required for students with CVI, that eye gaze technology is very useful for communication and language development.

My research findings aligned to Rytterstrom, Borgestig and Hemmingsson (2016) who studied the use of eye gaze technology of nonverbal students with severe motor impairment from a teacher and parent perspective. Rytterstrom et al. (2016) explored functionality in the home setting. The findings of my study supported Rytterstrom et al.'s (2016) study on a teacher's perspective related to the use of eye gaze technology. My study proved that students with severe disabilities were able to control the computer and express themselves. The use of eye gaze technology is a benefit to students who have been trapped in their own body and have physical limitations where they cannot use a

touch system to communicate. All of the participants of my study expressed the usefulness of eye gaze technology for communication and language development for nonverbal students with CVI had a positive impact. Students with motor, physical and visual impairment were able to use eye gaze technology successfully.

Interpretation of the Findings in Relation to the Conceptual Framework

The conceptual framework for this basic qualitative study was based on the UTAUT model (Venkatesh et al., 2003), and John Dewey's (1938) pragmatism theory. I used the unique combination of these theories to provide a frame upon which the study was designed. Additionally, I used a basic qualitative design approach including recorded interviews to determine educators' viewpoints on the usefulness of eye gaze technology on language development and communication for nonverbal students with CVI.

UTAUT was a framework first introduced by Venkatesh et al. (2003) to provide researchers with more insight into the area of technology acceptance and adaptation. I used UTAUT (Venkatesh et al., 2003) to identify challenges and investigate accommodations to improve communication and language skills, together with John Dewey's (1938) pragmatism theory, which provided structure to guide the interview questions and data collection. Technology holds great promise for nonverbal students with CVI. All interviewees agreed that the appropriate integration of eye gaze technology has been a great equalizer in a special education classroom or during speech therapy sessions. These theories offered insight and guidance for my study to examine educators' perceptions of eye gaze technology on communication and language development for nonverbal students with CVI.

Unified Theory of Acceptance and Use of Technology

The UTAUT was a framework first introduced by Venkatesh et al. (2003) to provide researchers with more information on the area of technology acceptance and adaptation (Parameswarn et al., 2015). Venkatesh et al. (2003) focused on performance expectancy, effort expectancy, social influence, and facilitating conditions as the four core constructs determining behavior intention and use behavior derived from the empirical comparison of the eight prominent theories.

Performance Expectancy

In this study, *performance expectancy* is defined as the degree to which individuals assume that the utilization of technology might be productive and enhancing their daily lives (Venkatesh et al. 2003). Risko, Richardson, and Kingstone (2016) stated that eye gaze has a dual function in human social interaction. This means that we can both perceive information from others and use our gaze to signal to others. Rubo and Gamer (2018) reported that the dual function of the eyes has often been ignored in cognitive research studying social interactions. Since language and CVI are linked to cognition, this is critical with the success of eye gaze technology for students with CVI. However, recent research has implemented ecologically valid approaches that can restore the dual function of eye gaze technology. The belief that someone can see us, intrinsic to live interactions, is thought to recruit a range of social cognitive processes that are missing when participants interact with videos or pictures (Risko et al.,2016).

Subquestion one on the opinions of educators about the ease of use, complexity related to the use of eye gaze technology for communication and language development

of nonverbal students with CVI is linked to performance expectancy. Participants in my study were emotional when they expressed the ability to respond to a student who used eye gaze technology to communicate being thirsty, hungry, bathroom use, tired, or in pain. While students were trapped in their own bodies, there was no avenue to communicate vital needs. Participants talked about one of the first things students learn when using eye gaze technology is to communicate needs. Continuous research will enhance the function of eye gaze technology that will continue to serve more students with complex physical disabilities.

Effort Expectancy

In this study, based on Venkatesh et al's (2003) ideas, effort expectancy was defined as the degree to which individuals can easily use various forms of technologies. Ease of use was one of the themes within the patterns and codes relevant to participants' perceptions on the usefulness of eye gaze technology for students with CVI. All participants in this study reported that eye gaze technology for communication and language development of nonverbal students with CVI was useful. Eye gaze technology has a program with common phrases for the individual to communicate quickly. The device could be attached to the student's wheelchair for easier access and vocabulary increases with the addition of words over time. The absolute adaptability of the device makes it extremely beneficial to a classroom environment. It is a valuable tool used to communicate between students and teachers, take notes, and do research on the internet.

Subquestion four supported effort expectancy with additional supports and facilitations to improve the usefulness of EGT for communication and language

development of students with CVI. Research findings supported that using eye gaze in the classroom has increased inclusivity where tailoring the environment and instruction improve students' performance. Students were able to participate using eye gaze throughout the day socially and make progress with the academic and functional curriculum. The main component that promotes usefulness is increasing accessibility and acknowledging the eye gaze device is the student's voice.

Social Influence

In this study, social influence is defined as the degree to which individuals' use of technology depends on the perception of the people around them and their environment (Dwivedi et al., 2017). Subjective norms, social factors, and image are known to be the three influential factors in the development of social influence as one of the UTAUT key constructs (Venkatesh et al., 2003). During the analysis of the data it emerged that social skills could be a difficult thing to teach using eye gaze technology. It was evident in the study that students are not socializing often; it is still difficult for them because they are not socializing like their typical peers. Games are helpful where there is some social interaction but not as much as casual everyday student-initiated interaction.

Subquestion two addressed social influence by exploring the social, cultural and interpersonal factors that affect the use of eye gaze technology for communication and language development of nonverbal students with CVI. All participants agreed that for many students, it is the first time they have ever had a voice after being trapped in their own bodies. Their thoughts have always been there with no outlet. The findings of my study revealed that without eye gaze, and if a student is nonverbal, communication goes

unrecognized and it seems as though the student experiences a sense of powerlessness. Once they have that voice, using eye gaze technology with words that matches whatever anyone else says, they start to realize the power in communication and that is intrinsically motivating.

Facilitating Conditions

In this study, a facilitating condition is defined as the degree to which individuals who use certain technologies believe that a reliable and well-funded support system was established to help them with the technology, Participants of this study identified some problems regarding the reliability and support systems when using eye gaze technology for language and communication. The teachers agreed that they always need a speech therapist to add boards and troubleshoot the device. Therapists reported frustration for students due to poor internet issues, calibration issues, and the frozen screens. Educators claimed that while eye gaze technology is valuable to students, having a standardized calibration system, additional training, and technical support would be beneficial. Hirai and Kanakogi (2018) stated that students with significant motor challenges were no longer limited to scanning as a single choice for AAC access. AAC specialists have been using light tech eye gaze boards and PVC pipe frames for years, but now we are able to offer voice output.

Subquestion three aligns with facilitating conditions as my study investigated challenges educators face when using eye gaze technology for improving communication and language development of students with CVI. Calibration seemed to be a common challenge amongst educators. They all agreed that the manufacturing companies of eye

gaze technology should invest in refining the calibration system and assist teachers and therapists with understanding the maximum potential of the eye gaze system.

Dewey's Pragmatism Theory

Dewey (1938) believed in pragmatic philosophy where human beings adapt to their environment and their actions are a direct result of that adaptation. Therefore, the experiences of human beings within their environments are the basis of Dewey's pragmatic and constructivist theories. According to Dewey, human experiences within an environment can change the course of action and the effects of various factors within the environment, which can directly influence outcomes (Dewey, 1938). Human activities within an environment can bring about a reaction that is either favorable or unfavorable. It supports the theory that life goes on through interaction with the environment.

In Dewey's pragmatic, cognitive thought processes, he believed that environmental experiences create a basis for, and influence, learning outcomes. Using eye gaze technology for language development to meet the needs students with CVI, activities are created based on different levels of cognition. In my study participant therapists revealed that a student may have come a long way in his or her communicative development and may be able to use complex symbol combinations or words and letters. At the same time, impairments such as CVI may require a layout with large symbols and few choices on every grid. On the other hand, a student may be at an early communicative level and just using single symbols to express needs and wants.

Limitations of the Study

The participants of this study were six speech therapists and six teachers who worked with nonverbal students with CVI using eye gaze technology. The participants were selected through purposive sampling and even though they volunteered, commitment through the data collection process was hindered because of work obligations. At least two of my participants needed to reschedule the interview session several times. Participants were required to serve students remotely due to the pandemic COVID-19 and since this was a new process, a few of my participants expressed some stressful situations at work. Moreover, because the data was collected from the participants recruited from my social media platforms such as LinkedIn, QIAT Listserv, Twitter, and Instagram, the invitation may not have reached participants without access to these platforms. I increased transferability of the study through keeping reflective journals and memos as well as recording every step taken in the process of the research in order to help other researchers replicate it in different contexts.

My bias could have been another factor that affected the outcome where I attempt to guide the interviewee toward providing my desirable answer. I avoided this type of bias by designing interview questions precisely. This allowed the participants to express their opinion freely, providing responses to the interview questions. As the interviewer, I encourage the participants to answer the questions honestly and elaborate when necessary. However, I was very cautious about not allowing my personal opinions to interfere with their experiences and viewpoints.

Recommendations

The purpose of this study was to gain a deeper understanding of what educators think about the usefulness of eye gaze technology for communication and language development of nonverbal students with cortical visual impairment. In this study, I examined educators' viewpoints on the usefulness and challenges associated with implementing eye gaze technology for students with CVI. Results demonstrated an emphasis on improving conditions for teachers and speech to become more effective with the implementation of eye gaze technology. The specific conditions educators expressed were; a technical support system, a standardized calibration system, resources and additional knowledge and skills. In addition, since eye gaze technology is quite costly, investment from stakeholders would increase availability. The cost of a device was very high but over time has become a little more affordable and portable.

Based on my findings of this study, I recommend that more resources should be made available to teachers and speech therapists using eye gaze technology with students. In addition, I recommend more time should be allotted in special education teachers' schedules for preparation time, related duties, and time for professional development training related to educating nonverbal students with CVI. Teacher participants considered additional time as necessary to address the needs of students with CVI. Both participant groups desired additional training regarding eye gaze technology implementation to increase their knowledge and skills. Additionally, teacher participants emphasized the need for technological support, so they are not dependent on the speech therapist to update the device. Nonverbal students with CVI who use eye gaze technology

for functional communication skills could experience more positive communication interactions and increase their social and academic opportunities. Functional communication skills contribute to forming relationships, the expression of feelings, thoughts, and needs. Therefore, nonverbal students with CVI could use eye gaze technology to become more involved with their community and increase their independence

UTAUT (Venkatesh et al., 2003), was used as one of the conceptual frameworks of this study. Venkatesh et al. (2012) identified performance expectancy, effort expectancy, social influence and facilitating conditions as the four core constructs determining behavior intention and use behavior derived from the empirical comparison of the eight prominent theories. The themes and findings of this study could address some of the core constructs of UTAUT; however, there was no information on students' and parents' viewpoints. Further studies can be conducted including student and parent perspectives as criteria for recruitment to gain a deeper understanding of the usefulness of eye gaze technology for communication and language development of nonverbal students with cortical visual impairment.

Implications

This basic qualitative study provided evidence to support the usefulness of eye gaze technology for communication and language development of nonverbal students with CVI. The findings of this study will assist speech therapists and teachers with providing a more inclusive environment for students seem to be trapped in their own bodies with physical limitations and cannot access a touch system to communicate. The

discoveries of this study demonstrated the possibility for nonverbal students with CVI to communicate and develop language skills. Students with CVI gained eye gaze skills, maintained those skills between sessions, and learned to communicate.

The results of this study also confirmed that no students with CVI should be denied access to language, learning, communication, and full participation. Learning, communication, and language development are developmentally linked. As a result, improvement in functional vision and communication for nonverbal students with CVI should be expected and can result in improvement across other developmental domains. The findings of this study also revealed the need for manufacturers of the device to investigate standardized calibration. Since calibration is individualized to the user, this would decrease the need for excessive technical support. Presently, eye gaze technology is used all over the world but not affordable to everyone. Once people understand the efficacy for eye gaze technology, it could change how nonverbal students with CVI communicate and develop language skills.

Implications for Social Change

The purpose of this study was to gain a deeper understanding of what educators think about the usefulness of eye gaze technology for communication and language development of nonverbal students with CVI. Eye gaze technology was perceived as a beneficial tool for nonverbal students with CVI. Because of eye gaze technology, nonverbal students with CVI learned to participate in activities not previously possible, and the research findings indicated that the opportunity to experience new things and discover new abilities lead to increased possibilities to improve communication and

develop language skills. Both participant groups in this study confirmed that eye gaze technology can improve communication and language development.

After examining the literature, there was no evidence supporting educators' viewpoints related to the usefulness of eye gaze technology for nonverbal students with CVI. There were some barriers identified in the current research that affected implementation of eye gaze technology. After researching educators' viewpoints on the usefulness of eye gaze technology for communication and language development for nonverbal students with CVI, the findings filled the gap in the research literature by proving usefulness. Some challenges were uncovered but it was limited to the functional issue of the device rather than the usage by students. The research findings promote positive social change as students with CVI are provided with opportunities using eye gaze technology to improve communication and language development.

Conclusion

The three main identified themes in this study, the effectiveness of eye gaze technology, ease of use and functional benefits were main factors influencing educators' viewpoints on the usefulness of eye gaze technology for communication and language development. Although eye gaze technology as an alternative access method for AAC is promising for many students with complex communication disabilities, knowledge and skills of the educator in gathering evidence to choose eye gaze access is critical to achieve the desired outcome of effective communication and language development. All participants agreed that students' motivation and engagement increased with the use of eye gaze technology. Participants reported that other students in the classroom began to

pay attention and listened as their classmate responded using eye gaze technology. Then, students would respond and become reciprocal. The student using eye gaze technology focused on the lesson activities. Speech therapists encouraged teachers to integrate eye gaze technology into all classroom activities throughout the day.

There are some challenges with using eye gaze on a high tech device that educators need to consider during the evaluative process. Some issues that may affect the ability to use eye gaze include access, movement disorders, certain medications including antidepressants and Baclofen. In addition, students with CVI may have difficulty with visual recognition of symbols and may need highly individualized modifications of the appearance of boards/symbols. The overall perception of eye gaze technology is that it is a hallmark technological achievement in the world of speech generating devices.

The use of eye gaze technology for nonverbal students with CVI for communication and language development have made a significant impact on the field of special education. The findings of my study revealed that eye gaze technology has been a great benefit to students who were *trapped in their own bodies* and have physical limitations where they cannot use a touch system to communicate. Using eye gaze technology by just looking at a screen and getting a reaction has really opened up doors for students. The therapists liked the continuum and that it is not a *one size fits all* device. The device is adjusted and calibrated to function for the individual user. Participants had positive feelings about the technology and continuous advances.

This study provided evidence to support the usefulness of eye gaze technology by special education teachers and speech therapists. The methodology for this study was

discussed along with the research design, questions, ethical procedures, data collection and analysis. The findings of this study should not be generalized to educators' perception on the usefulness of eye gaze technology for communication and language development of nonverbal students with CVI. However, an exploration of the effect of selectively different experiences of eye gaze communication on early social and communicative development could be beneficial. Continuous research on reaching nonverbal students with CVI who are *trapped in their own bodies* will enhancing the functionality of eye gaze technology and will continue to serve more students with complex physical and cognitive disabilities.

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