2013

Effects of an iPad-Based Augmentative and Alternative Communication Intervention on Wh-Question Answering Skills of an Adolescent with Autism Spectrum Disorders

Neslihan Canpolat-Cig
THE FLORIDA STATE UNIVERSITY
COLLEGE OF EDUCATION

EFFECTS OF AN IPAD-BASED AUGMENTATIVE AND ALTERNATIVE COMMUNICATION INTERVENTION ON WH- QUESTION ANSWERING SKILLS OF AN ADOLESCENT WITH AUTISM SPECTRUM DISORDERS

By
NESLIHAN CANPOLAT-CIG

A Thesis submitted to the College of Education in partial fulfillment of the requirements for the degree of Master of Science

Degree Awarded:
Summer Semester, 2013
Neslihan Canpolat-Cig defended this thesis on June 26, 2013.
The members of the supervisory committee were:

Mary Frances Hanline  
Professor Directing Thesis

Bruce Menchetti  
Committee Member

Lindsay Dennis  
Committee Member

The Graduate School has verified and approved the above-named committee members, and certifies that the thesis has been approved in accordance with university requirements.
To the memory of my mother, Hayal Canpolat.
ACKNOWLEDGEMENTS

This study would have been impossible without the valuable contributions of my committee members. I am lucky and grateful to have had them as my professors and guides during this challenging adventure.

From the day I started my graduate school journey at Florida State University to this day, Dr. Mary Frances Hanline has always supported me in various ways and taught me fundamental skills. Words fail to express my gratitude for all her efforts on my behalf.

Also, I appreciate Dr. Bruce Menchetti’s help and patience while going through every step of my study. I also appreciate Dr. Lindsay Dennis’ valuable insight and I am thankful for her willingness to join my committee.

The sudden passing of Dr. Barbara Edwards caught all her admirers by surprise and saddened a lot of people. As my committee member, she provided invaluable feedback and always cheered me up with her beautiful smile and happiness. I will always cherish her memory.

I would be remiss not to mention Dr. Dina Vyortkina, as my boss, my teacher, and most importantly, my friend. She encouraged, motivated, and inspired me in many ways. Dr. Vyortkina, thank you for your endless support and patience during my difficult times.

I would also like to thank Dr. Rima Hatoum for her feedback and insight.

I am also thankful for all the efforts put of my participant, Adam, and his parents toward the successful completion of my study. They opened their hearts to me and always welcomed me in their home. My study, targeting a specific population, would have been impossible without the vision and hope of Adam’s mother. I will always be grateful her for allowing me to work with her precious and ingenious son in order to complete my study.
I would also like to thank my father, Muammer Canpolat, and my lovely sisters, Dr. Emel Canpolat, Dr. Nihal Canpolat-Altiok, and Naime Canpolat-Bahrioglu for inspiring and encouraging me. Thank you for your continuous support from thousands of miles away.

Whenever I felt down or the burden of my studies felt too heavy on my shoulders, my mother was there to cheer me up. She would always ask about my assignments and projects, as well as share my worries and excitement. She was not only the best mother one could have, but also the best friend. The world has never felt the same after your departure, but your beloved memory and your desire to see me graduate gave me enough strength to get this far. I will always be grateful and feel lucky to be your daughter.

My dear husband, Oguzcan Cig, has always been my safe harbor during this journey and I could never articulate how much his support means to me. Thank you for believing in me!
TABLE OF CONTENTS

List of Tables ........................................................................................................................................... ix

List of Figures ............................................................................................................................................. x

Abstract ...................................................................................................................................................... xi

1. INTRODUCTION .................................................................................................................................. 1

  Statement of the Problem ....................................................................................................................... 3
  Purpose of the Study ............................................................................................................................... 6
  Significance of the Study ....................................................................................................................... 6
  Research Questions ............................................................................................................................... 7

2. LITERATURE REVIEW .......................................................................................................................... 8

  What are Autism Spectrum Disorders? ................................................................................................. 8
  Communication Challenges in Persons with Autism ........................................................................... 9
  Wh- Questions in Persons with ASD .................................................................................................... 10
  What is Augmentative and Alternative Communication? ............................................................... 12
  Sign Language ..................................................................................................................................... 12
  Picture Exchange Communication Systems (PECS) ........................................................................ 13
  Speech-Generating Devices ................................................................................................................ 15
  Static-Screen Speech-Generating Devices .......................................................................................... 16
  Dynamic-Screen Speech-Generating Devices ..................................................................................... 16
  iPod- and iPad-Based Speech-Generating Devices .......................................................................... 17
  Summary ............................................................................................................................................. 22

3. RESEARCH METHOD ............................................................................................................................ 23

  Participant ............................................................................................................................................ 23
    General Characteristics of Participant ............................................................................................. 23
  Materials ................................................................................................................................................ 25
    iPad-Based Proloquo2Go Application ............................................................................................... 25
    Wh- Questions and Question-Related Visuals ................................................................................. 26
    Cue Cards ........................................................................................................................................ 27
  Setting ................................................................................................................................................... 27
  Design ................................................................................................................................................... 27
  Intervention Package ............................................................................................................................ 28
F. APPEARANCE OF “WHO” FOLDER .................................................................................................................. 55
G. SAMPLE QUESTIONS FOR GENERALIZATION PHASE ............................................................................ 56
H. SAMPLE DATA SHEET & SAMPLE QUESTIONS ...................................................................................... 59
I. HUMAN SUBJECT REVIEW COMMITTEE APPROVAL ........................................................................... 59
J. HUMAN SUBJECT REVIEW COMMITTEE RENEWAL .......................................................................... 60
K. ASSENT TO PARTICIPATE IN RESEARCH ............................................................................................ 61
L. CONSENT FOR RELEASE OF INFORMATION ........................................................................................ 63

REFERENCES .................................................................................................................................................. 69

BIOGRAPHICAL SKETCH ................................................................................................................................ 76
LIST OF TABLES

Table 3.1 Task analysis for answering “What” questions.......................................................... 32
Table 3.2 Task analysis for answering “Where” questions....................................................... 33
Table 3.3 Task analysis for answering “Who” questions............................................................... 33
Table 4.1 Descriptive statistics for “What”.................................................................................. 39
Table 4.2 Descriptive statistics for “Where”............................................................................... 41
Table 4.3 Descriptive statistics for “Who”................................................................................... 43
Table 4.4 Improvement rate difference (IRD) effect sizes......................................................... 43
LIST OF FIGURES

4.1 Number of Unprompted Responses to “What,” “Where,” and “Who” Questions Across the Sessions................................................................. 40

A. 1 Appearance of iPad’s Main Screen ................................................................. 51
A. 2 Appearance of Proloquo2Go Home Screen .................................................. 52
A. 3 Cue Cards ........................................................................................................ 53
A. 4 Appearance of “What” Folder ....................................................................... 54
A. 5 Appearance of “Where” Folder ..................................................................... 55
A. 6 Appearance of “Who” Folder ........................................................................ 56
ABSTRACT

A multiple baseline design across three types of wh- questions was used to examine the effects of an intervention package in teaching wh- question answering skills to an adolescent with ASD. The intervention package consisted of a combination of (1) an iPad-based augmentative and alternative communication (AAC) application, Proloquo2Go; (2) a least-to-most prompting hierarchy; (3) interval reinforcement; (4) cue cards; and (5) question related visuals. The results of this study showed that using the intervention package is an effective way to teach wh- question answering skills to an adolescent with autism.
CHAPTER 1

INTRODUCTION

Autism was first described in 1943 by an American psychiatrist, Leo Kanner. Kanner called this condition “autism,” derived from the word “auto” because the children he observed seemed to function in isolation from their environment (Quill, 1995). He identified a number of distinct characteristics that were unique to the children he had observed. His findings included remarkably low social relatedness, impaired or abnormal language skills, and an almost obsessive desire for routine and sameness (Janzen, 2003; Prelock, 2006). Presently, the Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association, 2000) (4th ed., text rev.; DSM-IV-TR) identifies three main domains of dysfunction in children with autism: (1) social interaction impairment, (2) communication impairment, and (3) repetitive and stereotyped patterns of behavior.

Children with autism spectrum disorders (ASD) may exhibit symptoms relatively early in their lives. The National Research Council (NRC) states that ASD causes interruption in essential developmental skills including communication, emotion, and social interaction (2001). The effects of autism tend to vary greatly from one individual to another as the patterns of deficiencies and individual abilities are not identical among this population. According to DSM-IV-TR 4th ed., text rev. (American Psychiatric Association, 2000) impaired or abnormal communication is considered as the core deficit in autism. Indeed, developing functional and expressive communication skills are almost impossible for nearly half of the children with autism (Lord & Rutter, 1994; Prizant, 1983; Rutter, 1978). Although some children with autism can manage to develop communication skills and exhibit appropriate use of language (Minshew, Goldstein, & Siegel, 1995; Tager-Flusberg, Paul, & Lord, 2005) more than half of them still
exhibit idiosyncratic use of language. Echolalia and limited advanced communication skills are typical examples. Advanced communication skills are necessary for initiating or maintaining conversation (Baltaxe & Simmons, 1981; Wetherby, Prizant, & Schuler, 2000), and lacking these skills causes disruptions in natural ways of verbally interacting with others. These problems cause frustration for individuals with autism. The inability to carry out a conversation results in isolation of these individuals from the rest of society. Thus, a small circle of individuals, most likely their core family members, provide their primary social support.

Autism does not only affect individuals, but also their families, educational institutions, and communities as there exist reciprocal interactions among these entities. The number of cases estimated by the parent reports as reported by the National Survey of Children’s Health (NSCH) is 1 in 50 children aged from 6 to 17 years old as of March, 2013 (Blumberg, Bramlett, Kogan, Jessica, & Michael, 2013). The increasing number of autism cases raises concerns and directs public attention to appropriate ways to intervene. The ultimate purpose of treatment and intervention programs is to improve these individuals’ competency in using language and to promote independence so they can become active and productive members of the society. For these reasons and so many more, research efforts, policies, and programs are worth the investments.

Some researchers claim that problems in communication persist due to individuals’ inability to understand questions in spoken language (Botwinik-Rotem & Friedmann, 2009; Eigsti & Bennetto, 2009; Hawkins, 2011). Thus, many individuals with autism may face problems answering different forms of wh- questions (Paul, 1985) because of a lack of functional and expressive communication skills. Tager and Flusberg (1994) claimed that incompetency of wh- comprehension in children with autism is related to pragmatics. Conversely, less desire for
interaction with other people can cause pragmatic challenges such as predicting the right moment and place to ask questions appropriately (Rutter, 1978).

The ability to respond to these types of questions can be considered as essential for learning to formulate one’s own questions by using similar forms (Bloom & Lahey, 1978; Brown, 1968). Many individuals with autism have difficulty processing questions. This is compounded by the tendency of people who are in close proximity to these individuals to simply choose to interact with them by using basic yes/no questions (Curcio & Paccia, 1987). Thus the reduced frequency of verbal interaction, challenge of using advanced language skills, and problems in comprehending spoken language adversely affects the already-deteriorated communication skills for these individuals. In summary, the language deficits of individuals with autism allow a minimal level of social interaction and result in a reduced desire to communicate with others.

**Statement of the Problem**

Diagnosis of autism is significantly more widespread now than ever among individuals between the ages of 6 and 21 (Fombonne, 2008; Matson, Rieske, & Tureck, 2011). The increasing number of individuals diagnosed with ASD is forcing policy makers, educators, researchers, and parents to take a closer look at the problem. This positive attention has increased efforts to enhance the abilities of these individuals to boost their active participation in society and to improve the quality of their life.

According to the American Speech and Hearing Association (ASHA), approximately two million individuals in the U.S. have language deficiencies or some type of skill deficiency that prevents them from developing skills for effective verbal communication (1991). As mentioned earlier, approximately half of the individuals with autism never fully develop communication
skills, and a significant percentage of the remaining half with verbal skills fail to advance to the level of functional speech that meets their daily communication needs (Lord & Rutter, 1994; Prizant, 1983). The communication problems of individuals with autism may be protracted and lifelong in some cases. Effective communication, social interaction, and functional skills are important for an independent life. Otherwise, daily chores and other basic tasks may become too complicated and even impossible for individuals with autism.

However, undesired outcomes of ASD and deterioration of aforementioned skills can be halted with an appropriate intervention. Providing timely intervention is crucial to individuals with autism in order to alleviate their communication problems as they may always be in need of constant assistance otherwise. Careful evaluation and planning are of primary importance for designing an optimal intervention, so individuals with ASD are able to best adjust their abilities according to environmental needs. There are a large number of individuals with autism who find remedies with alternative communication systems that compensate or support their natural speech (National Research Council, 2001). Schlosser and Wendt (2008) reviewed several studies that employed AAC interventions to support or compensate the natural speech of children with autism. The results of the systematic reviews revealed that AAC is an effective way to promote speech production of children with ASD.

Olive, Cruz, Davis, Chan, Lang, O’Reilly, and Dickson (2007) conducted research to examine the effects of voice-output communication device intervention (VOCA) combined with milieu teaching on communicative behavior of three children with autism. The dependent variables of this study were requesting items and using VOCA to make requests. The result of this study showed that during the play activities, all three children increased their number of requests, from zero at baseline to an average of 18, by using the VOCA. In addition to the
increase in the number of requests, all the participants increased the social interaction with the aid of VOCA.

In another study, Schepis, Reid, Behrmann, and Sutton (1998) evaluated the effectiveness of voice-activated AAC devices and naturalistic training on social communicative behavior of four children with autism. The dependent variables of this study were number of requests, yes/no answers, statements, and social comments consistent with the conversational context. The result of this study showed that all four children improved their social communicative behaviors, competency in answering yes/no questions, initiating conversation, and making comments in social conversations taking place in a classroom setting.

In light of these findings, necessary steps should be taken toward recognizing non-verbal individuals with autism, and these individuals should be trained to use appropriate methods of alternative communications (Nunes, 2008). There are a variety of options for selecting Augmentative and Alternative Communication (AAC) systems that would best suit the needs of individuals with ASD, but thorough evaluation and analysis are crucial for maximum benefit. Training for selected systems should be provided by professionals as some devices are sophisticated and they might pose some challenges.

Although a significant amount of research verifies the effectiveness of AAC in developing communication skills for individuals with autism, there is still some controversy about appropriateness of using AAC to improve verbal ability of individuals with autism. A group of researchers claims that AAC systems are used to substitute for spoken language and using these systems may hinder communication opportunities that are necessary to develop natural speech. However, another group of researchers argues that using AAC to substitute or to
replace natural speech has no negative effect on speech production and it may actually help these individuals develop better communication skills in some cases (Millar, 2008; Mirenda, 2003).

**Purpose of the Study**

The purpose of this study was to measure the effectiveness of an intervention package that includes iPad-based Proloquo2Go, questions related visuals, cue cards, a least-to-most prompting hierarchy and interval reinforcement procedures in teaching responding skills to an individual with autism. Specifically, the responding skills investigated consisted of answering three different types of wh- questions. Due to their popularity in recent years, iPads and touch-screen devices and their effectiveness in teaching new skills have been examined in numerous studies (Flores et al., 2012; King, 2011). Dynamic-screen devices were found to be effective tools for teaching communication skills to individuals with autism. Unlike previous studies, which employed techniques focusing on requesting skills, this study focused on teaching responding skills that are an essential parts of reciprocal communication.

**Significance of the Study**

An increasing number of individuals diagnosed with autism spectrum disorders has been forcing policy makers, researchers, educators, and families to turn their attention to empirical evidence that supports effective intervention techniques for desirable outcomes. Communication skills are vital for individuals with autism, and every institution in society is likely to benefit from the effort undertaken to educate these individuals. Research in this field will not only help families of individuals with ASD, it will also help educators target communication problems and develop and construct programs and interventions based on empirical evidence. Research has shown that individuals with autism can benefit from AAC, but these standalone systems may be too cumbersome and costly. Novel developments in technology have made the integration of
AAC into portable devices with dynamic screens possible. Today, AAC systems are more accessible than ever for the families of individuals with autism. Its popularity, accessibility, and convenience make the iPad and other similar devices perfect candidates for teaching essential communication skills, particularly mastery in answering wh- questions (Flores et al., 2012).

**Research Questions**

I sought answers to the following research questions:

Question 1: Is there a functional relationship between the ability of an adolescent with ASD to answer wh- questions with the implementation of an intervention package that includes iPad-based Proloquo2Go application, a least-to-most prompting hierarchy, interval reinforcement, cue cards and question related visuals?

Question 2: Can an adolescent with autism generalize the learned wh- question–answering skills to novel conditions across different people, different settings, and different questions?
CHAPTER 2

LITERATURE REVIEW

What are Autism Spectrum Disorders?

Autism Spectrum Disorders (ASD) refers to a group of neurodevelopmental disorders, associated with impairments in social and communication development and accompanied with stereotypical behavior and interest (O’Hare, 2009). ASD is a broad term that covers a group of compound disorders that are related to brain development. Autistic disorder, Asperger’s Syndrome, Rett Syndrome, Childhood Disintegrative Disorder, and Pervasive Developmental Disorder Not Otherwise Specified (PDD-NOS) are considered as subtypes of ASD (Centers for Disease Control and Prevention, 2009), and they share, to a degree, common characteristics: (1) social interaction problems, (2) restrictive and repetitive behavior, and (3) verbal communication issues. The descriptions and classifications of related disorders, however, are being revised by The American Psychiatric Association (APA). A newer version of The Diagnostic and Statistical Manual for Mental Disorders was published in May 2013, and new criteria regarding autism diagnosis were proposed (American Psychiatric Association, 2012). Diagnostics labeling according to types of disorders was replaced with a common label, “Autism Spectrum Disorder,” with further classification according to severity of disorder (Grant & Nozyce, 2013; McPartland, Reichow, & Volkmar, 2012; Ozonoff, 2012).

Individuals with autism are evaluated based on severity of their disabilities and diagnosed as high- or low-functioning. While individuals with autism who have communication issues including speech and language problems can be considered as “high-functioning,” others who have severely impaired communication skills and social-interaction difficulties can be considered as “low-functioning” (H. Tager-Flusberg et al., 2005). There is no clear distinction between high-
and low-functioning autism, but researchers usually use IQ as a determiner (Mayes, Calhaun, Murray, & Morrow, 2011).

**Communication Challenges in Persons with ASD**

Communication dysfunctions of children with autism may be observed as early as in the first year of life. Infants start making babbling sounds when they are about 5 or 6 months old. Delayed babbling or no babbling, not responding when his or her name is called, and echoing what he or she hears are among the early symptoms of communication impairment of children with autism (Lenne & Waldby, 2011; Weismer, Lord, & Esler, 2010).

There may also be other challenges that follow the early communication impairments, such as difficulty understanding spoken language (receptive language problems), using a limited number of words to express personal needs (expressive language problems), and decreasing initiation of conversation with others. Individuals with autism may have problems having eye contact with others, and they may lack skills to use and understand facial expressions as communication tools (Lenne & Waldby, 2011). These deficits add another dimension to already-existing communication problems for individuals with ASD and take away their ability to interpret non-verbal cues that can alter the meaning of what is being told.

The ability to produce wh- questions to seek information and to generate an answer to wh- questions in verbal conversations is considered as one of the most challenging communication weaknesses for individuals with autism regardless of their proficiency level in communication skills. These individuals face problems with understanding and answering wh-questions while initiating or carrying out conversations with others (Helen Tager-Flusberg, 1994; Wetherby et al., 2000; Wetherby & Prutting, 1984). Competency in generating answers to wh-
questions is considered a fundamental skill for successfully formulating one’s own questions (Bloom & Lahey, 1978).

**Wh- Questions in Persons with ASD**

Communication challenges found in individuals with ASD have long gained the attention of researchers. While some researchers conducted intervention studies for improving basic communication skills of individuals with ASD to help them meet their daily needs (such as requesting a desired item), others focused on improving more-advanced communication skills, such as pragmatics of language and mastery of wh- questions (Jahr, 2001; Krantz, Zalenski, Hall, Fenske, & McClannahan, 1981; Secan, Egel, & Tilley, 1989). Jahr (2001) examined question-answering skills in five children with autism who were 3 to 7 years old, four girls and a boy. He employed a multiple-baseline design across a group of questions; (1) what, (2) where, (3) who, and (4) why. During the training phase, exemplars were selected from each question group; appropriate training was given for each wh- question group. The dependent variable of interest in this study was the ratio of correct answers to different questions in each group in the first session. Answers were considered appropriate when sentences were complete and consistent with the questions. The results of this study indicated that all the participants improved their question-answering skills. Specifically, all the participants successfully transferred and maintained their question-answering skills across different settings and persons.

In another study, nine children with autism were given training to improve their question-answering skills in a school setting (Krantz et al., 1981). For training purposes, the researcher asked groups of “what,” “why,” and “how” questions that were relevant and stimulating for each child. Training sessions took place in their classroom or homes during regularly scheduled
activities. The result of the study showed that using visual materials for question answering in children with autism is an effective strategy.

Secan, Egel, and Tilley (1989) investigated the effects of different strategies used for teaching generalized responses to three types of wh-questions: (1) what, (2) how, and (3) why. Wh-questions were divided into two or more subcomponents. Modeling and reinforcement procedures were used to teach question-answering skills to children with autism. Questions were presented with magazine pictures as referents. Children were expected to answer questions in 10 seconds. The result of this study revealed that picture training technique can be an effective way of teaching generalized responses for wh-questions, especially when the relevant cues (magazine pictures) are visible.

The majority of research on the comprehension of wh-question-answering studied, exclusively, individuals with autism who were verbal. Comprehension of wh-questions should also be a priority for training non-verbal children with autism as these skills are crucial and essential for establishing and maintaining healthy social ties with significant others (Sullivan, 1953) in their environment. Using AAC systems for training non-verbal children with autism is common practice. However, using these systems for teaching question-answering skills, specifically wh-questions, is an unorthodox idea. The number of studies is very limited due to design complexities and difficulties of working with individuals whose communication abilities are severely impaired by autism.

Unfortunately, as children with autism grow up, their communication issues tend to increase as well (Chawarska et al., 2007). The deterioration process can be drastically minimized or even eliminated if an effective intervention is provided to alleviate the communication impairments. AAC interventions are considered as one of the most effective techniques to
improve communication abilities of individuals with autism (Beukelman & Mirenda, 2005; R. Schlosser, 2003).

What is Augmentative and Alternative Communication?

The American Speech-Language-Hearing Association (ASHA) defines AAC as “a set of procedures and processes by which an individual’s communication skills (i.e., production as well as comprehension) can be maximized for functional and effective communication” (American Speech-Language-Hearing Association, 2002, p. 2). AAC systems compensate for the lack of communication skills by either supplementing or replacing natural speech and/or writing with aided (e.g. picture communication symbols, line drawing, Blissymbols, and tangible objects) and/or unaided symbols (e.g. manual signs, gestures, and finger spelling).

Aided and unaided AAC systems serve different purposes. Unaided systems do not typically require any assistance from another person or device, and individuals can manipulate these systems with their body or gestures (Ganz, Sigafoos, Simpson, & Cook, 2008; Mirenda, 2003). Aided AAC systems require the assistance of another person or device. Using communication facilitators, line drawings, photographs, words, letters, or speech-generating devices to communicate with others are some examples of aided AAC systems (Beukelman & Mirenda, 2005). Three popular AAC interventions are available for individuals who would like to develop or improve their communication skills: manual signing, speech-generating devices (SGDs) (Lancioni et al., 2007), and Picture Exchange Communication System (PECS) (Bondy & Frost, 1994, 2001).

Sign Language

Sign language is known as a main communication system and its usage is prevalent among individuals with hearing impairment (Moores, 1987). Sign language differs from other
AAC systems as it functions in a similar way to speech (topography-based) and it does not require external support (Sundberg & Partington, 1998). Researchers have been using sign-language interventions for about forty years to help individuals with ASD develop communication skills. However, sign-language interventions are not as common as they were once due to the development of computerized technology in AAC systems (Moodie-Ramdeen, 2008). According to Edelson (2007), providing sign-language training that is accompanied by verbal speech is the most effective way to promote speech production in persons with no speech. As it does not require any external device, sign language can be classified as an unaided AAC system, but the person who uses sign language should have fine motor control to perform the signs to communicate with others. One of the biggest handicaps of using sign language is that only people who can interpret sign language can act as a communication partner for those who solely use sign language (Moodie-Ramdeen, 2008).

The debate over advantages and disadvantages of sign language for children with autism is unsettled. Some argue that children with better imitation skills may benefit from sign language and that, when mastered, children would be able to communicate with sign language, thus helping their speech development (Bondy & Frost, 1994; Edelson, 2007). Others think that learning sign language may be an arduous job for children with autism and it may add to or worsen existing isolation problems and deteriorate the development of language skills (Tincani, 2004).

**Picture Exchange Communication Systems (PECS)**

The Picture Exchange Communication System (PECS) is a system that involves exchanging pictures with preferred items. The ultimate purpose of PECS is to promote independent communication by employing prompting and reinforcement strategies. Bondy and
Frost designed the PECS to help non-verbal individuals to improve communication skills (1994). Training for PECS is given by the speech-language pathologists and professionals to non-verbal individuals to replace natural speech (Hart & Banda, 2010). There are clear advantages of PECS, such as simplicity and comfort. As long as an individual is able to point out his or her message by using any body movement or gesture, PECS is an option to be considered (Bondy & Frost, 1994). 

Teaching PECS to individuals who lack functional speech requires completing six methodically ordered phases (Bondy & Frost, 1994). The PECS learner needs to achieve a certain mastery level for each phase. The first phase involves teaching to request a preferred item by exchanging pictures of an item with the trainer. At the end of the first phase, individuals are expected to be able to request a preferred item by exchanging pictures. In the second phase of training, the trainer teaches individuals how to locate the picture of a preferred item and who to talk to for honoring the request. The third phase of PECS involves teaching individuals how to recognize and discriminate pictures that would best describe the item desired. The fourth phase of the training focuses on formulating and generating sentences with pictures and generic cards. The purpose during this step is to increase individuals’ exposure to more complex exchanges. In the fifth phase of training, being able to use PECS to respond without any assistance is the main goal. The trainer reinforces previous phases by using the prompt, “What do you want?” In the final phase, phase six, individuals are expected to use PECS for responding and commenting, unlike previous steps, to prompts. For example, the trainers ask questions such as, “How was your cookie?” and individuals can respond by holding or pointing to one of the following pictures or cards: “Delicious;” “I like it;” or “I did not like it.” New pictures, cards, or signs can
be added to the repository of PECS based on individual preferences, as needed (Bondy & Frost, 1994).

Researchers have evaluated the effectiveness of PECS in many research studies and have consistently found it to be an efficient way for teaching requesting skills to children with no functional speech (Lancioni et al., 2007) and individuals with disabilities (Preston & Carter, 2009). While using PECS systems, users should be in close proximity to other persons in the conversation as they communicate by showing picture cards (Charlop-Christy, Carpenter, Le, LeBlanc, & Kellet, 2002). Also, options for PECS users are limited as picture cards they choose to carry may not be useful for spontaneous encounters. As these individuals develop competency in using PECS, they need a more comprehensive library of picture cards, which might become problematic. New cards can be always added to the library, but carrying a huge pile of picture cards is cumbersome as navigating through the cards and finding what is needed might require some time. Daily conversations happen at a very fast pace, and PECS systems should be carefully organized for optimum time efficiency and for meeting users’ needs.

**Speech-Generating Devices**

Speech-Generating Devices (SGDs) (Colby, 1973) are devices that have a computerized processing unit with a screen and speech-output function. The speech-output functions have usually two options to choose from: digitized speech and synthesized speech. Digitized speech is prerecorded human speech for each symbol or series of symbols on the device. AAC devices with digitized speech are considered as “closed” systems in the professional AAC literature as they have limited capacity to store prerecorded messages and options for users are limited to a prerecorded library. The total number of messages that can be stored in an AAC device with digitized speech output depends on the memory capacity of the device. On the contrary, AAC
devices with synthesized speech have the capacity to transform user inputs into computer-generated speech, and they are considered as “open” systems in the literature. SGDs are further classified as “static screen” or “dynamic screen” based on their purpose (Beukelman & Mirenda, 1998).

**Static-Screen Speech-Generating Devices**

Devices with static display have a tangible layout of language symbols, which is used to guide its users. Combinations of symbols vary depending on the purpose of the device. Some AAC devices have letters, punctuation marks, and other functional keys while others have symbols, pictures, photographs, words, or sentences with pre-created overlays and prerecorded messages. The content of the device is usually planned and organized by the professionals to meet the communication needs of individuals with speech impairment (Beukelman & Mirenda, 1992).

**Dynamic-Screen Speech-Generating Devices**

Unlike speech-generating devices with a static screen, devices with a dynamic display present the information in a digitized format on the screen and users have the freedom to personalize the layout of the display. Technological advancements created devices with user-friendly interfaces, bigger storage capabilities, better personalization and visualization, and faster response times. Users can store information for different scenarios systematically, and these prerecorded, context-specific subfolders can be recalled in a matter of seconds when needed. For example, an AAC device with a dynamic screen may be programmed for the majority of daily activities, such as shopping, and when the user decides to shop for groceries, a folder that contains useful picture cards for grocery shopping can be recalled quickly and used accordingly. As individuals gain more experience with dynamic-screen devices and become better users, the
speech-generation process becomes more efficient. These types of devices also make spontaneous speech generation possible. By using an on-screen keyboard, users can generate synthesized speech output for words, phrases, or sentences that did not exist in the device’s library.

Possibilities are endless for using dynamic-screen devices, but the devices designed solely as AAC systems may come at a greater cost and limit the users’ financial buying ability (Beukelman & Mirenda, 1992). Some multimedia devices, such as iPods and iPads, have been rising as alternatives for pure AAC systems because these devices can be utilized as dynamic-screen speech-generating devices, and they are more affordable and ubiquitous than ever.

iPod- and iPad-Based Speech-Generating Devices

iPods, iPads, and other similar iOS- (iPhone Operating System) based multimedia devices are some of the most commonly used touch screen–enabled multimedia devices. The popularity of these devices makes them good candidates for use as AAC systems. Special applications that are designed to deliver AAC system capabilities are available on iTunes, and some of these applications are well known for their capabilities as AAC devices.

Proloquo2Go stands out among AAC applications and offers great capabilities and user-specific personalization options. The software has a simple user interface that lets users customize previously saved words, messages, and symbols along with an extensive pre-loaded library of vocabularies that can be turned into synthesized speech. Users also have the option to use an on-screen keyboard to type in words, to generate synthesized voice for the words typed in, and to save these messages in the library for possible later use. A pre-loaded library is organized in a systematic and hierarchal fashion into subfolders for easier access and better user experience. Users also benefit from innovative features, such as easy access to most-used or
recently used items, automated help for creating and completing words, and automatic
conjugation. Such functions help these devices learn users’ behaviors and preferences; in turn,
they boost user experience. Dedicated AAC devices are prone to gather unwanted attention from
other people due to their size and different look. The popularity of iPods and iPads makes them
perfect candidates for individuals with ASD and has the additional advantage of helping them
feel “normal” (Mirenda, 2009; Sennott & Bowker, 2009).

Several studies (Achmadi et al., 2012; Kagohara et al., 2010, 2012; King, 2011; van der
Meer et al., 2011) examined possible effects of dynamic-screen multimedia devices on teaching
communication skills to individuals with ASD, and the results are promising. Kagohara et al.
(2010) used iPod Touch to teach and improve requesting skills to a 17-year-old adolescent with
autism who also was diagnosed with ADHD and obsessive-compulsive disorder (OCD). The task
was to request snacks and the location of intervention was his classroom. An iPod Touch with
Proloquo2Go (Sennott & Bowker, 2009) was used as a speech-generating device (SGD). The
participant successfully learned how to navigate the device and identify the correct choice,
although he sometimes failed to perform the final step of the task, which was to generate speech
output. Researchers designed an intervention that targeted the participant’s response topography
in order to improve his ability to generate speech output during the final step of the task. During
the initial baseline, the participant was rewarded with snacks when he accurately chose the
correct icon. For the intervention, the researcher followed a protocol to enforce delayed-
prompting procedures. The researcher helped and guided the participant through the process of
activating the speech when he was not successful at doing so for 10 seconds. During the next
step, the participant was given five seconds to respond before initiating guidance, and later, the
increment was set at 10 seconds, which helped the participant achieve a 100% success rate. To
establish experimental control, the participant was required to perform the same task as he previously did in the baseline. Although the initial success rate dropped significantly, employing a 10-second time delay helped the participant increase to a 100% success rate, and the 100% rate was sustained during follow-up sessions. The results of this study suggested that dynamic-screen devices, such as iPods and iPads, can be successfully used for training individuals with autism and for reshaping their response topography for generating speech with these devices (Kagohara et al., 2010).

In another study, van der Meer et al. (2011) also used an iPod Touch and Proloquo2Go to teach requesting skills to three individuals with different disabilities ranging from autism to severe intellectual disability. The main task was again to request snacks by using an iPod Touch with Proloquo2Go. Researchers employed a multiple probes across participants design (Kennedy, 2005). Short baseline sessions were conducted for increasing participants’ familiarity with SGD. Participants were asked whether they would like to have snacks. Regardless of getting an answer, the researchers provided snacks. During the initial intervention phase, the researcher helped participants choose the correct answers by physically guiding participants’ hands without a delay. Later, the same procedure was applied with a 10-second time delay, and snacks were provided as reward to the participants. In the last phase of intervention, no prompt was provided to the participants and they were required to respond accurately for rewards. Two participants were able to make progress and learned how to use the iPod Touch to request snacks and toys, but the third participant failed to make any progress over 40 training sessions. Researchers concluded that using Proloquo2Go on iPod Touch with differential reinforcement and a physical prompt, when necessary, is a feasible way to teach requesting skills to children with disabilities (van der Meer et al., 2011).
King (2011) used the iPad with the Proloquo2Go application in her study in order to examine its effectiveness in teaching communication skills to children with autism. To evaluate the effectiveness of the iPad, a multiple-probe design across participants was employed. The purpose of this study was to improve communication skills and to increase the mand repertoire of children with autism. Each participant was trained for requesting a preferred item by using the iPad-based Proloquo2Go application with four phases similar to the first four phases of PECS (Bondy & Frost, 1994). The results of this study showed that using the iPad-based Proloquo2Go application with training techniques similar to PECS (Bondy & Frost, 1994) is an effective way for enhancing the mand repertoire of children with autism. Also, the results of this study revealed that children with autism, who have no or limited speech, can also improve verbal requesting skills by using iPad-based Proloquo2Go as a speech-generating device (King, 2011).

Achmadi, Kagohara, van der Meer, O’Reilly, Lancioni, Sutherland, D., et al. (2012) employed an iPod Touch with Proloquo2Go as a SGD in their study. Their aim was to teach two adolescents with autism how to use the iPod-based SGD as an AAC device. Multiple-probe multiple-baseline design (Kennedy, 2005) was used in this study with physical prompting (least-to-most), differential reinforcement, and backward chaining (Duker, Didden, & Sigafoos, 2004). This study included two intervention phases. The first one consisted of teaching students how to operate an iPod-based SGD and how to navigate between two screen pages to perform the multistep response sequence to request a desired item or activity. In the second intervention phase, the aim was to teach students the basics of using an iPod, such as turning on and unlocking the device before moving on to the next screen. Training was carefully conducted as it was considered an important step for providing confidence for participants while operating the device. The results of this study proved that both interventions were effective for teaching
individuals with autism advanced operations of an iPod, such as unlocking and using iPod-based SGDs to complete multiple steps for requesting a desired item or activity (Achmadi et al., 2012).

With a less complicated design, Kagohara, van der Meer, Achmadi, Green, O’Reilly, Lancioni et al. (2012) examined the iPod Touch and iPad as SGDs and designed tasks that require participants to name pictures. Selected pictures were educationally relevant and were chosen from participants’ curricular activities. Verbal and physical prompts were used during the intervention phase of this multiple-baseline study. In their study, they presented two different experiments with both the iPod Touch and iPad. In the first experiment, picture-naming performances of two participants were evaluated in two different conditions: open-ended and closed-ended instruction. The participants had previous experience with the iPod Touch with Proloquo2Go. The main task was to identify a photograph pointed to by the researcher and to choose the correct icon on the device. A reward was given for each correct answer. The first participant had an initial correct response rate of 30%, but his later correct response rate was 100% for open-ended and 80% for closed-ended instructions. The participant was able to maintain a high correct-response rate during follow-up sessions. The second participant had an initial success rate of below 30%, and this rate was successfully increased to 100% open-ended and 75% closed-ended instruction performance, although his performance slightly decreased during follow-up sessions.

In their second experiment, Kagohara, van der Meer, Achmadi, Green, O’Reilly, Lancioni, et al.’s experiment employed an iPad and had the same participants perform similar tasks for pictures grabbed from a children’s book. During this phase, only closed-ended instruction was used. In the baseline phase, both participants failed to give any appropriate response to picture-naming requests. Both participants were able to increase their success rate to
100 percent in fewer than 10 sessions and stayed at this rate of success until the end of the intervention. Although these participants were subject to other studies that employed the iPod Touch and iPad as AAC systems, these results present evidence that support using these devices as speech-generating devices (2012).

Summary

To date, the majority of research that employed the iPod/iPad based Proloquo2Go application has focused on basic communication skills, such as single-step requesting and multi-step requesting. Many of these studies benefited from the same teaching techniques that have been widely used to teach a variety of skills (functional communication, daily life skills, vocational skills, etc.) to individuals with developmental disabilities. Prompt fading, prompt delaying, and gradual prompting are common examples of these techniques. In this short literature review, I summarized the majority of studies targeting requesting skills. While some of these studies used single-step requesting, others made use of multiple requesting techniques. Only one study (Kagohara et al., 2012) conducted an intervention using iPad-based Proloquo2Go for improving picture-naming skills of an individual with ASD. Kagohara’s study is similar to the study I conducted because it utilized pictures in the intervention as related stimuli and asked questions like “What do you see?” and “What is that?” but, I targeted different skills. Although using iPads and iPods with appropriate applications for teaching advanced skills, such as responding, is recommended as future research in a number of studies, there is a little research being done. The current study aims to help fill this literature gap and to chart a clear directions for future research.
CHAPTER 3

RESEARCH METHOD

Participant

In order to find a participant for this study, the researcher contacted the Center of Autism and Related Disorders (CARD), which is located in Tallahassee. Inclusion criteria for this study consisted of a prior diagnosis of autism and current problems with verbal communication, specifically problems with responding to wh- questions in given situations. The Gilliam Autism Rating Scale, second edition (GARS-2) (Gilliam, 2006) was used to determine communication competency of the participant. The criterion for inclusion was a total GARS-2 score greater than or equal to 85 on the communication subscale. Having prior experience with an iPad was not a requirement, but the participant was selected among individuals who did not have any previous experience with the augmentative and alternative communication (AAC) application Proloquo2Go. Additionally, the participant did not have sensory or physical problems that may possibly prevent the participant from operating an iPad. For the purpose of this study, a 15-year-old home-schooled adolescent with autism, Adam, was recruited according to the aforementioned inclusion criteria.

General Characteristics of Participant

When Adam turned one and a half years old, his family sought a professional evaluation because he was not meeting his communication milestones and was not exhibiting any form of pretend play. He also failed to develop age-appropriate communication skills. After a thorough evaluation process, Adam received the diagnosis of autism at age two from a professional health institution. Following the diagnosis, he started receiving occupational therapy (OT), speech therapy, and Applied Behavioral Analysis (ABA) therapy.
When he was younger, he received PECS training to enhance his communication skills, but he got frustrated, started to throw away PECS cards, and refused to use them. After this unsuccessful experience, his parents decided to train him to improve his verbal communication skills as he was somewhat able to communicate verbally. When this effort was conducted, he was able to communicate by using one- or two-word utterances when he had to request things that he wanted to eat, places that he wanted to go, and people that he wanted to see. However, he had difficulty initiating and maintaining conversation and engaging in social interactions with others.

Adam is highly echolalic. He exhibits both immediate and delayed echolalia. He often repeats movie dialogs and song lyrics. When he gets angry, his voice gets louder, he gets very echolalic, he uses immediate and delayed echolalia, he repeats what people say to him, he sings songs very loudly, and he exhibits more stereotypical behavior than usual, such as hand flapping rapidly and rocking continuously. His mother calms him down by letting him hit a pillow or giving him a tight hug. Generally, his tantrums last for about 30 seconds before he calms down.

He is also hyperlexic, which can be considered as one of his strengths since he can read everything from magazines to college textbooks with special terminology. He has a rich vocabulary and he is able to spell almost every word after reading it once. However, he has difficulties with expressive and receptive communication and communication pragmatics. Comprehending and answering wh- questions are also part of his communication challenges. For these reasons, his parents tend to ask questions that can be answered with a simple yes or no. He answers these types of questions when he is in a good mood. When someone asks any type of wh- questions, he tries to answer these questions with yes or no.
He is competent in using computerized technology: laptop computer, iPhone, and iPad. Before participating in this study, Adam used an iPad for entertainment, and his favorite activities included playing games as well as watching cartoons and music videos on his iPad.

Materials

iPad-Based Proloquo2Go Application

The communication application Proloquo2Go version 1.7 was used with an iPad 16 GB as a dynamic-screen, synthesized-speech AAC device. In order to protect the iPads from any possible damage (throwing, hitting, dropping, etc.), a black leather defender case was used during the study.

Proloquo2Go provides an AAC solution for individuals who have speech impairments. It has a text-to-speech function with four synthesized speech options, and it has more than 8000 depictive symbols. The application has only one language option, which is English. The user can use default grids to type a message by using the virtual keyboard on the screen if he or she has good spelling skills. The user is also able to retrieve recently used entries by pressing a button. Proloquo2Go can be used in different devices such as the iPhone, iPod Touch, and iPad. For this study, the iPad’s restriction settings and Proloquo2Go’s settings were used to program the iPad before each session. The iPad’s Wi-Fi, its camera, and all its applications were disabled. The iPad’s screen was set up vertically and locked in this position. Please see Appendix A for the appearance of the iPad’s main menu screen during the study.

In Proloquo2Go, the default home setting was changed to the page that consisted of folders containing answers to wh- questions being asked by the researcher. When the participant tapped on the Proloquo2Go icon on the main screen, three pre-created folders, “what,” “where,”
and “who,” appeared on the main screen. Please see Appendix B for a visual of the Proloquo2Go home screen during the study.

The item size was set up to large, Proloquo2Go pictures and symbols were turned off, the message window was enabled, the speak all items option was disabled, and the speak message only option was enabled. Also, after programming the iPad for each session, Proloquo2Go’s restriction settings were modified: edit mode, adding items, option view, typing view, punctuation pop-up, and recent view options were disabled. Proloquo2Go symbols were used only for the category folders.

Prior to the baseline session, the iPad was programmed to show all three folders: “what,” “where,” and “who.” The “what” folder included answer options for the questions that sought information about an object or an action. The folder named “where” included answer options for the questions that sought information about the place of objects, subjects, or verbs. The folder named “who” included the answer options for the questions that sought information about an action or situation. The answer options for each of the questions under the “what,” “where,” and “who” folders were updated before each session. As the researcher asked five questions in each session per wh- question type and every question had two answer options, there was a total of 10 items displayed in each folder (Appendices F, G, and H show the appearance of each folder as they were displayed during the study).

**Wh- Questions and Question-Related Visuals**

There was a total of forty-five questions used for each of the “what,” “where,” and “who” categories. The questions were preference-based, and the answers were similar in length to control the task difficulty. Throughout the baseline and intervention, similar types of wh-questions were used. Please see Appendix H for the list of sample questions. Also, in order to
visually support the questions, related visuals were selected with the assistance of Adam’s mother by considering Adam’s favorite movies, stories, and videos. The iPad’s picture album was used to show the question-related pictures.

**Cue Cards**

There were three cue cards used during Sessions 16, 17, and 18 for training Adam to answer the questions that were asked in random order. The cue cards consisted of the category names “what,” “where,” and “who” without any pictures. Please see Appendix C for the cue cards.

**Setting**

For all baseline, intervention, and follow-up sessions, Adam was in his home setting and he was seated at the kitchen table facing the researcher. The iPad with Proloquo2Go was placed on the table before each session, and the second iPad, which included question-related visuals, was held by the researcher to show the visuals to Adam before each question. All baseline and intervention sessions were recorded using a video recorder and a tripod. In order to prevent any possible distraction, the video camera was placed three feet high and five feet away from the table.

**Design**

A multiple-baseline design across three types of wh-questions was used for this study to evaluate the effectiveness of using an iPad for improving accurate responses of an adolescent with autism to wh-questions in the home setting. Responding to what, where, and who questions was selected as a target skill for intervention because answering these types of questions is problematic for individuals with autism (Curcio & Paccia, 1987). These skills are also central for
the development of social interaction skills in individuals with autism (Morrison, Kamps, Garcia, Parker, & Dunlap, 2001).

**Intervention Package**

The intervention package consisted of a combination of (1) an iPad-based augmentative and alternative communication (AAC) application, Proloquo2Go; (2) least-to-most prompting hierarchy; (3) interval reinforcement; (4) cue cards; and (5) question related visuals. Each is described more detailed below.

**Procedures**

**Pre-Baseline**

Pre-baseline assessment took a total of six sessions, and was conducted in the same setting as the baseline and intervention sessions. Video recording was employed to increase the participant’s familiarity with the baseline and intervention procedures. During the pre-baseline assessment, the researcher administered the Gilliam Autism Rating Scale (GARS-2nd Ed.), and shared the participant’s score with his parents. Since the intervention comprised visual materials to produce the wh- questions, the researcher observed the participant’s interest in age-appropriate magazines, pictures, and videos. Based on the observation and scores derived from the pre-baseline assessment, the researcher prepared the questions and accompanying visuals for each question.

**Baseline Conditions**

Baseline data for responding to three types of questions were collected at the same time as the first wave of initial data collection.

After successfully collecting at least three baseline data points that were flat or descending for responding to “what” questions, the researcher initiated training for “what”. Once
the participant independently used the iPad to appropriately answer “what” questions three times out of five consecutive intervention sessions, the researcher started training Adam for responding to “where” questions. Intervention continued for the “what” questions and “where” questions while the baseline was continuing for the “who” questions. The same training protocol was applied for the next set of items, and the intervention for responding to “what” and “where” questions continued along with the training for the “who” questions. In this study, any session conducted following Adam’s reaching the criterion of three independent answers to five consecutive questions was considered as the maintenance phase of skill acquisition.

The operational definition for “independent answer” consisted of independently taking the iPad, opening the Proloquo2Go application, choosing the appropriate folder according to the question, selecting one of the two pre-created answers that is consistent with the question, tapping on the message window to speak the answer, cleaning the message window, and going back to his folders by tapping on the “X.” For example, when Adam was presented with the visual and asked the question, “What is your favorite snack?” he was expected to perform the above-mentioned steps and choose one of two pre-created answers in the Proloquo2Go application such as “My favorite snack is a Honeybun” or “My favorite snack is a carrot.”

**What Questions**

Prior to the implementation of responding to “what,” “where,” and “who” question training by using the iPad, baseline data were gathered in the home setting under the identical conditions, time, and setting. For the baseline probe of “what” questions, Adam was shown a related visual for each question and then asked questions such as, “What do you want to eat for snack time?” “What do you use to heat your dinner?” or “What is your dog’s name?” After
asking each question, the researcher gave Adam 15 seconds and let him answer the question by using the iPad independently.

**Where Questions**

Baseline data for “where” questions were collected by following the identical guidelines as those for responding to “what” questions. During the baseline assessment, Adam was shown related visuals for each question and then asked questions such as “Where is Caillou in this picture?” “Where are the people sitting?” or “Where do you go when you get sick?”

**Who Questions**

Baseline data for responding to “who” questions were gathered following the same baseline procedures as those for responding to “what” and “where” questions. During baseline, Adam was shown related visuals for each question and asked questions such as, “Who do you see in this picture?” “Who is talking on the phone in this picture?” or “Who is playing with Caillou?”

For the baseline probes of “what,” “where,” and “who” questions, the participant was shown five visuals for each category followed by the five related questions. After asking each question, the researcher gave Adam 15 seconds to answer the questions by using the Proloquo2Go application on his iPad. If Adam failed to answer the question by using the iPad, the researcher waited for 15 seconds and moved on to the next question.

**Training Procedure**

In this study, Adam was trained to respond to three types of questions: “what,” “where,” and “who.” Training procedures followed a least-to-most–prompting hierarchy (gestural prompt, verbal prompt, modeling, partial physical guidance) with a 15-second time delay consistently as
these are the strategies that have a strong foundation in teaching individuals with developmental disabilities (Charlop & Trasowech, 1991; Duker et al., 2004).

Intervention conditions for responding to “what,” “where,” and “who” questions were identical to those for the baseline condition. However, during the intervention, the researcher provided Adam with verbal prompts, gestural prompts, and modeled the step when needed. When Adam performed the steps for answering the questions independently, he was given verbal reinforcement throughout the session and allowed to choose either to eat his favorite snack or to watch his favorite video at the end of the intervention session. Each intervention session lasted approximately 15–30 minutes, and occurred once a day, three times a week.

At the beginning of each session, the iPad was placed in Adam’s view on the table, the researcher showed a related visual, then asked a question to direct Adam to spontaneously use the iPad to answer the question. Following the question, the researcher waited 15 seconds for Adam to get his iPad and to answer the question by using Proloquo2Go application. If Adam did not use the iPad to answer the question, the researcher pointed to the iPad to get Adam’s attention. When the gestural prompt did not work for Adam to reach out for his iPad, the researcher used the verbal prompt, “Take your iPad,” and waited for 15 seconds for Adam to perform the task. If Adam still failed to perform the step, the researcher modeled the step and waited for 15 seconds for Adam to perform the step. After modeling the step, the researcher partially physically guided Adam’s arm to grab the iPad. If the step still did not occur, the researcher placed her hand over Adam’s hand, physically guided him to take the iPad, and articulated the following statement, “You are taking your iPad,” to remind Adam about the procedure. The same prompting procedures were employed for each step of the task analysis when Adam failed to perform any of the steps independently.
If Adam demonstrated inappropriate use of the iPad, preferred to do nothing, or refused to collaborate, the researcher redirected him to use the iPad appropriately by using the prompt hierarchy described above. When Adam was frustrated and did not want to collaborate, the researcher stopped the timer and video recording, and helped Adam meet his needs. The session resumed after the issue was resolved. If Adam was not able to complete the session, intervention was performed later that day. Adam’s mother stayed in another room at home in case of possible behavioral problems that might be hard for the researcher to manage.

**Intervention**

**Initial Intervention for Wh-Questions**

Interventions started with training for responding to “what” questions. The researcher displayed the related visuals and asked Adam five “what” questions. After each question, Adam was expected to perform each step in the task analysis for responding to “what” questions. Table 3.1 below illustrates the task analysis for the “what” questions, and Appendix H includes sample questions used during baseline and intervention.

Table 3.1 Task analysis for answering to “What” questions.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Take your iPad</td>
</tr>
<tr>
<td>2</td>
<td>Slide arrow to unlock the iPad</td>
</tr>
<tr>
<td>3</td>
<td>Tap on the owl symbol to open the Proloquo2Go</td>
</tr>
<tr>
<td>4</td>
<td>Tap on “What” to see the answer options for the “what” Questions</td>
</tr>
<tr>
<td>5</td>
<td>Read the options and choose the answer to the question</td>
</tr>
<tr>
<td>6</td>
<td>Tap on the message window to speak your answer</td>
</tr>
<tr>
<td>7</td>
<td>Tap on the “X” to clean the message window</td>
</tr>
<tr>
<td>8</td>
<td>Tap on “Back” to go back to your folders</td>
</tr>
</tbody>
</table>
Once Adam reached the mastery criterion for responding to “what” questions, the researcher initiated training for “where” questions. Then, Adam was asked five “where” questions, as in the baseline phase. Adam was expected to perform each step in the task analysis for responding to “where” questions.

Table 3.2 Task analysis for answering to “Where” questions.

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Take your iPad</td>
</tr>
<tr>
<td>2</td>
<td>Slide the arrow to unlock the iPad</td>
</tr>
<tr>
<td>3</td>
<td>Tap on the owl symbol to open the Proloquo2Go</td>
</tr>
<tr>
<td>4</td>
<td>Tap on “Where” to see the answer options for the “where” Questions</td>
</tr>
<tr>
<td>5</td>
<td>Read the options and choose an answer to the question</td>
</tr>
<tr>
<td>6</td>
<td>Tap on the message window to speak your answer</td>
</tr>
<tr>
<td>7</td>
<td>Tap on the “X” to clean the message window</td>
</tr>
<tr>
<td>8</td>
<td>Tap on “Back” to go back to your folders</td>
</tr>
</tbody>
</table>

When Adam reached the criterion for independently responding to “where” questions, the researcher started the training for “who” questions. In each session, the researcher displayed five visuals and asked five “who” questions about the visuals. Adam was expected to perform each step in the task analysis for responding to “who” questions.

Table 3.3 Task analysis for answering to “Who” questions.

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Take your iPad</td>
</tr>
<tr>
<td>2</td>
<td>Slide the arrow to unlock the iPad</td>
</tr>
<tr>
<td>3</td>
<td>Tap on the owl symbol to open “Proloquo2Go”</td>
</tr>
<tr>
<td>4</td>
<td>Tap on “Who” to see the answer options for the “who” questions</td>
</tr>
<tr>
<td>5</td>
<td>Read the options and choose an answer to the question</td>
</tr>
<tr>
<td>6</td>
<td>Tap on the message window to speak your answer</td>
</tr>
<tr>
<td>7</td>
<td>Tap on the “X” to clean the message window</td>
</tr>
<tr>
<td>8</td>
<td>Tap on “Back” to go back to your folders</td>
</tr>
</tbody>
</table>
Intervention Sessions with Cue Cards

After Adam reached the mastery criterion for all three types of wh-questions, the second phase of intervention with cue cards was initiated. This phase consisted of three sessions. In each session, 15 questions were asked in random order. The purpose of this phase was to prevent Adam from memorizing the order of questions and to navigate between three main folders that were created for each type of wh-question. The procedures for intervention with cue cards were similar to the initial intervention phase. The difference was that questions were asked in random order with cue cards presented.

Intervention Sessions with No Cue Cards

Three sessions with cue cards were enough for Adam to attain mastery level. The third phase of intervention, in which the participant was not provided cue cards, was initiated. A total of eight sessions was conducted for each type of wh-question, constituting a total of 15 questions. The questions were asked in random order, but no cue cards were provided.

Follow-up Sessions

There was a two-week break between the last intervention session and the first follow-up session. During the follow-up sessions, the questions were asked randomly without any cue cards or prompts. The follow-up phase consisted of a total of five sessions. All sessions took place at Adam’s home.

Generalization Sessions

In order to test for transfer of the training provided during intervention, Adam was required to perform the skills acquired in a community setting. The generalization sessions were conducted at the end of the study by a researcher who was not affiliated with the present study. In order to conduct the generalization probe, the researcher chose locations from the options
provided by Adam’s family. Three different places were chosen for generalization sessions. The first session took place in a bookstore, the second in a food court in the mall, and the third in a restaurant. Generalization sessions followed a less structured and more natural format than baseline and intervention sessions. The researcher asked questions without using question-related visuals and provided pre-created messages in Adam’s iPad that were consistent with the questions. The questions were related to Adam’s daily life and needs. The sample questions used in the generalization probes are provided in Appendix G.

During the generalization sessions, the data collection procedure was different from that used for the baseline and intervention sessions. The generalization sessions were not video recorded and the researcher used data sheets to record Adam’s responses to wh-questions in the community setting. Because the generalization sessions were not video recorded, the reliability coder collected data in the community setting at the same time as the researcher who was conducting the session.

**Dependent Measures**

In this study, the primary dependent measure was the number of independently performed responses for each session. During the baseline assessment, intervention, follow-up, and generalization probes, Adam was expected to answer the questions asked by the researcher by using the iPad. For the baseline probe, the data sheet was used to record the answer to each question that was used in that session. On the data sheet, independently performed answers were recorded as correct and “I” was used to symbolize it. An incorrect response for the baseline probe was defined as steps that Adam failed to complete independently. “P” was used to symbolize the incorrect steps. The definition of a correct answer for the intervention phase was defined as independently performing each step in the task analysis. Incorrect response for the
intervention probe was defined as any step that requires getting a prompt to perform it. “P” was used to indicate incorrect steps. At the end of the data collection for the baseline and intervention, only independently performed steps were counted to aggregate the total score.

**Inter-Rater Agreement**

Reliability was obtained on the presence and absence of appropriate responses in the intervention sessions. Each intervention session, as well as the baseline sessions, was videotaped to measure reliability of the obtained scores. The researcher recorded data as baseline and intervention occurred. A randomly selected 15% of baseline and 15% of intervention sessions were coded for reliability by a doctoral student in the School of Teacher Education. The student was trained to identify independent and prompted responses. The inter-rater agreement score was calculated by dividing the number of agreements by the sum of the numbers of agreements and disagreements and then multiplying that quotient by 100. Inter-rater reliability scores for “what,” “where,” and “who” were 97%, 90%, and 96%, respectively.

**Procedural Reliability**

In order to assess procedural reliability, two trained graduate students blind to the study completed the fidelity checklists after watching 75% of the baseline, intervention, and follow-up sessions’ videos. For treatment of fidelity, a checklist that included the steps that are critical to the appropriate implementation of the study phases was created by the researcher and provided to procedural-reliability raters. The results of this assessment showed that the researcher implemented the study with 97% accuracy.

**Data Analysis**

Data gathered in this study were analyzed by using the visual analysis and statistical analysis techniques. The SPSS, 19th version, was used to calculate descriptive statistics. The
improvement rate difference (IRD) method was used to calculate the effect size of the study. IRD is considered as a nonparametric method for the calculation of effects size of non-overlapping data and it allows the researcher to determine the improvement rate between baseline and intervention sessions (Parker, Vannest & Brown, 2009).
CHAPTER 4

RESULTS

The purpose of this study was to examine the effects of an iPad-based AAC intervention on the wh- question–answering skill of an adolescent with autism. Specifically, the researcher concentrated on the following research questions:

Question 1: Is there a functional relationship between the ability of an adolescent with ASD to answer wh- questions and implementation of an intervention package that includes iPad-based Proloquo2Go application, least-to-most prompts hierarchy, interval reinforcement, cue cards and question related visuals?

Question 2: Can an adolescent with autism generalize the learned wh- question–answering skills to novel conditions across different people, different settings, and different questions?

Figure 1 displays the number of unprompted responses for each wh- question type (what, where, and who) during the baseline, initial intervention, intervention with cue cards, intervention with no cue cards, follow-up, and generalization sessions. Tables 4.1, 4.2, and 4.3 display the mean scores of each wh- question category across the sessions.

Data Analysis by Question Types

What

As shown in Figure 1, during the first three baseline sessions, Adam was not able to respond to questions with the iPad. Throughout the initial intervention for “what,” Adam consistently increased his score with little fluctuation. A total of 12 initial intervention sessions were conducted before the introduction of the cue cards. As presented in Table 4.1, the mean score for this phase was 3.58. In the following three intervention sessions, cue cards were used. Although the questions were randomly ordered during this phase, Adam consistently scored the
highest possible points. Adam’s mean score in this phase was 5.00, which shows an improvement over the initial intervention. In the next step, a total of seven intervention sessions were conducted without using cue cards with randomly ordered questions. During the second and third sessions of this phase, there was a 20% decrease in Adam’s performance, but in the remaining sessions he consistently scored 100%. The mean score for this phase was 4.71.

The follow-up sessions were conducted two weeks apart from the intervention without cue cards. There was a total of five follow-up sessions. Throughout these five sessions, Adam consistently scored 100% and the mean score of this phase was 5.00. After taking a break for another three weeks, the researcher proceeded with the generalization phase, which took place in three different public places. For each session, the researcher recruited help from graduate students from Florida State University as generalization-session conductors. Adam scored 100% across all three sessions throughout the generalization phase. The mean score for the generalization phase was 5.00. The IRD effect size for “what” intervention was 100%.

Table 4.1 Descriptive statistics for “What”.

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Range</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Sum</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>3</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Initial Intervention</td>
<td>12</td>
<td>4.00</td>
<td>1.00</td>
<td>5.00</td>
<td>43.00</td>
<td>3.5833</td>
</tr>
<tr>
<td>Intervention W/ Cue Cards</td>
<td>3</td>
<td>0.00</td>
<td>5.00</td>
<td>5.00</td>
<td>15.00</td>
<td>5.0000</td>
</tr>
<tr>
<td>Intervention W/O Cue Cards</td>
<td>7</td>
<td>1.00</td>
<td>4.00</td>
<td>5.00</td>
<td>33.00</td>
<td>4.7143</td>
</tr>
<tr>
<td>Follow-Up</td>
<td>5</td>
<td>0.00</td>
<td>5.00</td>
<td>5.00</td>
<td>25.00</td>
<td>5.0000</td>
</tr>
<tr>
<td>Generalization</td>
<td>3</td>
<td>0.00</td>
<td>5.00</td>
<td>5.00</td>
<td>15.00</td>
<td>5.0000</td>
</tr>
</tbody>
</table>
Figure 4.1 Number of Unprompted Responses to “What,” “Where,” and “Who” Questions Across the Sessions.
**Where**

The baseline phase for “where” took nine sessions. Adam’s baseline score was 0 for the baseline phase for “where” during the first three sessions. After Session 7, Adam’s score increased consistently to 100%. The mean score of the baseline phase was 1.33.

The criterion for proceeding with the “where” intervention was to achieve three unprompted correct responses for the five questions in the “what” intervention. As Adam reached this mastery level, the initial intervention phase for “where” started in Session 10. A total of six sessions was conducted during the initial intervention phase. The mean score of the initial intervention phase was calculated as 3.50. Adam’s performance during the initial intervention was not consistent until the intervention with cue cards was initiated. In the intervention with cue cards, Adam had a mean score of 4.66. Following this phase, seven sessions took place without using cue cards with a mean score of 5.00. During the follow-up sessions, Adam consistently scored 100% and the mean score of this phase was calculated as 5.00. In the generalization phase, Adam was able to sustain his 100% success rate with a mean score of 5.00. The IRD effect size for the “where” intervention was 77%.

Table 4.2 Descriptive statistics for “Where”.

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Range</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Sum</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>9</td>
<td>5.00</td>
<td>0.00</td>
<td>5.00</td>
<td>12.00</td>
<td>1.3333</td>
</tr>
<tr>
<td>Initial Intervention</td>
<td>6</td>
<td>2.00</td>
<td>3.00</td>
<td>5.00</td>
<td>21.00</td>
<td>3.5000</td>
</tr>
<tr>
<td>Intervention W/ Cue Cards</td>
<td>3</td>
<td>1.00</td>
<td>4.00</td>
<td>5.00</td>
<td>14.00</td>
<td>4.6667</td>
</tr>
</tbody>
</table>
Who

The baseline session for “who” took a total of 14 sessions with some fluctuations in Adam’s scores. As seen in Table 4.3, Adam’s mean score was 1.92 for the baseline phase. After Adam reached the mastery level in the initial intervention for “where,” the initial intervention for “what” started in Session 15, and it took only one session. In the intervention with cue cards phase, Adam increased his score to 100% and the mean score of this phase was calculated as 4.66. Although in the first three sessions of intervention without cue cards phase Adam’s score dropped to 80%, he reached a score of 100% in the fourth session and sustained this score. The mean score of this phase was calculated as 4.57. Adam continued to score 100% during the follow-up sessions with a mean score of 5.00. In the generalization phase, Adam’s score was 100% for all three sessions with a mean score of 5.00. The IRD effect size for the “who” intervention was calculated as 92%.
Table 4.3 Descriptive statistics for “Who”.

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Range</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Sum</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>14</td>
<td>4.00</td>
<td>0.00</td>
<td>4.00</td>
<td>27.00</td>
<td>1.9286</td>
</tr>
<tr>
<td>Initial Intervention</td>
<td>1</td>
<td>0.00</td>
<td>4.00</td>
<td>4.00</td>
<td>4.00</td>
<td>4.0000</td>
</tr>
<tr>
<td>Intervention W/ Cue Cards</td>
<td>3</td>
<td>1.00</td>
<td>4.00</td>
<td>5.00</td>
<td>14.00</td>
<td>4.6667</td>
</tr>
<tr>
<td>Intervention W/O Cue Cards</td>
<td>7</td>
<td>1.00</td>
<td>4.00</td>
<td>5.00</td>
<td>32.00</td>
<td>4.5714</td>
</tr>
<tr>
<td>Follow-Up</td>
<td>5</td>
<td>0.00</td>
<td>5.00</td>
<td>5.00</td>
<td>25.00</td>
<td>5.0000</td>
</tr>
<tr>
<td>Generalization</td>
<td>3</td>
<td>0.00</td>
<td>5.00</td>
<td>5.00</td>
<td>15.00</td>
<td>5.0000</td>
</tr>
</tbody>
</table>

Table 4.4 Improvement rate difference (IRD) effect sizes.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>What</td>
<td>100%</td>
</tr>
<tr>
<td>Where</td>
<td>77%</td>
</tr>
<tr>
<td>Who</td>
<td>92%</td>
</tr>
<tr>
<td>Omnibus</td>
<td>90%</td>
</tr>
</tbody>
</table>
CHAPTER 5
DISCUSSION

The purpose of this study was (1) to evaluate the effects of the implementation of an intervention package that included a combination of an iPad-based Proloquo2Go application, a least-to-most prompting hierarchy, interval reinforcement, cue cards and question related visuals in teaching wh- question answering skills to an adolescent with ASD; and (2) to evaluate the level of transferring of the learned skills to novel people, settings, questions and time. In the present study, Adam’s ability of responding to wh- questions by using the iPad was assessed before the intervention, during the different phases of intervention, following the intervention, and after the intervention was completed to evaluate the generalizability of the learned skills across different times, people, and places.

Visual analysis of slopes of the graph (Figure 4.1) and statistical analysis revealed that during the first three sessions of the baseline phase, Adam failed to use the iPad to answer to wh-questions asked even though he had been using an iPad for a year for entertainment purposes when this study was conducted. In the first session of the baseline phase, Adam exhibited a lot of stereotypical behavior and refused to use the iPad. When the researcher showed the question-related visuals and asked the questions, Adam blurted out one- or two- word utterances related to what he saw in the pictures, used a lot of echolalia, and sang a song repeatedly. By the time the initial intervention started for “what,” Adam started to increase the number of correct responses for the baseline phases of “where” and “who” questions. This showed that Adam was able to transfer his newly acquired skill to “where” and “who” questions before the intervention phase started for these skills. As Adam progressed through the “what” intervention, his ability to transfer learned skills consistently increased across baseline phases for “where” and “who.”
Throughout the initial intervention phase, Adam’s score fluctuated because he was quite moody and sometimes uncooperative. Before conducting Session 10, Adam had a change in his daily routine and missed his swimming time with his mom. Adam was really moody and not cooperative to proceed the session. He was singing a song aloud and was not listening to what the researcher had to say. For these reasons this session was held a day later instead of on the originally scheduled day.

Even though the intervention with cue cards was quite a short phase, it helped Adam discriminate between the three different types of wh- questions and navigate the Proloquo2Go application on the iPad to answer the randomly ordered questions. In the first session of this phase, when he was provided the cue cards, he successfully transferred his newly acquired skill of using Proloquo2Go to this condition for the “what.” As for the “where” and “who,” his scores fluctuated slightly. After the third session of intervention with no cue cards phase, Adam sustained a 100% score. This proves that Adam was able to transfer his learned skills further with practice. Although there was a two-week break between the last session of the intervention with no cue cards and the follow-up phase, Adam’s follow-up phase scores were impressive too. During the two-week break, he did not have access to his own iPad at home or the iPad used for this study; he performed well and sustained his 100% score for each type of wh- question. A three-week break inserted between the follow-up and generalization phases did not negatively affect Adam’s performance in the generalization phase. Even though the related visuals were not employed, the questions were completely different from the questions used in baseline and intervention phases, and the session conductors, times, and places were novel, Adam scored 100% during the generalization phase. This indicates that Adam was able to generalize the
acquired skills enabling him to answer all the novel questions presented by three different conductors in three different public settings and times.

Additionally, in one of our post-research meetings with Adam’s mother, she shared her experience regarding Adam’s wh-comprehension skill that took place in a family meeting. Adam’s mom and his aunt were talking about a restaurant where they had a big family dinner recently and had a hard time remembering the name of the place. Adam’s aunt directed the following question to his sister: “What was the name of the restaurant where we had a family dinner?” Immediately Adam started singing the name of the restaurant his aunt was asking about. They were both surprised to hear Adam’s made-up song in which he responded to a wh-question. He repeated the name of the restaurant at least ten times by using different intonations and rhythms. Adam’s mother was convinced that he was able to respond because of the AAC intervention and training he received during this study. She also stated that she noticed improvement in his comprehending of questions and his generating of appropriate answers to those questions. More research studies are needed to validate similar experiences of parents of children with autism.

In summary, using an intervention package combining a least-to-most prompting strategy, interval reinforcement, cue cards, and question related visuals was found to be an effective way to teach an adolescent with autism to operate the iPad-based AAC application Proloquo2Go when answering the three types of wh-questions. The intervention method of using the least-to-most prompting strategy with a time delay enabled the participant to improve his performance when answering both ordered and randomly ordered questions while operating the iPad independently.
Implication and Application of Findings

In the current study, a least-to-most prompting strategy with interval reinforcement, an iPad-based AAC application as an SGD, question-related visuals, and cue cards with questions presented in random order were used to teach an adolescent with ASD to answer wh- questions. The interventions were found to be effective. These strategies can be combined and used to teach different sets of skills to individuals with autism. Also, in the current study, the participant was a homeschooled adolescent with autism and all the phases except generalization took place at his home during less-structured activities, such as snack time. This indicated that acquiring new skills and transferring the learned skills to different conditions is possible for adolescent with autism, even in a less-structured environment.

There are some important aspects that differentiate the current study from the previous studies using the same AAC application, Proloquo2Go, on iPod and iPad. First, previous studies aimed to teach less-complex skills such as basic one-step requesting skill (van der Meer et al., 2011), multi-step requesting skill (Achmadi et al., 2012), or picture-naming skills (Kagohara et al., 2012). The current study is the only study that deals with improving the wh-question–answering skill of an individual with autism. Having said this, the implication of this study is valuable for the field of autism as the number of children diagnosed with autism is increasing dramatically in the US and all over the world.

Second, the current study showed some possibilities for using popular dynamic-screen devices, such as iPod and iPad, as an alternative way of communication for individuals with autism, and these findings were backed with empirical evidence. iPods and iPads can provide inexpensive alternatives to the more expensive, complicated speech generating AAC devices, and they can also serve other purposes at the same time. Another advantage of using the iPad and
iPod as AAC devices is that they are more socially acceptable and as a result are less stigmatizing than most AAC devices.

**Limitations of the Present Study**

The current study is limited because of the small sample size and it was conducted with a single participant. Although AAC interventions are highly personalized and require meticulous evaluation and planning, studies with more participants are needed to better evaluate the effectiveness of using an iPad-based AAC applications with individuals with autism.

The iPad presents many entertaining features that could easily distract any individual. For the purpose of this study, the iPad’s restriction settings were used and only the Proloquo2Go application was displayed. The iPad was treated as a dedicated AAC device to prevent any distractions and to optimize the benefits of Proloquo2Go. Thus, the participant was not allowed to make his own decision and choose the application among others when using the iPad as an AAC device, and this might be a threat to generalizability of findings across different times and settings.

Baseline, intervention, and follow-up sessions took place in the participant’s home, which is considered a natural environment. As findings from other studies support the positive effects of conducting behavioral experiments in the participants’ natural environment, the participant was quite comfortable throughout the study. This also helped the researcher to have a smooth research experience. However, it was not always possible to create a distraction-free environment. Although the family made outstanding efforts to help solve any problems that arose during the study, a high noise levels in the home caused short interruptions from time to time and Adam had a hard time staying on task until the distraction was removed.
Additionally, Adam’s participation in the current study sometimes caused an interruption in his daily routines, which incorporated frustration in a number of sessions. He would usually exhibit echolalic behaviors or start singing with the rhythm created by his hand beats. His frustrations would usually disappear after a small conversation with the researcher or when his mother was in close proximity. The researcher had to cancel one of the sessions as Adam refused to cooperate. The current study would have been more accurate if the researcher had been able to follow a regular schedule for conducting sessions and getting Adam familiar with the process by integrating these sessions into his routine, but time restrictions and unpredicted events hindered the efforts toward this direction. Conducting similar research in a school setting with more structured activities and daily routines would yield more accurate results, but this was not the case for Adam as he was being homeschooled.

Adam was highly visual, and he was quickly able to learn the layout of Proloquo2Go as he already had some experience with using the iPad. It took him a short amount of time to get comfortable with the device and figure out the whereabouts of each subfolder. Adam was also hyperlexic, and he, most of the time, quickly scanned through answer options and found the right answer, but this quick scanning sometimes caused him to miss the right answer. If a similar study were to be carried out with a less visually inclined individual, the results might be different.

**Future Research Directions**

The current study provides empirical evidence that supports using the iPod and iPad as speech-generating AAC devices, but further research is needed to explore their possibilities. In this study, the iPad’s restriction settings were used, and replicating this study with less-restricted iPad settings would be a good way to investigate the effectiveness of using an iPad as a
speech generating device, as such findings would be more generalizable. The iPad used in this study was limited to being an AAC device, and the participant perceived it as an AAC device. It is equally important for individuals with autism to recognize an AAC application among other applications and find out exactly when to use the application. Therefore, studies measuring this perspective are needed.

Attention is also needed to assess the outcomes when a similar study is conducted in a school setting where gains may be greater as more social interaction is present. In the school setting, participants may have more structured activities and routines, and it may be easier to integrate AAC interventions into these routine activities. Every individual with autism is unique, and each of them exhibits different characteristics and different skills. In the current study, the participant was a highly visual learner and hyperlexic. He also had prior experience using the iPad. Future studies should target teaching similar question-answering skills to participants with varying skill levels to better evaluate the effectiveness of this intervention.
Figure A.1 Appearance of iPad’s Main Screen
Figure A.2 Appearance of Proloquo2go Home Screen
APPENDIX C

CUE CARDS

Figure A.3 Cue Cards
APPENDIX D

APPEARANCE OF “WHAT” FOLDER

Figure A.4 Appearance of “What” Folder

<table>
<thead>
<tr>
<th>Description</th>
<th>Description</th>
<th>Description</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>The dog is wearing a sunglasses on his eyes</td>
<td>Caillou is wearing a captain hat on his head</td>
<td>The flowers are black, white and pink colors</td>
<td>I see a car accident in this picture</td>
</tr>
<tr>
<td>Charlie Brown is playing with his friends</td>
<td>I see a shipwreck in this picture</td>
<td>The dog is wearing eyeglasses on his eyes</td>
<td>Charlie Brown is checking his mailbox</td>
</tr>
<tr>
<td>Caillou is wearing a crown on his head</td>
<td>The flowers are red, blue and yellow colors</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

54
APPENDIX E

APPEARANCE OF “WHERE” FOLDER

Figure A.5 Appearance of “Where” Folder
APPENDIX F

APPEARANCE OF “WHO” FOLDER

Figure A.6 Appearance of “Who” Folder
### APPENDIX G

**SAMPLE QUESTIONS FOR GENERALIZATION PHASE**

<table>
<thead>
<tr>
<th>Questions</th>
<th>Answer Options</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What</strong></td>
<td></td>
</tr>
<tr>
<td>1. What is your brother’s name?</td>
<td>My brother’s name is Jonny</td>
</tr>
<tr>
<td></td>
<td>My brother’s name is James</td>
</tr>
<tr>
<td>2. What animal is the Shrek’s best friend?</td>
<td>Shrek’s best friend is donkey</td>
</tr>
<tr>
<td></td>
<td>Shrek’s best friend is giraffe</td>
</tr>
<tr>
<td>3. What do you use to keep the rain off of you outside?</td>
<td>I use an umbrella to stay dry when it rains</td>
</tr>
<tr>
<td></td>
<td>I use my hat to stay dry when it rains</td>
</tr>
<tr>
<td>4. What do you use to change the channels on a TV?</td>
<td>I use a remote control to change the channels on TV</td>
</tr>
<tr>
<td></td>
<td>I use a screwdriver to change the channels on my TV</td>
</tr>
<tr>
<td>5. What are the names of your dogs?</td>
<td>My dogs’ names are Maylo, Leo, and Bamboo</td>
</tr>
<tr>
<td></td>
<td>My dogs’ names are Oscar, Silly, and Windy</td>
</tr>
<tr>
<td><strong>Where</strong></td>
<td></td>
</tr>
<tr>
<td>1. Where do you get ice for your drink at home?</td>
<td>I get some ice from the freezer in my kitchen.</td>
</tr>
<tr>
<td></td>
<td>I get some ice from the cabinet in my bedroom.</td>
</tr>
<tr>
<td>2. Where do you go when you have a flight?</td>
<td>I go to airport when I have a flight</td>
</tr>
<tr>
<td></td>
<td>I go to the park when I have a flight</td>
</tr>
<tr>
<td>3. Where do you go to get gasoline for your mom’s car?</td>
<td>We go to the gas station to get gasoline for my mom’s car.</td>
</tr>
<tr>
<td></td>
<td>We go to the hospital to get gasoline for my mom’s car.</td>
</tr>
<tr>
<td>4. Where can you see the different kinds of animals?</td>
<td>I can see the different kinds of animals at a zoo.</td>
</tr>
<tr>
<td></td>
<td>I can see the different kinds of animal in the pharmacy</td>
</tr>
<tr>
<td>5. Where do people play soccer?</td>
<td>People play soccer in the soccer field</td>
</tr>
<tr>
<td></td>
<td>People play soccer in the airport</td>
</tr>
<tr>
<td><strong>Who</strong></td>
<td></td>
</tr>
<tr>
<td>1. Who delivers your mail and puts them in your mailbox?</td>
<td>The mailman delivers my mail</td>
</tr>
<tr>
<td></td>
<td>The policeman delivers my mail</td>
</tr>
<tr>
<td>2. Who lives in a trashcan in Sesame Street?</td>
<td>Elmo lives in a trash can in Sesame Street</td>
</tr>
<tr>
<td></td>
<td>Oscar the Grouch lives in a trash can in Sesame Street</td>
</tr>
<tr>
<td>3. Who is the best friend of Charlie Brown?</td>
<td>Linus is the best friend of Charlie Brown</td>
</tr>
<tr>
<td></td>
<td>Calliou is the best friend of Charlie Brown</td>
</tr>
<tr>
<td>4. Who drives a Van in your family?</td>
<td>Daddy drives a van in my family</td>
</tr>
<tr>
<td></td>
<td>I drive a van in my family</td>
</tr>
<tr>
<td>5. Who can put out a fire?</td>
<td>A fireman can put out a fire</td>
</tr>
<tr>
<td></td>
<td>A mailman can put out a fire</td>
</tr>
</tbody>
</table>
## APPENDIX H

### SAMPLE DATA SHEET AND SAMPLE QUESTIONS

### Data Sheet

**Participant:**
**Date:**
**Time:**
**Skill:** Responding to three types of wh- questions by using the iPad.
**Coded by:** Researcher 2 (Reliability Coder)
**Session #:**
**Scoring Legend:**
- **I:** Independently performed correct responses
- **P:** Prompted responses

<table>
<thead>
<tr>
<th>Question 1:</th>
<th>Independently</th>
<th>Prompted</th>
</tr>
</thead>
<tbody>
<tr>
<td>What color are the flowers?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question 2:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>What is the dog wearing on his eyes?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>What is Charlie Brown doing?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question 4:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>What do you see in this picture?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question 5:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>What is Caillou wearing on his head?</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question 1:</th>
<th>Independently</th>
<th>Prompted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Where is the cat sitting on?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question 2:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Where is Caillou in this picture?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Where is Snoopy lying on?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question 4:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Where are Caillou and his family?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question 5:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Where is the yellow kite in this picture?</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question 1:</th>
<th>Independently</th>
<th>Prompted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Who is writing numbers on the board?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question 2:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Who is holding an umbrella?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Who is wearing a hat in this picture?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question 4:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Who is having a cup of tea in this picture?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question 5:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Who do you see in this picture?</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX I

HUMAN SUBJECT REVIEW COMMITTEE APPROVAL

Florida State University

Office of the Vice President For Research
Human Subjects Committee
Tallahassee, Florida 32306-2742
(850) 644-8641 · FAX (850) 644-3892

APPROVAL MEMORANDUM

Date: 03/09/2013

To: Nesilhan Campolat-Cig

Address: Special Education & Rehabilitation Counseling

From: Thomas L. Jacobson, Chair

Re: Use of Human Subjects in Research

Effectiveness Of Proloque 2 Go Augmentative Alternative Communication App In Teaching Requesting, Responding, and Commenting To Adolescent With Autism

The application that you submitted to this office in regard to the use of human subjects in the research proposal referenced above has been reviewed by the Human Subjects Committee at its meeting on 05/09/2012. Your project was approved by the Committee.

The Human Subjects Committee has not evaluated your proposal for scientific merit, except to weigh the risk to the human participants and the aspects of the proposal related to potential risk and benefit. This approval does not replace any departmental or other approvals which may be required.

If you submitted a proposed consent form with your application, the approved stamped consent form is attached to this approval notice. Only the stamped version of the consent form may be used in recruiting research subjects.

If the project has not been completed by 05/08/2013, you must request a renewal of approval for continuation of the project. As a courtesy, a renewal notice will be sent to you prior to your expiration date, however, it is your responsibility as the Principal Investigator to timely request renewal of your approval from the Committee.

You are advised that any change in protocol for this project must be reviewed and approved by the Committee prior to implementation of the proposed change in the protocol. A protocol change/amendment form is required to be submitted for approval by the Committee. In addition, federal regulations require that the Principal Investigator promptly report, in writing, any unanticipated problems or adverse events involving risks to research subjects or others.

By copy of this memorandum, the chairman of your department and/or your major professor is reminded that he/she is responsible for being informed concerning research projects involving human subjects in the department, and should review protocols as often as needed to insure that the project is being conducted in compliance with our institutional and with DHHS regulations.

This institution has an Assurance on file with the Office for Human Research Protection. The Assurance Number is IRB00000446.

Cc: Mary Hanline <mhanline@fsa.edu>, Advisor
HSC No. 2012.8262
APPENDIX J

Human Subject Review Committee Renewal

Office of the Vice President For Research
Human Subjects Committee
P. O. Box 3062742
Tallahassee, Florida 32306-2742
(850) 644-8673 · FAX (850) 644-4392

RE-APPROVAL MEMORANDUM

Date: 05/09/2013
To: Neslihan Canpolat-Cig

Address:

Dept.: SPECIAL EDUCATION & REHABILITATION COUNSELING

From: Thomas L. Jacobson, Chair

Re: Re-approval of Use of Human subjects in Research:
   Effectiveness Of Proloquo2Go Augmentative Alternative Communication App In Teaching Requesting, Responding,
   and Commenting To Adolescent With Autism

Your request to continue the research project listed above involving human subjects has been approved
by the Human Subjects Committee. If your project has not been completed by 04/09/2014, you are
must request renewed approval by the Committee.

If you submitted a proposed consent form with your renewal request, the approved stamped consent
form is attached to this re-approval notice. Only the stamped version of the consent form may be used
in recruiting of research subjects. You are reminded that any change in protocol for this project must
be reviewed and approved by the Committee prior to implementation of the proposed change in the
protocol. A protocol change/amendment form is required to be submitted for approval by the
Committee. In addition, federal regulations require that the Principal Investigator promptly report in
writing, any unanticipated problems or adverse events involving risks to research subjects or others.

By copy of this memorandum, the Chairman of your department and/or your major professor are
reminded of their responsibility for being informed concerning research projects involving human
subjects in their department. They are advised to review the protocols as often as necessary to insure
that the project is being conducted in compliance with our institution and with DHHS regulations.

Cc:
HSC No. 2013.10255
APPENDIX K

ASSENT TO PARTICIPATE IN RESEARCH

Assent to Participate in Research

My name is Neslihan Canpolat-Cig and I am from the School of Teacher Education Department at Florida State University. I am conducting a research study entitled “Effects of iPad Based Augmentative and Alternative Communication Intervention on Wh-Question Answering Skill of Adolescent with Autism Spectrum Disorders.” I am asking you to take part in this research study because I am trying to learn more about the effects of a using communication application Proloquo2Go, to enhance the wh-question responding skills of individuals with autism. This study will approximately last 6 months.

If you agree to be in this study, you will be asked questions and will be expected to answer these questions by using a special communication application “Proloquo2Go” on the iPad. Participation for this study will take approximately 30-35 sessions. No more than 3 sessions will be scheduled in a week. Each session will last 15-30 minutes approximately. All of these sessions will take place at your home and these sessions will be videotaped. Only three sessions will take place in community settings and will not be videotaped. During these sessions, you will answer a set of questions. You will need to respond these questions by using your iPad. Some sample questions may include the following: “What do you want to drink?” , “What is the name of your brother?” , and “What do you use to heat your pizza?” You do not have to answer any question you do not want to and you can stop participating in this study at any time. No one will be able to know how you responded to the questions and your name will never be used.

Please talk about this study with your parents before you decide whether or not to participate. I will also ask your parents to give their permission for you to participate. Even if your parents say “yes” you can still decide not to participate. You may also change your mind before or during the study. No one will be upset with you if you do not want to participate or if you change your mind later and want to stop.

You may ask me any questions about this study. You can call me at any time on ___________ email me from ___________ or talk to me the next time you see me.

By signing below, you are agreeing to participate with the understanding that your parents have given permission for you to take part in this project. You are participating in this study because you want to. You and your parents will be given a copy of this form after you have signed it.

________________________________________
Print Name

_________________________  ______________
Signature                  Date

APPENDIX L

CONSENT FOR RELEASE OF INFORMATION

Consent for Release of Information

I hereby authorize and request an exchange of information as indicated below between:

Mary Frances Hanline, Ph.D.,
Professor, School of Teacher Education
College of Education
Florida State University
Tallahassee, Florida, 32306
850-644-8417
mhanline@fsu.edu

and

Neslihan Campolat-Cig
School of Teacher Education
College of Education
Florida State University
Tallahassee, Florida, 32306

The purpose for release of information is to allow for ongoing contact concerning your child’s communication evaluation and intervention. The information to be released includes communication evaluation reports and family information sheets.

I understand that by signing this form I am authorizing the release of this information, and I agree to be contacted later.

Signature of Parent/Legal Guardian ___________________________ Date ____________

Relationship to Child ____________________________

Identifying Information (please print)

Child’s Name: ____________________________

Date of Birth: ____________________________

Dear Parent,

You and your child are invited to participate in an intervention study to be initiated this summer. This study will be conducted as a thesis project by Neslihan Canpolat-Cig, as a master’s candidate, under the guidance of Dr. Mary Frances Hanline at the Florida State University, School of Teacher Education Department. The aim of this study is to validate the effectiveness of a communication app, Proloquo2Go. For the purposes of this study, Proloquo2Go will be used for promoting responding skills to three forms of wh-questions skills (what, where, and who) in an adolescent individual with autism. By increasing responding skills, individuals with autism may also increase social communicative behavior and social interactions with people. The instruction is short, iPad based and focuses on teaching responding to three types of wh-questions (what, where, and who) by using iPad app Proloquo2Go. All materials associated with participation in this intervention will be provided at no cost. It is hoped that your participation in this study will help in determining the effectiveness of iPad app Proloquo2Go intervention on communication skills of individual with autism in home setting.

If you are interested in having your child participate in this study, please contact Neslihan Canpolat-Cig Dr. Mary Frances Hanline 644-8417. I look forward to hearing from you soon.

Respectfully,

Neslihan Canpolat-Cig

Parent Agreement to Participate In Clinical Investigation

Project Title: Effects of iPad Based Augmentative and Alternative Communication Intervention on Wh-Question Answering Skill of Adolescent with Autism Spectrum Disorders

You and your child are being asked to participate in a research project described in this form below. This research project is governed by the rules of both the federal government and Florida State University. These rules require that you give your signed agreement for participation in this project. This research is being conducted by Neslihan Canpolat-Cig, M.A under the guidance of Dr. Mary Frances Hanline, who is a Professor at Florida State University. For further information, please contact Neslihan Canpolat-Cig or Dr. Mary Frances Hanline at 644-8417.

The investigator will explain to you the purpose of this project, the procedures to be used, as well as potential risks and benefits associated with participation in this project. You may ask questions to help you understand this study. A basic explanation of this study is written below. Please read this explanation and discuss any questions you might have with the investigator.

If you decide that you will participate in this project, please sign this form on the line below. You will be given a copy of this form to keep.

Nature and Purpose of the Project: The purpose of this study is to determine the effectiveness of using augmentative alternative communication app Proloquo2G, to enhance responding to three types of wh- questions (what, where, and who) of individuals with autism. Gilliam Rating Scale 2nd Edition (GARS-2) will be used to determine the individual’s level of communication skills and identify skills to be taught.

The teaching sessions will include instructing and prompting the child to engage in targeted activities. The estimated duration of the project is six months. Once initial evaluations are completed, one teaching session about 15-30 minutes long will be scheduled each day according to availability of participant and his/her family.

Explanation of Procedures: Baseline and intervention sessions will occur in your home. We will also want to see if your child can use the iPad in the community setting.

Therefore, we will conduct three generalization sessions in community settings of your choice.

A baseline and intervention data collection sessions will be conducted to determine the effectiveness of Proloquo2Go application for enhancing communication skills of adolescents with autism. The procedures for baseline and intervention include collecting a 15-30 min data collection at designated times and a range of activities (snack time, reading etc.). The intervention itself will consist of teaching sessions that include observing, and prompting of the participant to operate the Proloquo2Go to answer the questions asked by the researcher. During the teaching session, the communication application “Proloquo2Go™” version 1.7 will be used with an iPad, 16 GB + 3G as a dynamic screen, synthesized speech augmentative and alternative communication device (AAC). All baseline and intervention sessions will be recorded by using a video recorder and a tripod. Video tapes will be reviewed for purposes of data collection and on occasion to provide you with feedback. Generalization sessions will not be videotaped. The researcher and reliability coder will record the observed data on a data collection sheet.

Discomforts and Risks: These procedures do not involve activities that would cause discomfort to your child or put you at any risk. However, if your child should become upset with involvement in the intervention, you can decide to withdraw from the study at any time.

Benefits: You and your child may benefit from this project in many ways. First, there is a possibility of learning a useful communicative skill development intervention for working with your child with autism throughout the day. Secondly, the results of this study will provide empirical evidence of effectiveness of Proloquo2Go intervention on the communicative behaviors such as responding.

Confidentiality: The records of this study will be kept private and confidential to the extent permitted by law. In any sort of report we might publish, we will not include any information that will make it possible to identify a subject. Research records will be stored securely and only researchers will have access to the records. All records and videotapes will be maintained in the locked office until December 31, 2015. After that time, written records will be shredded and videotapes will be bulk erased. Presentations

and publications resulting from this project will utilize pseudonyms when referring to participants within this study.

Refusal/ Withdrawal: Any time during your participation in this study, you will have the opportunity to refuse participation or withdraw from the study at any time without prejudice or effect on you.

I ACKNOWLEDGE THAT I HAVE READ AND FULLY UNDERSTAND THE ABOVE EXPLANATION OF THE PROJECT, THAT ALL OF MY QUESTIONS HAVE BEEN SATISFACTORILY ANSWERED, AND I GIVE PERMISSION FOR MY CHILD TO PARTICIPATE IN THIS RESEARCH PROJECT.

Signature of Parent                  Date

If you have any questions about your rights as a subject participant in this research, or if you feel you have been placed at risk, you can contact the Chair of Human Subjects Committee; FSU Institutional Review Board (IRB) at 850-644-8633 or humansubjects@magnet.fsu.edu. You will be given a copy of this consent form for your records.

Mary Frances Hanline, Ph.D.,
Professor, School of Teacher Education
College of Education
Florida State University
Tallahassee, Florida, 32306
850-644-8417 mhanline@fsu.edu

Neslihan Canpolat-Cig
School of Teacher Education
College of Education
Florida State University
Tallahassee, Florida, 32306

I CERTIFY THAT I HAVE EXPLAINED FULLY TO THE ABOVE PARENT THE
NATURE AND PURPOSE, PROCEDURES, POSSIBLE RISKS AND POTENTIAL
BENEFITS OF THE RESEARCH PROJECT.

________________________________________
Signature of Investigator                      Date

2013.10252
References


BIOGRAPHICAL SKETCH

Neslihan Canpolat-Cig received her Bachelor’s degree in Social Science Education at Cumhuriyet University in Sivas, Turkey. She worked for a private school for five years as a social science and geography teacher in Istanbul, Turkey. After her marriage-related relocation to the U.S., she attended the graduate school at Florida State University (FSU) to pursue a Master of Science degree in Special Education.

During her studies at FSU, Neslihan worked in several different positions at the university. She was a graduate assistant at the Augmentative and Alternative Communication Laboratory in the College of Education and the School of Communication Science and Disorders. She was actively involved in teaching students how to operate various kinds of AAC devices, creating AAC materials, and giving presentations in courses, conferences, and exhibitions about AAC systems and their implementation in educational environments. She is currently working as a research assistant in a federally funded reading research project at the Florida Center for Reading Research and as a graduate assistant in the Learning Resource Center at the College of Education.

Neslihan’s research interests include: using augmentative and alternative technology interventions to improve the social-communicative behavior of individuals with autism, using up-to-date technologies in special education to improve learning outcomes, and technology implementations in teaching vocational skills to individuals with autism and developmental disabilities.