Interventions for Individuals with Autism and a Research Proposal Comparing Two Augmentative and Alternative Communication Aids

A Senior Project submitted in partial fulfillment of the requirements for the Bachelor of Science Degree in Child Development

by

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CHAPTER ONE

Introduction

Autism spectrum disorders (ASD) are a neurobiological condition, affecting at least 60 per 10,000 children under 6 years (Couteur, Haden, Hammal, & McConachie, 2007). According to the DSM V, individuals with ASD exhibit developmental deficits in communication, both in expressive and receptive language, social interaction, and behavioral. Although there is a major behavioral aspect of autism, the focus of this project will remain on the communication and social interaction impairments.

There are a variety of interventions available for an individual with ASD, to assist and promote communication and social interaction skills. Some interventions include: face-to-face interaction, augmentative and alternative communication aids, video modeling, and mobile technologies like iPads. Face-to-face interaction specifically refers to the reciprocal imitation training, where a child with ASD is taught to imitate appropriate social interactions. Augmentative and alternative communication aids (AAC) are a common intervention method that can come in two forms: unaided or aided systems. Unaided AAC tools do not use any external equipment, but instead involve the use of sign language, hand gestures or motions to help children learn communication skills. Aided AAC aids involve the use of external equipment like pictures, symbols or images to foster communication and social interaction. The most common form of an aided AAC intervention tool is the Picture Exchange Communication System (PECS). PECS was developed by Bondy and Frost (1994) and is a picture-based technique that requires the child to learn to communicate by exchanging a picture for a desired item. There is a sizable amount of research suggesting the effectiveness of PECS to promote communication, both expressive and receptive, and

social interaction (Gordon, Pasco, McElduff, Wade, Howlin, & Charman, 2011; Hart & Banda, 2010; Ganz, Sigafoos, Simpson, & Cook, 2008).

Although PECS is a widely employed AAC intervention tool, there has been a dramatic shift of interest towards the use of mobile technology, like the Apple iPad as an AAC device. To date only one study exists that evaluates the use of iPads as an intervention approache for individuals with ASD. Flores, Musgrove, Renner, Hinton, Strozier, Franklin and Hil (2012) conducted a study comparing the use of an iPad as an AAC with use of traditional PECS in promoting communication in children with ASD. Flores et al. (2012) results revealed mixed findings. One participant showed more communication behaviors when using the iPad, whereas two other participants showed no difference in communication behaviors between PECS or the iPad. Flores et al.'s (2012) findings suggested that there was no clear pattern across all students using the iPad. The goal of the proposed study is to extend the work of Flores et al. (2012). The study will be comprised of 40 participants, half male and half female, with ASD, between ages 5-8. Half the participants will be from School A and the other half with be from School B. Participants at School A will use PECS as an AAC, while participant at School B will use iPads. Baseline and outcome measures will be collected that will test every participant's language (expressive and receptive) and communication behaviors. Depending on whether baseline measures are equal for participants of both schools then a variety of scenarios for results can occur. If baseline measures are equal for participants at both schools then results may reveal that after a year of treatment, iPad users increase, decrease, or stay the same in communication behaviors and language from baseline compared to PECS users. Alternatively, results might show that PECS users increase at a higher rate than iPad users over a year in the

frequency of language and communication behaviors. Lastly, results may reveal that approaches using an iPad or communication binder with PECS are equal in increasing all outcome measures, and there are no significant differences with either intervention tool.

However, if baseline measure are not equivalent for participants at both School A and School B at the onset then comparisons between which AAC increases communication behaviors the most cannot be made. Instead, results will focus on which group improved over time the most. Results may show that participants at School A had higher baseline measures than participants at School B, but after treatment iPad users at School B might show more growth over time then PECS users. Such findings would support that the use of iPads promote more growth over time than the use of PECS. Alternatively, results may show that PECS users exhibit more growth in communication and language behaviors over time than iPad users. Lastly, results might show that iPad users and PECS users exhibit similar patterns of growth over after a year of treatment. Such findings would indicate that neither AAC system could be considered superior over the other.

The proposed research study will provide several contributions. One contribution is that the proposed study will consist of 40 participants, greatly improving the very limited number of participants typical of studies involving children with autism (Flippin et al., (2010); Flores et al., (2012); Ganz et al., (2004) and Gordon et al., (2011)). Another contribution is that the proposed study is in the form of a longitudinal study, unlike the majority of empirical studies evaluating AAC devices. A longitudinal study will provide several benefits. A year of treatment will allow enough time for the AAC interventions to show some sort of pattern of change in communication behaviors. Additionally, a

longitudinal design allows for the repeated observation of the same group of participants to evaluate changes over time.

Despite the anticipated contributions, if iPads prove to be significantly beneficial in increasing communication behaviors, and language, then schools will have to figure out policies and funding on how to provide iPads for individuals with autism. The policies would need to determine what the requirements are for individuals with autism to qualify for an iPad. In addition, due to the mobility of iPads, schools will need to determine if children will be permitted to use them at home and in school. The ability to transport the iPad between home and school would provide consistent and continual intervention, potentially increasing communication and language behaviors for children with ASD at a higher rate then when previously limited to intervention only during school.

CHAPTER TWO

Autism spectrum disorders are the fastest-growing developmental disability in the United States. About 1% of the U.S. population of children between the ages of 3 and 17 years have an autism spectrum disorder. The American Psychological Association states that atypical communication and social behaviors are typically the first warning signs of Autism spectrum disorders (ASD). These disturbances can be severe, with between 30-50% of people with ASD failing to develop speech and language skills that are adequate for normal communication. There are many interventions for parents to choose from to help children affected with autism. Such interventions can not only increase quality of life, but also can reduce the cost of lifelong care by 66% with early diagnosis and intervention (American Autism Society, 2012). Selecting from among the many interventions, however, can be difficult and requires a close look at the empirical support for each approach. However, before reviewing studies that evaluate differing intervention methods, it is important to be familiar with current understandings of autism.

What is Autism?

Autism is a neurobiological condition wherein children experience life-long pervasive difficulties with social interaction and communication (Couteur, Haden, Hammal, & McConachie, 2007). The broader spectrum around Autism includes individuals with a range of severities, language and intellectual abilities. Autism has widely variable symptoms that manifest differently in each individual, in highly unpredictable combinations (Lenne & Waldby, 2011). According to the American Psychological Association, autism spectrum disorders (ASD) are a group of conditions characterized by

an early onset in early childhood. In the DSM IV, the diagnostic criteria for an individual with autism spectrum disorder (ASD) are divided into three primary areas of impairments: communication, social interaction and behavior. However, the DSM V (currently in revision) acknowledges the significant intersection and influence of communication and social interaction impairments. Social impairments associated with ASD include poor eye contact, uncommunicative gestures, and sometimes a lack of friends (Lenne & Waldby, 2011). Research shows that children with ASD that exhibit social impairments and social awkwardness have difficulty forming important peer and family relationships (Lenne & Waldby, 2011). Communication impairments can include a substantial delay in or absence of spoken language, as well as repetitious or imitative use of language, where the child repeats another's utterances without understanding the meaning of what they are imitating (Lenne & Waldby, 2011). Research consistently indicates that children with ASD express significant identifiable delays in language and communication development compared to other children of the same age who do not have autism (Weismer, Lord, & Esler, 2010).

According to the American Psychiatric Association (2004), diagnosis of ASD requires a multidisciplinary assessment procedure that includes a detailed developmental history and description of current behaviors, assessment of cognitive and language abilities, and observations of functioning in a variety of settings. Although the procedures for diagnosing ASD are quite involved, early screening methods are available to support identification of the social and communication deficits in early childhood.

Early Screening Techniques to Start Identifying Autism

Early screening can help catch any signs of communication or speech delays that can help form an early and accurate diagnosis of autism. Although diagnosis of autism is often made around the age of three years, it is sometimes possible to identify early signs of speech and language delays earlier. Doing so allows for the implementation of effective strategies to minimize or prevent developmental and socioemotional problems (Carscadden et al., 2010). Carscadden et al. (2010) state that speech and language delays are reported to negatively affect later communication and literacy skills, as well as the successful development of other academic areas like math and science. Since speech and language delays significantly impact almost all areas of development—social, cognitive, emotional—the Speech and Language Pathology Early Screening Instrument (SLPESI) was developed by four speech and language pathologists, Carscadden, Corsiatto, Ericson, and Illchuk (2006). A total of 252 families with children aged 17-23 months participated in testing of the SLPESI. The SLPESI consists of six "yes or no" questions that parents answered in reference to their child. These questions were based upon developmental norms and speech and language behaviors that are common indicators of speech and language delays. Carscadden et al. (2010) formed these questions by creating a list of age appropriate speech and language skills they felt were essential in making a differential diagnosis. An example of one of these questions is, " Does your child use 10-20 words" (Carscadden et al., 2010, p. 90). Typically developing children ages 17-23 months are usually saying at least 10-20 words. A response of "no" to any of the questions (meaning the child does not demonstrate a particular skill) was indicative of a *potential* speech and language delay, and an indication that the child may need further in-depth assessment by a

speech pathologist for an accurate diagnosis.

In addition to the core six questions, the SLPESI provides a comment section for parents to explain particular difficulties their child may have with language. For example, a parent commented that her child "seems to know information but does not verbalize" (Carscadden et al., 2010, 89). Carscadden et al., (2010) successfully tested and demonstrated that the SLPESI is an effective screening instrument that may help identify speech and language delays in children as early as eighteen to twenty-one months of age.

Although the SLPESI is designed to be interpreted by professionals, there are screening instruments for speech and language delays that can be conducted by parents of children aged 2 and younger. The *Denver Developmental Screening Test* (DDST) is one of the common screening tools used by parents (Frankenburg, Dodds, Archer, Bresnick, Maschka, Edelman & Shapiro, 1992). The DDST is an instrument used to screen children aged two weeks to six years, and includes language skills, as well as gross and fine motor skills. It is important for parents and caretakers to be cognizant of their child's basic developmental process, and the early signs of language delays. These early screening tools, like the SLPESI and the DDST are used in conjunction with others to help identify and later diagnose autism.

Once children are diagnosed with ASD, parents are faced with a variety of choices on how to help. Close examination of several common interventions to help children with ASD improve their communication and social interaction skills can inform parents the next step to take after diagnosis.

Interventions for Children with ASD to Promote Communication and Social Interaction

After appropriate screening and accurate diagnosis of ASD are established, there are a variety of interventions available for children to promote communication and social interaction. The National Research Council (2001) identified the following characteristics of effective interventions for young children with autism: early intervention; intensive instructional programming (defined as 5 days per week, 25 hr per week, and 12 months per year); the use of systematic instruction; one-to-one and small-group instruction; instructional objectives addressing social, communication, adaptive living, recreation-leisure, cognitive, and academic skills; ongoing monitoring of the effectiveness of interventions; an emphasis on the generalization of skills; and opportunities for supported interaction with typically developing students (Steege, Mace, Perry, & Longenecker, 2007).

Some intervention techniques that address these characteristics may include: face-to-face interaction, augmentative and alternative communication aids, video modeling, and mobile technologies like iPads. It is important to note that there is no one intervention that is appropriate for all people with autism and that a combination of methods may be beneficial to some individuals.

Face-to-Face Interaction Techniques

Reciprocal Imitation Training. Reciprocal imitation training (RIT) for children with ASD is believed to promote the development of numerous important skills such as play, communication and social interaction (Cardon & Wilcox, 2010). Ingersoll and Schreibman (2006) evaluated RIT as a method to teach children with autism to imitate

through naturalistic social interactions with an adult. In RIT, a child learns that imitation can be intrinsically motivating. This is accomplished by teaching children that they need to imitate when they see another person perform an action with an object instead of in response to a verbal command (Cardon & Wilcox, 2010). During RIT interventions, researchers first imitate the child's actions because that increases the imitation rates that occur during contingent imitation activities. Researchers will also verbally describe the activities they are doing with the child in order to foster some communication skills. Cardon and Wilcox (2010) evaluated the effectiveness of RIT by including five children with autism, ranging in age from 29 to 45 months. The children participated in RIT interventions three times a week for a total of 10 weeks. Results indicated that all participants demonstrated significant increases in their object imitation skills and also made gains in their imitative language skill (Cardon & Wilcox, 2010). It is also important to note that after the removal of RIT treatment, at a 1 month follow-up visit, the same five participants maintained higher than baseline levels of their motor imitation skills (Cardon & Wilcox, 2010). The five children were evaluated using the Motor Imitation Scale (MIS pre and post RIT intervention and demonstrated significant increase in object imitation post treatment.

Another common face-to-face interaction intervention that incorporates some imitation based therapy is Dr. Stanley Greenspan's Floortime Approach. The main goal of the Greenspan Floortime Approach is to help children with ASD develop their impaired social interaction skills. In order to promote children's impaired social interactions, Greenspan emphasizes the importance of first creating a warm bond with the child. Once a bond is established, between child and parents or child and speech pathologist, the adults'

role is to find ways, usually through the use of toys, to excite the child's interests and promote social interaction and connection. At any age the Floortime Approach requires the adult to do three things: 1) follow the child's lead to figure out what they're interested in 2) challenge and promote creativity and spontaneity and 3) try to expand the child's social interactions by including most of his or her senses and motor skills.

Although the Greenspan Floortime Approach is widely used by professionals, there are no empirical studies currently available that evaluated its' effectiveness. However, according to Greenspan (2006) the use of the Floortime technique has demonstrated that children with autism do not have a fixed and limited potential, but can learn and improve their communication and social interaction impairments and be fully capable of leading healthy lives. Further research is still necessary to evaluate the effectiveness of promoting a child's communication and social interaction ability using the Greenspan Floortime Approach.

Applied Behavior Analysis. Applied Behavior Analysis (ABA) is another face-to-face intervention system that focuses on systematically improving social interaction. ABA methods are used to support persons with ASD in at least five ways: (a) to teach new skills (e.g., systematic instruction and reinforcement procedures to teach functional life skills, communication skills, or social skills), (b) to reinforce and maintain previously acquired skills, (c) to generalize behavior from one situation to another (e.g., teaching and transferring social skills to natural settings), (d) to restrict or narrow conditions under which interfering behaviors occur (e.g., modifying the learning environment; antecedent modification), and (e) to reduce interfering behaviors by discontinuing their reinforcement and reinforcing competing replacement behaviors (Steege et al., 2007). ABA assumes that

children are more likely to repeat behaviors or responses that are rewarded, and they are less likely to continue behaviors that are not rewarded. Eventually, the reinforcement is reduced so that the child can learn without constant rewards. Research shows that using ABA with children who have ASD reduces inappropriate behavior and increases communication, learning, and appropriate social behavior (Steege, Mace, Perry, & Longenecker, 2007).

Interventions like reciprocal imitation training, and applied behavior analysis have promise but are labor intensive and require the constant and strategic guidance of an interactive adult to improve communication and social interaction deficits. Video modeling is another less labor intensive intervention used to help children with ASD develop their imitation skills and promote social interaction.

Video Modeling

There is great support for the use of video modeling to promote social interaction and communication in children with ASD. Video modeling involves the child observing a videotape of a model engaging in a particular behavior and then having the child imitate that behavior (Maione & Mirenda, 2006). In combination with video modeling, video feedback is also a common intervention. Video feedback involves the child being videotaped performing certain behaviors and then having the child review the videotape so that he or she can evaluate his or her own behaviors. According to Maione and Mirenda (2006), videotape treatments have many aspects that make them useful for assisting in communication and social growth with children with autism. In a case study, Maione and Mirenda (2006) worked with a five-year old boy who had been diagnosed with autism at

age two. The purpose of the their study was to assess the effectiveness of video modeling and video feedback for teaching a child with autism to use social language and promote his social interaction skills with peers during play. A total of nine videotapes were developed for the participant to watch, showing models talking and playing with identical toys that the child had. The participant viewed these videotapes at home and follow-up measurements of their effect on the child's social interactions were also conducted at the home. After the child watched the videotapes modeling social interaction, Maione and Mirenda (2006) measured (a) the total number of verbalizations made by the participant, (b) the frequency of both scripted and unscripted verbalizations and (c) the frequency of initiations and responses. Scripted verbalizations included speech that was identical to the verbalization in the video, whereas unscripted verbalizations were words or phrases the participant said that were different from the video model.

In addition to video modeling, the participant in Maione and Mirenda (2006)'s case study received video feedback, in order to show the child the desired behaviors. During video feedback, the child watched a videotape of himself and a peer engaging in a play activity. The experimenters would pause the tape to teach the participant when he engaged in "good talking" versus "bad talking. Verbal reinforcements along with a green happy face representing "good talking" were used to instruct the child. Maione and Mirenda (2006) results suggest that video modeling was effective in increasing social language in several play activities with peers, particularly with unscripted verbalizations. Video feedback also promoted a stable rate of increased social language. Additional studies show that many children with autism find watching videotapes to be reinforcing and very motivating (Banda et al., 2010). In addition, the video camera has the ability to zoom-in on

very specific behaviors or gestures of a task that is very helpful to a child with autism that can be distracted by the extraneous stimuli from the entire scenario (Banda et al., 2010).

While Maione and Mirenda (2006) tested the effects of video modeling and video feedback on teaching social interaction skills, Banda et al. (2010) conducted a study investigating to what extent individuals with autism would learn to operate a speech generating device (SGD) to request a preferred item through video modeling. An SGD, which is also referred to as a voice output communication aid, is an electronic augmentative and alternative communication (AAC) system used to supplement or replace speech or writing for individuals with severe speech impairments, allowing them to verbally communicate their needs. Banda et al.'s (2010) study consisted of two participants: a 17 year-old African American male with autism and speech impairments and a 21-year-old Caucasian male also diagnosed with autism and speech impairments. Before video modeling intervention began, baseline communication requests were measured for each participant. During baseline neither of the two participants made communication requests using their speech generated device (SGD). Then each participant watched a 10 to 15 second video model that showed the accurate requesting of a preferred object using a speech generating device (SGD). Result showed that both participants demonstrated the subsequent ability to request preferred items using their SGD without prompting from the researcher or instructor (Banda et al., 2010).

Augmentative and Alternative Communication Aids

Efforts to promote communication skills in individuals with ASD using the face-to-face approaches and video modeling techniques are often paired with training and use of

augmentative and alternative communication (AAC). According to the American Speech-Language-Hearing Association (ASHA), augmentative and alternative communication (AAC) includes all forms of communication (other than oral speech) that are used to express thoughts, needs, wants, and ideas. AAC includes facial expressions or gestures, symbols, pictures, or writing. Individuals with ASD with severe speech or language problems rely on AAC to assist existing speech or replace speech that is not functional. Special augmentative aids, such as picture and symbol communication boards and electronic devices, are available to help people express themselves. AAC includes systems where an instructor uses sign language, hand gesture or motions to assists children in learning communication skills (Ganz, Sigafoos, Simpson, & Cook, 2008).

There are two types of AAC techniques: unaided and aided. Unaided communication does not require any equipment that is external to the body and involves the use of symbols such as manual signs, pantomimes, and gestures (Mirenda, 2003). Aided communication involves devices or visual supports that are external to the person who use them, and includes communication books and the use of symbols such as photographs, line drawings, letters, and words. Visual supports are beneficial for assisting in communication because they can accommodate the complex social and communication deficits and strengths present in children with ASD (Johnston et al., 2003). Visual supports, with their nontransient qualities (unlike speech), can allow children with ASD to use their relative visual-spatial strengths, while assisting their weaker ability to process more ephemeral information, like verbal speech. Most speech pathologists use a combination of unaided and aided communication techniques, depending on the context and communication level of their student. In essence, the primary purpose of any AAC is to compensate (either

temporarily or permanently) for the impairment and disability patterns of individuals with severe communication deficits. One of the most commonly used aided AAC visual supports is the Picture Exchange Communication System.

Picture Exchange Communication System. The Picture Exchange Communication System (PECS) designed by Bondy and Frost in 1994 is a widely used picture-based aided augmentative and alternative communication system. PECS is used to support or replace natural speech for individuals without functional speech (Hart & Banda, 2010). PECS instructors, usually speech and language pathologists, work with a child to exchange a picture for a desired item or activity. For example, when a child successfully gives a picture to an adult in an effort to request an item, the adult reinforces that behavior by handing the corresponding item to the child (Ganz et al., 2008). PECS is implemented in six systematic phases. In Phase 1 children learn to initiate communication by exchanging a single picture for a highly desired item; Phase 2 teaches children to actively seek out their pictures and to travel to someone (teacher, parent, etc) to make a request using the pictures; during Phase 3 children learn to discriminate between several pictures and to select the picture that represents the item they want; Phase 4 implements the use of a sentence structure with their picture of a desired item. For example, "I want…to go outside", and the child would be holding or pointing to a picture of a playground. During Phase 5 children are intended to learn to respond to the question "What do you want?" Finally, in Phase 6 children learn to use and generalize their pictures to comment about their environment both spontaneously and in response to a question. In order to expand a child's vocabulary using PECS, pictures of shapes, colors, sizes and other adjectives are added for them to use and communicate more accurately.

Research on PECS shows that it is very promising communication intervention technique because it allows children with autism to acquire functional communication skills (Preston & Carter, 2009). Ganz et al. (2008) examined the use of PECS to promote functional communication skills. The single participant was a 12-year-old boy with autism, Ryan who had considerable communication and language deficits. Ryan did not speak, but occasionally made vocalized sounds; he communicated primarily by pointing or leading an adult by the hand to what he wanted (Ganz et al., 2009). Research materials for the study included a communication binder that had strips of Velcro with 2in x 2in pictures of preferred items that Ryan could use to make requests. These pictures were of only five items: cracker, raisin, pretzel, water and juice. This communication binder or AAC device and the process of choosing the pictures and making requests with them are the essence of PECS. The procedures of the study involved Ryan attempting to master three phases using the Picture Exchange Communication System method in order to evaluate the effectiveness of PECS. Phase 1 included teaching Ryan to successfully use his communication binder when his instructors were near or far away from him. An instructor being far from the participant meant that he would have to move from his current location and walk at least ten feet to reach the instructor. The goal of Phase 2 involved the generalization of picture exchanges when the participant's AAC device and preferred items were far. Finally in Phase 3, the goal was to determine how the participant would spontaneously communicate the need for help or request desired items when his communication binder was out-of-reach (Ganz et al., 2008). The results of the study indicated that Ryan was able to successfully use PECS and master the three phases. He was able to generalize his communication skills across a variety of instructors and effectively use non-verbal

strategies, like gestures or taking an instructor's hand, to indicate that he needed his AAC device that was out-of-reach.

The representativeness of Ganz's et al. (2008) findings are confirmed by Hart and Banda's (2010) meta-analysis of 13 published studies examining the effectiveness of PECS, the effects of PECS on speech and problem behaviors, generalization beyond training conditions, and social validity of the intervention. Like Ganz et al. (2008), Hart and Banda (2010) found that PECS increased functional communication, decreased problem behaviors and increased speech in some individuals.

While there are numerous studies that show that the use of PECS increases a child's communication opportunities, there are other studies like Preston and Carter (2009) that found very limited data suggesting positive effects of PECS on communication. Preston and Carter (2009) analyzed and reported results of 27 studies on the efficacy of PECS. Results of their meta-analysis showed that there is still very limited data suggesting positive effects of PECS on both social interaction and communication impairments. To inform interpretation of the discrepancy between Hart and Banda (2010) and Preston and Carter (2009), Flippin, Reszka, and Watson (2010) conducted yet another meta-analysis reviewing the literature on PECS written between 1994 and June 2009. Flippin et al. (2009)'s results are consistent with those reported by Preston and Carter (2009) confirming that although PECS might be a promising intervention, it does not have established evidence-based data proving it to be an effective technique for promoting communication.

It is difficult to accurately measure the effectiveness of PECS due to the variability in instruction methods that each individual child receives. Also, the effectiveness of PECS can

vary per individual depending on the severity of the child's autism.

In sum, there is substantial evidence to support the use of reciprocal imitation training, , ABA, video modeling and PECS. However, these methods are starting to be overshadowed by the recent technological innovations. To complicate the intervention options available to those working with children with ASD, the media attention has particularly focused on the promise of touch screen based mobile devices, specifically the Apple iPad, as a tool to support language and communication development among individuals with ASD. Because the use of touch screen mobile technologies as intervention tools is very new, there is scant empirical evidence on the effectiveness of these tools in promoting communication and social interaction for children with autism. With the continuous development of technology, AAC applications have become available for personal devices like cell phones, computers and now iPads. Such devices also have the potential to be used for reciprocal imitation training, video modeling, or even ABA.

To date only one study exists that evaluates the use of iPads in intervention approaches for individuals with ASD. Flores, Musgrove, Renner, Hinton, Strozier, Franklin and Hil (2012) conducted a study comparing the use of an iPad as an AAC with use of traditional PECS in promoting communication in children with ASD. Their goal was to explore whether iPads are a viable communication device for making requests. The participants were five elementary school students with ASD. Each of the students' cognitive and spoken language abilities were evaluated. Cognitive ability was measured using the Leiter International Performance Scale Revised, a nonverbal test appropriate for children who have cognitive delays, limited language, or English proficiency. Spoken language was measured using the Test of Language Development Intermediate (TOLD-I-4).

Within the TOLD-I-4, the Picture Vocabulary subtest measured the participants' understanding of spoken language by having them point to a picture that matches the spoken word. The design of their study involved the five participants to alternate between using PECS for three days and then iPads for three days, during snack time to request different types of food and drink. Snack procedures were the same each day lasting for fifteen minutes. Data was collected on the frequency of communication behaviors, defined as accurate requests for snack using PECS or the iPad. Communication behavior was defined for PECS when the participant: a) pointed to a picture card, b) removed a picture card from its Velcro strip and gave it to the teacher, c) or removed the picture cards from the Velcro strip and placed them on a sentence strip. For example, one child removed the picture cards symbolizing *I WANT, MORE,* and *PRETZELS* and placed them on a sentence strip, accurately demonstrating a communication behavior requesting for snack. For the iPad, a communication behavior was defined as the participant: (a) touching a picture (of the snack item) on the iPad screen, highlighting the picture, or (b) touching the screen such that the picture of the desired snack item became highlighted as the iPad generated speech. Data were collected daily during the snack period by one of the teachers who was not conducting the snack activity. Flores et al. (2012) results did not reveal that one AAC system was better than the other. The results were mixed, suggesting the use of an iPad as an AAC device to be highly subjective per individual child. One participant showed more communication behaviors when using the iPad, whereas two other participants showed no difference in communication behaviors between PECS or the iPad. Notably, however, the iPad use was never found to have a negative affect on communication behaviors. Flores et al.'s (2012) findings suggest that there was no clear pattern across all students using the

iPad. Flores et al. (2012) suggest that the increase in communication behaviors for some may be based on individual's unique skills and preferences for the iPad. This study was limited in that it did not evaluate the children's preferences as to which AAC system to use (PECS or iPad). Another limitation of the Flores et al. (2012) study is the very low sample size, which is a common concern in much of the research regarding individuals with ASD.

Further research needs to be conducted to test whether the use of iPads to promote communication and social interaction is truly an effective intervention method. It is still unclear whether iPads increase communication behaviors or are simply a popular fad that has exploded in the media, making every parent that has a child with autism feel the need to own one. The proposed research study takes the form of a longitudinal study with the goal of extending Flores et al.'s (2012) study comparing the use of iPads and a picture-based system. Although this research proposal only focuses on comparing the interventions of iPads against PECS, it's an important overlook of the other interventions because of the powerful shift towards digital technology, and the rise in popularity of iPads as a possible AAC tool.

CHAPTER THREE

Method

The proposed research takes the form of a longitudinal study that will compare children with Autism Spectrum Disorders developing communication ability when given one of two forms of AAC devices. Specifically, one group of children will use iPads as their primary AAC and the other will use PECS. This study will reveal whether there is a cause to promote or discourage the use of one AAC platform over another.

Participants

Participants will be 40 students, half male and half female, between the ages of 5 and 8 years. Half of the participants will be from School A, while the other half will be from School B. Each participant will have ASD, as previously diagnosed by a professional and will be familiar with some form of non-digital AAC method, like PECS prior to the study.

Materials

A communication binder with PECS will be constructed that will contain pictures of snack items, activities, and toys that the children will use to make requests. The laminated color picture cards will be 1.5 inches by 1.5 inches and will be attached to Velcro strips within the communication binder. Similarly, an iPad will be loaded with digital pictures of snack items, activities, and toys in order to support children's requests.

Procedure

Baseline data collection. To ensure equivalency of groups and provide a point of comparison for later growth in language skill, at the outset of the study, researchers will measure the language and communication behaviors of each participant. To test expressive language the researcher will use the Test of Language Development

Intermediate (TOLD-I-4). Within the TOLD-I-4, the Picture Vocabulary subtest will measure the participants' receptive vocabulary by having the child point to pictures that match the spoken words.

Also, each child from both schools will be tested on their ability to construct requests for desired items using PECS. Such communication behaviors will be measured by the frequency of verbal requests or by: (a) pointing to a picture card, (b) removing a picture card from its Velcro strip and giving it to the teacher, or (c) removing picture cards from the Velcro strip and placing them on a sentence strip. In addition, each participant's social interaction will be measured by the frequency of eye-contact he or she makes with the teacher while making requests, using either PECS or the iPad.

Treatment. Children from School A and School B will be randomly assigned an AAC. Neither school nor the resource specialists at each school carrying out the treatments will be aware that there are two groups in the study. The resource specialists at each school will undergo rigorous training process on how to accurately implement the AAC they will use with the children. Participants at school A will carry on the school year using PECS, while participants at school B will each receive an iPad.

Outcome data collection. Post-intervention, communication behaviors and language skill (expressive and receptive) as defined in baseline, will be measured for the PECS users and the iPad users. Communication behaviors for the iPad users will be measured when the child: (a) touches a picture on the iPad screen such that the screen will be highlighted, or (b) touches the screen such that the screen will be highlighted as the iPad-generates speech. This will allow for 4 main comparisons: (1) a comparison between PECS users and iPad users' communication behaviors and language at baseline (2) pre and

post treatment measures for PECS users will be compared to evaluate growth in communication behaviors and language over a year, (3) pre and post treatment for iPad users will be compared to look at the growth in communication behaviors and language over the course of a year, and (4) post interventions measures between PECS users and iPad users in order to see if there are significant differences between the use of an iPad or PECS.

However, if baseline measures between the participants at School A and School B prove to be significantly different, then the outcome measure of interest will be to compare the growth of communication behaviors and language over time between PECS users and iPad users. With differing baseline measures at the onset of the study, conclusions post treatment cannot be made that one AAC platform promotes communication more than the other.

Design. There are three main research protocols as indicated in Table 1. First, there are baseline procedures where the language and communication behaviors of PECS users and iPad users are measured and compared. Then treatment will be implemented for an entire school year, where participants at School A will continue to use PECS and participants at School B will use iPads. Lastly, the outcome measures of PECS users and iPad users will be compared as described above in *outcome data collection.*

Table 1. Proposal design

	BASELINE	TREATMENT	OUTCOME
School A: PECS users	Language and Communication behaviors (a)	1 year duration	Language and Communication behaviors (b)
School B: iPad users	Language and Communication behaviors (c)	1 year duration	Language and communication behaviors (d)

CHAPTER FOUR

Results and Discussion

There are several potential scenarios and questions to explore in examining the results of this proposed study, each with different implications for the use of AACs with children with ASD.

Comparison of PECS Users and iPad Users at Baseline

There are two possible scenarios for the results of comparing PECS users and iPad users' communication behaviors at baseline. Baseline measures between both groups could either be equal at baseline or not. If baseline measures are equal for participants at both schools then results may reveal that after a year of treatment, iPad users increase in communication behaviors and language from baseline more than PECS users. Such a finding would be strong evidence that the use of iPads as an AAC improves and promotes communication skills and social interactions, and does so more successfully than PECS. These results could imply that an iPad may be more intuitive and easier to use to communicate for children with ASD.

However, if baseline measures are not equivalent between iPad users and PECS users, then comparisons between which AAC increased communication behaviors the most cannot be made. Instead, results will focus on which group improved over time the most. Results may show that participants at School A had higher baseline measures than participants at School B, but after treatment iPad users at School B might show more growth over time then PECS users. Such findings would support that the use of iPads promote more growth over time than the use of PECS. Alternatively, results may show that PECS users exhibit more growth in communication and language behaviors over time than

iPad users. Lastly, results might show that iPad users and PECS users exhibit similar patterns of growth over after a year of treatment. Such findings would indicate that neither AAC system could be considered superior over the other.

Pre and Post Treatment Outcome Measures for PECS Users

After prolonged use of PECS, results will most likely reveal that communication behaviors, language and social interaction will increase from baseline. These findings would be consistent with the research that supports the use of PECS increases communication (Gordon et al., 2011; Ganz et al., 2008; Hart & Banda, 2010).

Pre and Post Treatment Outcome Measures for iPad Users

After prolonged use of iPads, results may reveal that communication behaviors increase, decrease or stay the same from baseline to outcome measures. Based on evidence from current research on the effectiveness of iPads as an AAC device, it is still unknown if iPads would increase communication behaviors. However, based on Flores et al.'s (2012) findings that some participants' communication behaviors increased, it seems reasonable to predict that results will reveal some growth in communication behaviors over a year. Whether the growth of communication and language for iPad users is significant still needs to be further tested.

Comparison of Post Intervention Measures Between PECS Users and iPad Users

There are three potential results that could arise from comparing the outcome measures between iPad and PECS users. First, results may reveal that when compared to PECS users, iPad users demonstrate a greater increase in communication behaviors from baseline over the duration of a school year in communication behaviors. Such a finding would be strong evidence that the use of iPads as an AAC improves and promotes

communication skills and social interactions, and does so more successfully than PECS. These results would imply that an iPad might be more intuitive and easier to use to communicate for children with ASD.

An alternative finding might be that PECS users increase at a higher rate than iPad users over a year in the frequency of communication behaviors. These results would suggest that using an iPad as an AAC device will show no significant increase from baseline in the frequency of communication behaviors.

A third possible outcome may reveal that approaches using an iPad or communication binder with PECS are equal in increasing all outcome measures.

The possibility of such a variety of results further emphasizes the need for future research to be invested in this area. More research testing the utility of an iPad as an intervention will enlighten parents, teachers and the public on whether it is a viable tool to help children with ASD communicate effectively.

CHAPTER FIVE

Conclusion

There has been an overwhelming amount of media attention on the use of iPads as a potential AAC for children with autism. The media is trying to convince parents and teachers that iPads are the solution to help all children with autism improve their lives. However, there is very limited data on the effectiveness of iPads on promoting communication, social interaction or behavior. To date, there is only one study by Flores et al. (2012) that investigates the utility of the iPad as a viable communication device by comparing the frequency of communication behaviors against the use PECS. The design of their study involved the five participants to alternate between using PECS for three days and then iPads for three days, during snack time to request different types of food and drink. Snack procedures were the same each day lasting for fifteen minutes. Data was collected on the frequency of communication behaviors. Flores et al. (2012) results did not reveal that one AAC system was better than the other. One participant showed more communication behaviors when using the iPad, whereas two other participants showed no difference in communication behaviors between PECS or the iPad. Results were mixed, suggesting the use of an iPad as an AAC device to be highly subjective per individual child. Flores et al. 's (2012) findings suggested that there was no clear pattern across all students using the iPad. These mixed results further emphasizes the need for more research to be conducted in this area.

The purpose of the proposed research study is to extend Flores et al's. (2012) study and to provide several contributions. One contribution is that the proposed study consisted of 40 participants, greatly improving the very limited number of participants

typical of studies involving children with autism (Flippin et al., (2010); Flores et al., (2012); Ganz et al., (2004) and Gordon et al., (2011)). Another contribution is that the proposed study is in the form of a longitudinal study, unlike the majority of empirical studies evaluating AAC devices. A longitudinal study will provide several benefits. A year of treatment will allow enough time for the AAC interventions to show a pattern of change in communication behaviors. Additionally, a longitudinal design allows for the repeated observation of the same group of participants to evaluate changes over time. Lastly, a longitudinal study can also provide information on individual change of each participant over time.

Although the anticipating contributions of the proposed work provides, there are constraints on the practicality of conducting this study. One main challenge will involve the high cost to conduct a longitudinal study and to provide each participant with an individual iPad. Another difficulty will be recruiting 40 children with autism to participate in a study for an entire school year. Despite these challenges, it is still important for parents and families as they consider the diverse interventions available for individuals with autism to invest in this research to become better informed on the potential benefits of iPads as an AAC.

However, if iPads prove to be significantly beneficial in increasing communication behaviors, and language, then schools will have to figure out policies and funding on how to provide iPads for individuals with autism. The policies would need to determine what the requirements are for individuals with autism to qualify for an iPad. In addition, due to the mobility of iPads, schools will need to determine if children will be permitted to use them at home and in school. Having the ability of transporting the iPad between home and

school would potentially provide constant and consistent intervention potentially increasing communication and language behaviors at a higher rate than other. Research would need to be invested in this area to further examine the possibilities of the school to home connection.

In addition to the policies and funding, schools and parents will need to consider the possibility of integrating several interventions onto the iPad. For example, video modeling, reciprocal imitation training, and digital form of PECS are just a few interventions that could be implemented using the iPad. Future research in this area is extremely important because it could unveil a more beneficial and inclusive system of helping individuals with autism communicate effectively.

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