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Social Communication and Technology

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(First Fly Leaf)

SOCIAL COMMUNICATION AND TECHNOLOGY

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SOCIAL COMMUNICATION AND TECHNOLOGY

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Abstract

Research has been well documented as to the effects of screen time on mental health, physical health, cognitive development, and social development. However, little research exists as to the effects of screen time on the nonverbal aspects of communication, specifically eye gaze. In order to inform speech language pathologists when treating children with language and pragmatic disorders, this study examined the eye gaze of participants during physical play. Twenty-six participants from 5 to 8 years of age were recruited from a western Kentucky school. Results of eye gaze durations in participants were compared to screen time amounts in the home. Screen time averages were divided into two categories: passive screen time (e.g. television and videos) and interactive screen time (e.g. video games). No statistical differences were noted for either category.

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Chapter I

Introduction

As early as infancy, children begin to learn language. Caregivers assist in this process by speaking and responding to their infant as if the child already possesses the ability to comprehend complex language. During this exchange, the caregiver will pause allowing the child time to "speak" establishing turn-taking style interactions. They will also label items or events in the immediate vicinity, give meaning to utterances—both voluntary and involuntary, and begin sending verbal and nonverbal signals to the child. The caregiver, although unintentionally, is increasing the child's vocabulary as well as introducing the infant to the social aspects of communication. Researchers have reported the caregiver's role in developing the child's language is crucial (Kaderavek, 2015; Zampini, Salvi, & D'Odorico, 2015). During the first year of life, the caregiver is the primary communicative partner, thus has the greatest impact on language growth.

The main facilitator for increasing the child's language acquisition and communication during this early stage in an infant's life is believed to be through joint attention. Joint attention requires both communicative partners to focus on the same object or event. Once both communicative

partners establish focus, the caregiver labels the object or event expanding the child's vocabulary. Along with increasing a child's lexicon, joint attention also starts the process of interpreting and developing nonverbal cues during conversation.

Ho, Foulsham, and Kingstone (2015) stated eye gaze during conversation is used for more than polite social skills. This form of social communication also sends information from both the speaker and the listener. For example, when the speaker is speaking, eye gaze signals, "I have the floor." When the listener is actively listening, eye gaze signals, "I am listening." Through eye gaze, conversation flows from one speaker to the next. During everyday activities the caregiver begins to teach the child these rules of language in the early years in naturalistic settings using the nonverbal cues and eye gazes (both eye-to-face gaze and glancing away from the child).

Joint attention and eye gaze initiated and interpreted by the caregiver are not the only way children learn the rules of language. Children also learn through physical play (Buckley, 2013). When the child is old enough to voluntarily move his or her own hands, the child will begin manipulating toys and objects in the environment. Items being placed close to the child by the caregiver often encourage the child to learn more about his or her surroundings. When the child begins to manipulate the object, the caregiver will interpret the child's eye gaze and manipulation of the toy as purposeful

focus and will label the object. This combined form of learning helps the child begin to interact with his or her surroundings (Buckley, 2013).

From this point, the child will move into interactive play with peers and adults further developing social and verbal skills needed for communication (Buckley, 2003; Mistrett & Bickart, 2010). It is common during interactive or imaginative play to observe a child bring a block to his or her ear pretending to use a telephone. This indicates the child has seen the communication model of speaking on a telephone and is practicing the skill. Through these imaginative play opportunities, the child begins to manipulate and practice in his or her environment individually and with peers or adults (Buckley, 2003; Mistrett & Bickart, 2010).

Knowing from past research that children develop language through interaction with caregivers and manipulating their environment, Christakis et al. (2009) questioned whether the dynamic from caregiver to child would change if technology were present. These researchers conducted a study involving recorders placed on the child throughout an entire day. Following this study, Christakis et al. reported a television playing in the vicinity altered the conversational patterns of the adult towards the child. The authors stated the caregivers spoke 500-1000 less words per hour when technology was present (Christakis et al., 2009).

Having the combined research of Ho et al. (2015) and Christakis et al. (2009) a gap in literature appears to be present regarding the effects of

technology on the social communication aspect of eye gaze. Ho et al. reported eye gaze is used as a way to regulate turn-taking in conversation. Christakis et al. concluded fewer utterances occurred by the caregiver when technology was present. These two bodies of research bring to question how technology, or specifically screen time, could effect a child's language acquisition and use including nonverbal communication, specifically eye gaze. Kaneshiro (2015) defined screen time as a sedentary time spent engaged in a tablet, computer, television, or cellphone. If the pattern of adult-to-child communication is interrupted and produces less exposure to language for the child, does it also have a negative impact on social communication?

When there is a breakdown in communication or language development, a speech-language pathologist evaluates a child and attempts to assess the child's social skills. He or she relies on evidenced-based research to conclude what is typical and what is not typical. For a child to be considered delayed in social communication, there must be research to corroborate that stance. Therefore, studies must be conducted to see what typical social communication, specifically eye-to-face gaze, looks like.

Most children around the age of five begin to transition from playing to learn to instructional learning when entering public or private schools. Since this transition is standard for most children in the United States, the school setting provides scholars a uniform environment to examine children from different backgrounds or home settings. For this reason, this thesis study will

focus on children ages five through eight who are in the same environment (i.e. public schools) in order to gather data to better understand how eye gaze differs in typically developing children based on passive (e.g. watching television or videos) and interactive (e.g. playing video games) screen time averages in the home. Additionally, the thesis project will run as an additional variable within the primary research study.

Chapter II

Literature Review

Research has been completed as to the effects of screen time use regarding language development (Christakis et al., 2009), cognitive load (McEwen & Dubé, 2015), health concerns such as obesity (Christakis et al., 2004), cognitive development (Hsin, Li, & Tsai, 2014; McEwen & Dubé, 2015), and social development (Ho et al., 2015; Hsin, et al., 2014). In the area of speech language pathology, overall amounts of time focused on teaching language in the form of joint attention have been studied (Bono, Daley, & Sigman, 2004; Zampini et al., 2015). However, when combining the topics of language acquisition and screen time, is there a correlation? Does screen time in the home effect the child later in regards to social communication? This thesis project aims to look at both areas and determine whether there is cause for further investigation.

Language Development

Joint attention. Joint attention is defined as periods of time in which the child and communication partner are focused on the same object or event (Buckley, 2003). To establish joint attention, the communication partner looks at the eye gaze of a child and assumes the eye gaze is consistent with

the child's focus. The social interactionist theory promoted by Lev Vygotsky, stated the adult's role in language development of children was crucial (Kaderavek, 2015). Through interactions with more able peers and adults, children are motivated to learn language, problem solve, and interact with the world around them. Many times, these influential individuals are the child's own caregivers. The caregiver will begin labeling objects or actions, respond to the child's utterances—establishing a turn-taking order, and build on the child's utterance by expanding on and making the utterance meaningful.

Jerome Bruner also promoted the social interactionist theory to the western culture during the 1980s and explained five ways the caregiver assists in the development of the child's language acquisition: infant-directed talk, coordinating attention, scaffolding, mediation, and parent-child communication routines (Kaderavek, 2015). First, during infant-directed talk, also referred to as parentese, the parent uses varying intonation while speaking to the child regarding items or actions in the child's field of view. During coordinating attention, or joint attention, the adult will match the attention and eye gaze of the child. The adult will often point to and label items during this type of attention. When scaffolding, the parent will add support related to what the child's actions. Often, scaffolding will include many supports at the beginning and will fade supports as time goes on. Through mediation the parent will talk about the activity or steps needed for

the child to work independently. Finally, during caregiver-child communication routines, the caregiver will create predictable routines to create a pattern or familiarity in order for the child to see his or her role in communication. During these times, the caregiver may say and wave "bye-bye" while expectantly waiting for the child to respond. During all of these types of interactions, the caregiver naturally guides language development according to the social interactionist theorists (Kaderavek, 2015).

When joint attention is initiated both by the caregiver and the child it helps to "organize perceptual information and develop language skills as a direct product of understanding of referential cues across attempts to initiate, maintain, or increase participation in spontaneous social interactions that provide a rich array of social learning opportunities" (Bono et al., 2004, p. 496). During typical daily activities, children listen to their caregivers, establish joint attention, and begin to understand both the cognitive and social aspects of language. Through this interactive form of teaching, the child begins to establish and create his or her lexicon. The action of labeling and the development of the child's early vocabulary are performed in such a naturalistic setting the caregiver often does not recognize information is being taught.

Zampini et al. (2015) studied the relationship between joint attention and the child's vocabulary growth. The authors reported a correlation between the time a child spends in joint attention at 14 months and

vocabulary size by the ages of 18 and 24 months. This discovery supports the hypothesis a child continues to process and store information gathered by the caregiver throughout social interactions. Researchers have supported joint attention as being a language-learning activity and have suggested children who respond to joint attention by their communication partner at least 85% of the time gain more language skills than their peers who respond less to joint attention (Bono et al., 2004). This information substantiates the importance joint attention has on the development and acquisition of language.

Christakis et al. (2009) conducted a research study and questioned how the introduction of a television effected the caregiver's interaction with the child. The authors hypothesized with a television present, a caregiver would interact less with his or her child (Christakis et al., 2009). This hypothesis arose from a previous research study in which the authors' reported an association was found between language development and infant television or video viewing. To test their hypothesis, Christakis et al. recorded monthly sessions in which the parents placed a recording device in the pocket of the child's vest. From the moment the child woke up to the moment the child went to bed at night (removing only for naps, bath, and car rides) the device recorded daily activities and vocalizations. During the first three months, the caregivers were instructed to turn off any ambient noise, such as televisions

or radios. Instructions were to not to turn off televisions or radios and to go about typical daily activities throughout the final three months of the study.

Following the study, Christakis et al. (2009) reported a reduction of "parental word counts, child vocalizations, and conversational turns for children 2 to 48 months of age" (p. 556) when the television was on. Televisions were in the same room or an adjacent room. During these times, 500 to 1000 fewer adult words were spoken per hour of television. Christakis et al. state adult norms are 941 words per hour. During this reduction in word count, the child had decreased exposure to language while the television was present. The authors suggest the reduction of words spoken were likely due to the child viewing television alone or the parent being distracted by the television (Christakis et al., 2009).

This thesis project aims to gather information regarding possible implications technological devices, such as tablets, televisions, and cellular devices, can have on the development of social communication. Considering children learn not only language acquisition through caregiver/child interaction but also learn the social aspects of language, the question remains as to whether large amounts of screen time with these devices hinder the development of social communication in the same way it creates a negative effect on language acquisition (Carpenter, Nagell, & Tomasello, 1998; McCauley & Fey, 2006; Tomasello, 2001).

Eye gaze. Joint attention is not only important to build vocabulary, it is also a tool utilized by caregivers in teaching the social aspects of communication. Eye gaze is a form of social communication and shifts in eye gaze are believed to be used to regulate turn-taking and the flow of conversation (Ho et al., 2015). Just as eye gaze is used during joint attention to label objects and develop the child's vocabulary, eye gaze is also used to establish moments to speak and moments to listen (Ho et al., 2015). These social aspects of communication seem to be guided by the caregiver in the same way the caregiver guides the development of language. Often, the caregiver will speak to the child, wait for the child to make a sound, and then respond to the child. During the establishment of turn-taking, the caregiver will often nod his or her head, gesture, or make nonverbal movements to not only show the caregiver is listening to the infant but also signaling the caregiver is ready to speak (Ho et al., 2015). Attending to the caregiver from a young age fosters the child's ability to develop language, better understand his environment, make informed judgments, and develop important skills to interact successfully in a social environment (Freeth et al., 2013).

Ho et. al (2015) conducted a study specifically looking at eye-to-face gaze towards and away from the communication partner. The authors suggest eye-to-face gaze indicates different intentions during the conversation. Ho et al. (2015) theorized the speaking and listening partners both contribute actively when joined in conversation. For example, the

listening conversational partner requests a turn to speak by gesturing more frequently as well as shifting gaze prior to speaking. Once speaking, the conversational partner averts gaze signaling he or she has the floor and plans to continue speaking. When the speaking partner intends to transition to the listening role, the individual gazes at the listening partner to signal the turn is over. This element of give and take shows both conversational partners play vital roles in successfully continuing the dialogue. The authors' research has been conducted with this hypothesis in mind; however, the research of the study was not performed in a naturalistic setting (Ho et al., 2015).

To continue with their hypothesis and test the theory in a more naturalistic setting than previous experiments, Ho et al. (2015) monitored eye-to-face gaze during typical turn-taking behaviors in a separate study. The study continued with the assumption an individual gazes more frequently at the listening partner's face when speaking but holds the gaze for longer when listening. For this study, the researchers recruited thirty-eight undergraduate students from the University of British Columbia. Participants were paired and played two games (*Head's Up* ™ and *20 Questions* ™).

During the games, the students wore mobile eye tracking devices similar to the Tobii Pro Glasses 2 Eye Tracking System utilized in this study to track the eye gaze of both the speaker and the listener (Elvesjö, Skogö, & Eskilsson, 2014a). Ho et al. (2015) concluded eye-to-face gaze is used to signal

when one communication partner has the floor and the other is listening. Their findings showed speakers end the turn with a direct eye-to-face gaze at their partner, the partner begins speaking around 400ms later, the partner will begin speaking and then gaze back at the listening partner 700ms later. These results show eye gaze plays a dynamic role in of social communication.

Freeth, Foulsham, and Kingstone's (2013) findings are consistent with Ho et al.'s (2015) results. Additionally, the authors stated active speaking participants averted eye gaze when answering questions by an interviewer. Seeking to compare a more naturalistic setting to a laboratory setting, the investigators interviewed thirty-two undergraduate students studying at the University of British Columbia. During this experiment, the participants were asked to speak about four different topics. Some individuals were asked via live interviewers; other participants were asked through a video of the interviewer. The goal was to analyze eye gaze patterns of the interviewee when listening and answering questions. The authors theorized having an individual present and in the room would alter the eye movements when compared to a video (Freeth et al., 2013).

Both scenarios produced results showing participants averted their eye gaze when answering questions; however, the researchers noted participants who were interviewed by an individual present in the room looked at the experimenter's face when eye-to-face gaze from the interviewer was present. This action did not take place for those asked questions by an interviewer via

video. The authors concluded the aversion of eye-to-face gaze while speaking signaled to the experimenter that the interviewee had not completed his answer and was not ready for the next question (Freeth et al., 2013).

Screen Time

Children today have more access to technology than any generation before. From televisions to computers, children begin at a very early age being introduced and participating in activities with technology. These intervals with technology are often referred to as screen time. Kaneshiro (2015) defined screen time as a sedentary interval with an electronic device such as: television, computer, tablet, or cellphone.

Strasburger (2010) reported the American Academy of Pediatrics (AAP) claimed sleeping is the only activity children are engaged in more than technology usage. Due to these concerns, the AAP has established screen time recommendations for children from birth to two and also ages two and older. The AAP recommendations caregivers spend time in interactive play sessions in place of screen time for children younger than two years of age. For children over the age of two, caregivers are encouraged to only permit the child to participate in activities with screen time two hours per day or less (Council on Communications Media, 2013).

Kaneshiro (2015) stated the average child exceeds the AAP's recommendation of two hours per day for children over the age of two and reported the average American child is engaged in an average of three hours

per day of both watching television and playing video games. Strasburger, Jordan, and Donnerstein (2010) also reported higher averages and stated the youth in America exceeded seven hours per day of combined screen time. These results are broken down into an average of four-and-a-half hours of television viewing and three hours of computers and video games. Brown's (2011) previous results were not as conservative as Kaneshiro's (2015) later results or Strasburger et al.'s (2010) and stated many families have the television on six hours per day or more, and thirty-nine percent of families with infants and young children have a television on constantly. Although each of these authors report different exact amounts American children view television or play video games, it does indicate screen time has become part of daily life for American children.

Research on health effects from screen time. Data on screen time has been collected for study in many aspects of a child's life. Some of the research includes hours per day the child: watches television (with adults or individually), surfs the internet, plays video games, spends time with a television playing in the background (Christakis et al., 2004). In addition, the number of days per week the child eats a meal while watching television, whether the child possesses a television in his or her bedroom, and how engaging and useful devices are in the learning environment have been examined (Hsin et al., 2014; McEwen & Dubé, 2015; Yimaz, Caylan, & Karacan, 2014). These variables were investigated in research studies to look

for links between screen time and the following: weight gain, linguistic development, cognitive development, and social development (Christakis et al., 2004; Christakis et al., 2009; Ho et al., 2015; Hsin, et al., 2014; McEwen & Dubé, 2015).

Researchers have shown a correlation between hours of screen time and negative health effects (Anderson et al., 2003; Bushman & Anderson, 2009; Strasburger et al., 2010). Whether the health effects are physical or mental, time spent in front of a screen (television, tablet, gaming system) is argued by these authors to lead to negative effects on a child's health. This information begins to establish questions as to the effects screen time has on other aspects of daily living. This thesis project aims to better understand the relationship between large amounts of screen time and eye gaze as a social aspect of communication.

Positive and negative effects of screen time on language development and social communication. Contradicting research is present as to the positive and negative effects of screen time on the development and use of language and social communication in children (Hsin et al., 2014; Infante et al., 2010; Sharkins, Newton, Albaiz, & Ernest, 2015). Some say technology creates too high of a cognitive load, decreases executive functioning abilities, creates poorer academic performance, hinders the child's social skills from developing and decreases the quality of social communications due to the lack of in-person interaction, and may create difficulties in the child's physical and

emotional development (Hsin et al., 2014; Sharkins et al., 2015). Other researchers argue technology brings generations together, creates interactions, and promotes social communication (Infante et al., 2010). Information regarding how technology is used and the effects screen time has on a child are important to uncover not only for parents but also educators and speech language pathologists.

To look at technology in the classroom, McEwen and Dubé (2015) conducted a research study to determine whether tablets used for education were beneficial or created too large a cognitive load impairing the educational process. The researchers hypothesized although tablet computers are thought to be effective tools for learning, the electronic devices create a cognitive load impairing the working memory from holding information required to perform the task at hand. With an estimated 195 million tablet devices sold in 2013 (Gartner, 2014), McEwen and Dubé (2015) saw the need to see how these devices are effecting the working memory of the child and tested the hypothesis.

McEwen and Dubé (2015) enlisted thirty second-grade students during the 2013-2014 school year for their study. Participants worked through one simplistic and one complex mathematic application on a tablet device. Researchers utilized the 60Hz FaceLab 5 eye tracker similar to ones utilized in the current research project to observe eye gaze, fixation count, and fixation duration during the research project. The authors concluded the

tablet computers and educational applications created impairments in the working memory of students. The educational applications were described as being complex, and the authors recommended educators use less complex applications when implementing tablets in the classroom to lessen the cognitive load for the child.

While McEwen and Dubé (2015) concluded electronic tablet use creates a negative impact on the child, Hsin et al. (2014) came to different conclusions. Through a systematic review, these authors gathered information from 87 published articles from the Web of Science database during 2003 to 2013. Information was collected as to the relationship between technology and learning in children. Following their review, the investigators indicated most of the articles suggested a positive relationship between technology and learning. The authors stated the majority of articles suggested a positive effect of technology on social communication. The examples given were: children often collaborate with peers to complete tasks or achieve new levels in video games, technologies used in the home promote adult-child interaction and maintain family relationships as adults and children work together to achieve a technology-related goal, and the use of technology promotes the child's development of multiculturalism. Children use items around them, whether play toys or technology, to communicate to family members and peers. Hsin et al. (2014) deemed technology a useful way

for children to develop expressive language when interacting with family members in the home as well as peers in the classroom.

When looking at technology and children's cognition, researchers come to different conclusions as to the positive and negative influences. Brown (2011) claimed children older than 2 years of age who watch high-quality educational programs appear to possess higher social and language skills as well as overall school readiness. However, Schmidt, Rich, Rifas-Shiman, Oken, and Taveras's (2009) longitudinal study showed no greater cognitive development in two-year-old children who watched television over their three-year-old peers who did not watch television.

While researchers argue the positives and negatives of screen time, the question as to the effects of screen time on communicative language, such as eye gaze, remains. To help answer this question, this thesis project will gather data examining the differences in eye-to-face gaze averages between typically developing children ages five through eight years old when engaged in a physical play activity. This information when compared to screen time averages in the home will begin to answer whether screen time has an effect on the communicative development of social language.

Chapter III

Methodology

Participants

Twenty-six typically developing five through eight-year-old students were recruited from western Kentucky. The caregivers received a flyer sent home from school with an initial invitation and information regarding the primary research study. If interested, the caregiver returned the flyer, which included their contact information. The primary investigators reviewed the informed consent document over the phone with interested caregivers, and consent forms were returned to school for each participant. The primary investigator and classroom teacher coordinated scheduling of the participant. Information has been submitted and approved by the Institutional Review Board at Murray State University.

Research Design

A nonexperimental research design was used for this thesis project. Information for each participant on daily screen time averages was gathered through a parent questionnaire.

Procedures

Primary research study. Each participant completed a warm-up activity and two research conditions. Administration of conditions were counterbalanced. The Tobii Pro Glasses 2 Eye Tracking System (Elvesjö, Skogö, & Eskilsson, 2014a) recorded eye gaze location and duration during each condition. Data was tracked and analyzed using the Tobii Pro Analyzer software suite (Elvesjö, Skogö, & Eskilsson, 2014b). Information gathered was utilized to view possible differences between screen time play and physical play on the social communication aspect of eye gaze.

The experiment began with the adult and child participating in a warm-up activity. During the warm-up activity, the adult and child took turns retrieving and labeling interesting objects while playing a popular language intervention game (*What's in Ned's Head* TM). Condition A (real castle block game) and condition B (castle block game on iPad) followed the warm-up activity.

During condition A, the adult and child took turns playing with a real wooden block set including a variety of castle pieces and animal figures. The research procedure began when the child entered the room with block castle built. The child had the opportunity to roll a ball to knock the castle down or add additional blocks or animal figures to the castle. In response to the child's initiation (either verbally or nonverbally), the investigator returned with at least ten positive comments or statements regarding the child's

actions or engagement with the materials. These comments were used to open the dialogue and provide opportunity for the child to respond verbally or through eye gaze.

During the second condition (condition B), the adult and child took turns playing a virtual block game on an iPad including a variety of castle pieces and animal figures just as in condition A. However, in place of physical blocks being manipulated, the items were on the screen of an iPad. The adult responded verbally to initiations made by the child in the same manner as condition A.

Thesis project. Research has been gathered in regards to social interaction and development during passive screen time (e.g. television and videos) and interactive screen time (e.g. video games) durations (Hsin et al., 2014; Infante et al., 2010). However, this thesis project aims to see if there is a relationship between the two types of screen time and eye gaze. To look at each type of screen time specifically, the research question was divided into the two separate categories. A parent questionnaire was sent home with each participant to gather data and was returned back to school by the student. Using a Likert scale, parents answered the following questions:

What is the daily average your child views television or videos?
(A) Less then one hour
(B) More than 1 hour and less than 2 hours
(C) More than 2 hours and less than 3 hours
(D) More than 3 hours

What is the daily average your child plays video games (computer, tablet, cellphone)?
(A) Less then one hour
(B) More than 1 hour and less than 2 hours
(C) More than 2 hours and less than 3 hours
(D) More than 3 hours

Data Analysis

Results for each question on the parent questionnaire were divided into two categories (above average and below average). The daily averages were adapted from Kaneshiro (2015) who reported the average American child spends around three hours per day in each category (watching television and playing video games). Therefore, data reported above Kaneshiro's (2015) averages of more than three hours per day fell into the "above average" category. Daily averages below three hours per day fell into the "below average" category. Subcategories within the "below average" category allowed for additional comparisons.

Following the primary research study, data from the Tobii Pro Glasses 2 Eye Tracking System (Elvesjö et al., 2014a) were analyzed using the Tobii Pro Analyzer software suite (Elvesjö et al., 2014b) comparing condition A to the daily screen time averages collected through the parent questionnaire. An Analysis of Variance (ANOVA) was used to compare the above average screen time amounts and below average screen time amounts to the primary research study results of eye gaze. These comparisons were analyzed following the real block play scenario (Condition A) in order to answer the research questions as to the relationship between daily screen time averages

and the social communication aspect of eye gaze in children five through eight years of age.

Chapter IV

Results

Examiners gathered and categorized data to determine whether a relationship exists between screen time averages in the home and the nonverbal communication of eye gaze for typically developing children ages 5 to 8 years old. The research questions were divided into two categorical questions: 1) Is there a difference in duration of gaze in typically developing children ages 5 to 8 when engaged in physical play based on below average passive screen time and above average passive screen time averages in the home? 2) Is there a difference in duration of eye gaze in typically developing children ages 5 to 8 when engaged in physical play based on below average interactive screen time and above average interactive screen time averages in the home? Research was analyzed using an Analysis of Variance (ANOVA) to compare daily screen time averages and eye gaze durations to answer both research questions and look for statistically significant differences.

Research Question 1) Is there a difference in duration of eye gaze in typically developing children ages 5 to 8 when engaged in physical play based on below average passive screen time and above average passive screen time averages in the home?

The first research question looked at the difference in duration of eye contact in typically developing children ages 5 to 8 when engaged in physical play based on below average passive screen time and above average passive screen time averages in the home. Given that assumptions for equal variance were met, ANOVA was deemed a suitable procedure for these data. A statistically significant difference was not found for: (a) eye gaze fixated on toy $F(2, 22) = .253$ $p > 0.5$; (b) eye gaze fixated on researcher's mouth $F(2, 22) = .949$, $p > 0.05$; (c) eye gaze fixated on researcher's eyes $F(2, 22) = .377$, $p > 00.5$; and (d) eye gaze fixated on researcher's face $F(2, 22) = .3.144$, $p > 0.5$.

Research Question 2) Is there a difference in duration of eye gaze in typically developing children ages 5 to 8 when engaged in physical play based on below average interactive screen time and above average interactive screen time averages in the home?

The second research question explored differences in duration of eye gaze in typically developing children ages 5 to 8 when engaged in physical play based on below average interactive screen time and above average interactive screen time averages in the home. Given that assumptions for equal variance were met, ANOVA was deemed a suitable procedure for the following analysis: eye gaze fixated on toy and eye gaze fixated on researcher's mouth. A statistically significant difference was not found for either case: (a) eye gaze fixated on toy, $F(2, 22) = .485$ $p > 0.5$; and (b) eye gaze fixated on researcher's mouth, $F(2, 22) = .654$, $p > 0.05$.

Assumption for equal variance was not met for either eye gaze fixated on researcher eyes or eye gaze fixated on researcher's face. Thus, independent samples t-test were conducted for these data (groups were identified by number of participants who have less than one hour of screen time [$n = 15$] and number of participants who have more than one hour of screen time, but less than 2 hours of screen time [$n = 6$]) that viewed television; and within this analysis, assumption for equal variance was not violated. Results for the sample revealed that mean eye-to-eye contact time for participants who had one hour of screen time did not exceed the mean eye-to-eye contact time for participants who had more than one hour of screen time, $t(19) = 1.834$, $p > 0.05$. Furthermore, results for the sample revealed that mean eye-to-face contact time for participants who had one hour of screen time did not exceed the mean eye-to-face contact time for participants who had more than one hour of screen time, $t(19) = .478$, $p > 0.05$.

Chapter V

Discussion

The purpose of this thesis project was to begin to explore the possible implications of passive screen time averages and interactive screen time averages on eye gaze. However, no statistical differences were noted when looking at above screen time averages or below screen time averages for either category when compared to eye gaze averages. Additional analysis was conducted to examine subcategories of the "below average" category (i.e. less than one hour, more than one hour less than two, more than two hours less than three). No statistical differences were noted when examining these subcategories. Implications, limitations, and considerations for future research will be summarized in the following sections.

Implications

As previously stated, results of this thesis project show no statistical differences between screen time averages in either passive screen time or interactive screen time when compared to eye-to-eye contact or eye-to-face gaze. In light of these results, one may attempt to suggest no information was found. However, the lack of statistical differences does not necessarily imply no information can be found from this thesis project. For example, a

systematic review was conducted by Hsin et al. (2014) to examine the relationship between technology and learning in children. Hsin et al. (2014) found many articles state a positive relationship between technology and social communication. The authors went on to conclude technology was a useful way to develop expressive language in children when utilized with adults or higher functioning language partners. While this thesis project did not look at eye gaze development through technology, the notion a parent may be teaching this form of communication while using technology cannot be ruled out.

Hsin et al. (2014) results were consistent with Jerome Bruner's (1983) position that stated children learn through everyday routines with parents. Acknowledging screen time has become part of everyday routines for many parents in the western culture, one can begin questioning whether children may also be developing the conversational use of eye gaze during these daily routines with technology. Ho et al. (2015) suggests eye gaze signals the beginning, sustaining, and ending of conversations with communication partners. Just as parents and caregivers teach turn-taking during the verbal aspect of conversation, parents also teach the nonverbal use of eye gaze.

However, the results of this thesis project are not consistent with Christakis et al.'s (2009) research project and conclusion that the usage of technology negatively impacts the child. Christakis et al. (2009) hypothesized having a television present would reduce adult-to-child interaction and

performed a research project to test this hypothesis. Christakis et al. (2009) concluded following the research study that the parents spoke 500-1000 less words per hour. Considering the average adult speaks 941 words per hour, this research shows a reduction in words the caregivers spoke to the children (Christakis et al., 2009). This reduction is important to note because it shows the child had less exposure to language when the television was present.

While this thesis project did not actively study language development, a negative impact was not seen in children's use of social communication. If we conclude a parent or caregiver guides the child's social communication in the same manner as language development, a negative impact following technology usage should have been seen. However, no statistical differences were noted. This data is not significant enough to conclude screen time does not effect the child's acquisition of eye gaze as a means of social communication. However, the results also cannot determine Christakis et al.'s (2009) findings are consistent with social communication development.

Limitations

The research project was designed by randomly assigning students to an activity (Condition A or B) he or she would participate following the warm-up activity. The initial hopes for the research project was to have 60 students randomly assigned to these scheduled activities. Unfortunately, only 26 parents of the students ages 5 to 8 years old at the school in western Kentucky gave consent and filled out the parent questionnaire. While 26

participants were adequate for the study, the larger sample size originally projected would have been more representative of the test population. Roessner (2014) states larger sample sizes show a greater representation of the population. A larger sample size would have provided a better representation of the overall population and offered more information to aid in determining whether a relationship exists between passive and interactive screen time averages and eye gaze.

Additionally, the way in which information was gathered may have created a condition for the halo effect to alter data given by parents on the questionnaire. To gather information, parents completed the questionnaire regarding daily averages of passive and interactive screen time in their homes and sent it back to the school to be collected. This method of gathering information relies heavily on the accuracy to which the parents report the hours the child is engaged in screen time versus the actual minute-by-minute count. The halo effect refers to an individual making inferences about another individual with few facts or information (Forgas, 2011). In this case, the parents were not making inferences on others but may have felt inferences would be made towards him or her based on information given. With the negative social stigma in western culture regarding high screen time averages in the home, parents may have felt pressure to self-report a lower screen time average for their children than was accurate. While this idea cannot be proven, it is a limitation that requires being noted.

Considerations for Future Research

Research going forward should explore the use of technology to initiate conversation between children and peers or adults. Hsin et al.'s (2014) notion of technology being an aid to developing expressive language in children should be explored further and extended to nonverbal language, specifically eye gaze. Study in this field would not only enrich the information pool accessible to speech language pathologists but also aid parents in ways to guide the development of eye gaze.

Future research should continue looking deeper into the relationship between screen time averages in regards to eye gaze. In order to assess eye gaze in typically developing children, averages need to be documented on both the high and low ends of the spectrum. This data will benefit speech language pathologists when developing clinical judgment in regards to children who do not appear to have typical eye gaze patterns.

One way to increase the pool of research available is through longitudinal studies following several children of the same age to better determine eye gaze averages for typically developing children. When screen time averages are included throughout exploration of typical eye gaze, correlations can begin to be seen. For example, a child who does not have access to personal technology for several years then acquires access may produce results that begin to shed light as to what changes occur as increased screen time averages are observed. A longitudinal study would allow future

researchers to better see any cause and effect in long-term use of screen time has on the social communication aspect of eye gaze (Roessner, 2014).

In regards to the self-reported screen time averages in this study, future studies should gather information in a more concrete manner than a self-reporting questionnaire consisting of two questions. Reporting on averages in two questions limits exact data amounts. Gathering information daily as to the amount of screen time for that specific day may hold more accuracy than giving overall averages. Other methods, which track daily use on technological devices, would also yield more accurate data.

Finally, performing the research project in a more natural environment (e.g. in the child's home) and with a familiar communication partner (e.g. parent or caregiver) might elicit a closer look into typical eye gaze durations and patterns for children. Interacting with a familiar communicative partner would stimulate typical everyday conversational patterns for the child. Bono et al. (2004) stated parent and caregivers help develop social communication through daily living activities through joint attention. A child interacting with a parent or caregiver who has helped develop his or her language and social communication may show more natural eye gaze in the child's every day environment. Comparing eye gaze results with familiar communication partners to screen time averages would likely yield a more accurate look into whether there is a relationship between screen time averages and eye gaze.

Conclusion

While much information exists on the effects from screen time on physical health, mental health, cognitive development, and social development, more evidence-based research is needed in the area of typically developing eye gaze. With modern technology growing and changing at a rapid pace, ways in which typical social communication development is altered following hours of exposure to screen time should be observed. This addition to research is imperative for parents, educators, and speech language pathologists. Future research in this area will help educators and speech language pathologists provide the greatest evidence-based practice therapy when treating a client. Although no statistical differences were observed, this thesis project begins to look at the possible relationship between eye gaze and screen time.

Center for Communication Disorders

MURRAY STATE UNIVERSITY

Does the Introduction of Technology alter Eye Contact Durations in Social Interactions?

Researchers: Dr. Sharon Hart, Dr. Kelly Kleinhans, Stephanie Schaaf
Center for Communication Disorders, Murray State University

We would like to invite your child to participate in a research project. The project will be directed by faculty in the Center for Communication Disorders at Murray State University. If you choose to allow your child to participate in this project, we will need your signed permission.

The researcher will explain to you in detail the purpose, procedures and the potential benefits and possible risks of your child's participation. You may ask her any questions you have to help you understand the project. A basic explanation of the project is written below. Please read this explanation and discuss with the researcher any questions you may have.

If you then decide for you and your child to participate in the project, please sign on the space indicated. You will be given a copy of this form to keep.

1. ***Nature and Purpose of the Project:*** This research project is designed to gather developmental information that will result in a better understanding of how eye contact behavior differs in play situations with and without technology (iPad) in typical children.

2. ***Explanation of Procedures:*** The study will be completed at your child's school. Your child will participate in play tasks for one 30 minute session outside of the classroom. This will only occur one time. The researcher will ask if your child wants to participate before beginning. In the first play task your child and the researcher will play with a wooden block set including a variety of castle pieces and animal figures. During the second task your child and the researcher and your child with take turns playing with an iPad block game including a variety of castle pieces and animal figures. During both activities your child will wear an eye glass tracking system (looks like a pair of glasses) that will record eye contact location and length. The researcher will also wear a similar set of glasses. The session will be video recorded.

3. Discomfort and Risks: There are no known discomforts or risks associated with this research project. Your child will be participating in typical play activities.

4. Benefits: There are no direct benefits for your child. However, the results from this study can help speech language pathologists in their clinical practice working with children with autism, as this population often has difficulty with eye contact.

5. Confidentiality: All study results (eye contact data and video recordings) will be kept private. Your child's name and other personal information will not be identified or shared in any part of the research process.

6. *Refusal/Withdrawal:* Participation in this study is voluntary. You can withdraw your child from this study at any time without affecting your child's regular classroom activities. The researcher will explain to your child that "you can stop whenever you want to."

I understand the purpose of this research project and all of my questions have been answered. I have been informed that I may withdraw my child from participation at any time. I voluntarily agree for my child to participate in this research project.

_____ _____

Parent Signature Date

_____ _____

Signature of Person Obtaining Consent Date

THE DATED APPROVAL STAMP ON THIS CONSENT FORM INDICATES THAT THIS PROJECT HAS BEEN REVIEWED AND APPROVED BY THE MURRAY STATE UNIVERSITY INSTITUTIONAL REVIEW BOARD (IRB) FOR THE PROTECTION OF HUMAN SUBJECTS.

ANY QUESTIONS PERTAINING TO YOUR RIGHTS AS A PARTICIPANT SHOULD BE BROUGHT TO THE ATTENTION OF THE IRB COORDINATOR AT msu.irb@murraystate.edu

ANY QUESTION ABOUT THE CONDUCT OF THIS RESEARCH PROJECT SHOULD BE BROUGHT TO THE ATTENTION OF DR. SHARON HART AT (270) 809-6841 OR 111 ALEXANDER HALL, MURRAY STATE UNIVERSITY. If you would like to know the results of this study, please contact Dr. Sharon Hart.

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