# EFFECTS OF PEER ASSISTED COMMUNICATION APPLICATION TRAINING ON THE COMMUNICATIVE AND SOCIAL BEHAVIORS OF CHILDREN WITH AUTISM

By

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ABSTRACT

EFFECTS OF PEER ASSISTED COMMUNICATION APPLICATION TRAINING ON THE COMMUNICATIVE AND SOCIAL BEHAVIORS OF CHILDREN WITH AUTISM

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Non-verbal children with autism are candidates for augmentative and alternative communication (AAC). One type of AAC device is a voice output communication aid (VOCA). The primary drawbacks of past VOCAs were their expense and portability. Newer iPod-based VOCAs alleviate these concerns. This dissertation sought to extend the iPod-based VOCA research by training children with autism more sophisticated communication skills with the assistance of same-aged peers. Using a multiple baseline design, 4 children with autism were taught through peer assisted communication application (PACA) training how to mand using a 2-step sequence and respond to the questions, “What do you want?“ and “What is your name?” using a 2-step sequence. Data were taken on the number of independent mands, independent responses, social initiations, length of social interactions, problem behaviors, and verbalizations. Results indicated that 3 of the 4 participants were able to acquire communicative skills targeted through the implementation of a peer-mediated intervention. The implications of the study are analyzed in regards to the effectiveness of peer assisted communication application training to teach sophisticated communication skills.

DEDICATION

Dedicated to Jamie and Tails for all of their love and support.

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# CHAPTER 1

# INTRODUCTION

The following dissertation evaluates the effectiveness of using peer assisted communication application (PACA) training to teach children with autism to use Proloquo2go™ on an iPod touch® (referred to as just Proloquo2go™) in order to request items (using sentences) and respond to the questions ("What do you want?" and "What is your name?"). The present chapter provides an overview of the topics that will be covered in greater detail in the remaining chapters of the dissertation. This includes an introduction to (a) autism, (b) applied behavior analysis (ABA) and verbal behavior (c) augmentative and alternative communication (AAC), and (d) peer-mediated interventions. The paper explains how AAC can be used with non-verbal children with autism. These children can be taught how to use AAC devices through principals of ABA, and may largely benefit from the use of using peers in the implementation of such interventions. The introduction concludes with a statement explaining the purpose for the dissertation.

## Autism

The autism spectrum disorder (ASD) includes Asperger syndrome, Rett syndrome, childhood disintegrative disorder, autism, and pervasive developmental disorder not otherwise specified. Autism is a disorder characterized by a qualitative impairment in social interactions and communication skills, and the displaying of repetitive or restrictive interests (APA, 2000). Children with autism lack both the verbal and nonverbal behaviors used in reciprocal social interactions (Wetherby, Watt, and Morgan, 2007). Such behaviors include making eye contact and manding (which is similar to

requesting). Children with autism do not typically reach the same communication milestones, as children without autism. Most children with autism do not engage in joint attention (directing one's attention towards an activity through an action such as a gaze) or symbolic play (substituting the meaning of one object for another imaginary object) in the same manner as typically developing children (Charman et al., 1997, Dawson et al., 2004; Sigman, Mundy, Sherman, & Ungerer, 1986). Without adequate communication skills, many children with autism (a) may have difficulty obtaining access to preferred items/events and avoiding non preferred items/events, (b) may instead express themselves through problem behaviors, such as hitting and screaming (Sigafoos, Drasgow, & Schlosser, 2003) and, (c) are at risk for developing less meaningful relationships with their peers and others (White & Roberson-Nay, 2009). One way to mediate the deficits of communicative behavior with individuals with autism is through the use of interventions that utilize principals of ABA (National Research Council, 2001).

## Applied Behavior Analysis and Verbal Behavior

Applied Behavior Analysis includes an emphasis on behavioral principles, empirical principles, and analysis of relevant outcomes involving behaviors (Cooper, Herron, & Heward, 2007). In 2009, the National Autism Center released the National Standards Report (NSR) to provide parents, educators, and researchers a comprehensive guide on evidence-based practice for individuals with autism. Upon reviewing 700 research studies from 1957-2007, the panel of experts identified established, emerging, unestablished, and ineffective interventions. Interventions that used components of ABA were considered the most effective for children with autism (NSR, 2009). In fact, nearly 85% of evidence-based practices include a component of ABA. Interventions that used

aspects of ABA were also found to have the most significant impact on reducing problem behaviors in students with autism (Campbell, 2003).

Sundberg & Michael (2001) outlined some important connections between behaviorism and autism: early and intensive intervention is vital, ABA can increase behavioral objectives, and the highest priority of treatment must involve language skill development (for communication).

Communication, through the lens of behaviorism can be thought of based on Skinner's (1957) functional description of verbal behavior. Verbal behavior encompasses all behavior that exists between a speaker and listener, in which the listener's behavior (or response) grants the speaker access to reinforcement (Sundberg, 2007). The mand is a type of verbal behavior where the individual's response is controlled by an establishing operation (EO), such as deprivation or satiation (Sundberg & Michael, 2001). For instance, I may be hungry for dessert. If I haven't had any frozen yogurt (my favorite dessert) for months, I'd be more likely to request it. The mand gives an individual control over his or her environment making it a vital operant to target when deficient. Not all individuals with autism however, can communicate vocal-verbally. Approximately 30% of individuals diagnosed with autism remain non-verbal after receiving speech directed interventions (Klin, 2007). Therefore, not all individuals with autism can vocal-verbally mand, and are in turn candidates for AAC (Reichle, Beukelman, & Light, 2002).

## Augmentative and Alternative Communication

Augmentative and alternative communication is defined as any method that supplements or replaces communication when language impairments are present (Mirenda, 2003). Augmentative and alternative communication includes unaided systems,

which do not use an external device (i.e. manual signs), and aided systems, which do use an external device (i.e., picture exchange communication aids, voice output communication aids) (Light, Roberts, Dimarco, & Greiner, 1998).

The Picture Exchange Communication System (PECS) is an instructional system that teaches aided communication through the exchange of graphic picture symbols. The picture symbols (paired with the corresponding word) used in the PECS are universally understood and therefore create a larger audience for the user compared to manual signs (Bondy & Frost, 2001; Mirenda, 2003). This is in stark contrast to behaviors such as gesturing or tantrums that aren't understood as effectively. The PECS includes a training procedure with six phases. These include (a) physical exchange, (b) expanding spontaneity, (c) picture discrimination, (d) sentence structure, (e) answering a direct question and (f) commenting. This study utilizes an adapted version of these training procedures.

Voice output communication aids (VOCAs) are a higher technological AAC. Specifically, VOCAs are portable electronic devices that produce synthetic or digitized speech (Mirenda, 2003). The function of speech output on VOCAs allows users to produce consistent and accurate messages. The ability for users of VOCAs to communicate at increased distances makes them a viable option in teaching communication to individuals with autism (Sigafoos, Didden, & O'Reilly, 2003, Schepis, Reid, Behrmann, & Sutton, 1998). Previous research studies that have examined the effects of VOCAs on the communication skills of children with autism have shown positive results (Olive, 2008, Schlosser et al., 2007, Sigafoos, O'Reilly, Seely-York, & Edrisinha, 2004, 2003, Durand, 1999). However, there are two primary limitations of

VOCAs, which are a lack of portability and the expense of such devices (Mechling, Gast, & Fields, 2008).

With an increase in application development in recent years, the iPod touch® has become a viable alternative to more expensive and heavy AAC devices. The iPod touch® is a touch screen mobile device that can be used for many different purposes including productivity, entertainment, and education. The iPod touch® weighs 4.05 ounces, measures 4.3 by 2.4 inches, and costs $199. The iPod touch® is controlled when the user touches the screen in order to select a command. The iPod touch® is a versatile device and has been used in many capacities with children with autism. The iPod touch® has been used to increase self-monitoring behaviors (Blood, Johnson, Risdenour, Simmons, & Crouch, 2011), appropriate transitional behaviors (Cihak, Ayres, & Smith, 2010) and appropriate communicative behaviors (Achmadi et al., 2012, Kagohara et al., 2010). In order to transform the iPod touch® into an AAC device, the application Proloquo2go™ can be downloaded onto it.

Proloquo2go™ is an application for the iPod touch®, iPhone®, and iPad® that produces speech when either a picture (with word or phrase) is touched, or a message is typed (or organized via touching word pictures) (Reynolds & Alvarez, 2009). Proloquo2go™ has received much attention in the AAC community (Hyatt, 2011, McLeod, 2011). Proloquo2go™ alleviates the past concerns of expensive and large

VOCAs with its $190 price tag and a weight of 4.05 oz. Although other communication applications exist, Proloquo2go™ is one of the most popular with 435 ratings (Apple, 2012). Proloquo2go™ may also be helpful in addressing the social stigma of past VOCAs as many children without autism carry iPod touches® and iPhones®. There is limited research though on the effectiveness of Proloquo2go™. The few published studies that exist use training procedures that utilize a combination of differential reinforcement, prompting, and time delay (Achmadi et al., 2012, Kagohara et al., 2010, van der Meer et al., 2010). Although iPod-based VOCAs, such as Proloquo2go™ have their advantages, one potential enhancement would be the introduction of same-aged peers into the intervention package. However to date, there have not been any published studies that evaluated the use of peer-mediated interventions in the training of newer iPod-based VOCAs. (Trottier, Kamp, and Mirenda, 2011, Trembath, Balandin, Togher, and Stancliffe, 2009).

## Peer-Mediated Interventions

Peer-mediated interventions involve a typically developing peer assisting or providing interventions to children with a social or academic deficit (McConnell, 2002). The role of adults varies in peer-mediated interventions from direct involvement to monitoring the intervention from a distance (Odom & Strain, 1984). One of the benefits of peer-mediated interventions is that they increase the probability children with disabilities will use social skills learned with same-aged peers. The additional step of generalizing from adults to peers is taken away, which increases interactions between

children with and without disabilities (McConnell, 2002). Utley, Mortweet, and Greewood (1997) categorized six different types of peer-mediated interventions: (a) peer modeling, (b) peer initiation training, (c) peer monitoring, (d) peer networking, (e) peer tutoring, and (f) group-oriented contingencies. For the purposes of this study, elements were taken from peer networking and peer tutoring to help facilitate the training procedures.

## Purpose of the Study

The purpose of the present investigation is to extend the literature by examining the effectiveness of using PACA training to teach children with autism how to use Proloquo2go™ in order to request using sentences (phase IV of PACA training), respond to the question, "What do you want?" (phase V of PACA training), and respond to the question, "What is your name?" (phase VI of PACA training). This study seeks to measure the effects of PACA training and Proloquo2go™ on increasing children with autism's communicative skills and social skills when using Proloquo2go™.

# CHAPTER 2

# LITERATURE REVIEW

The following chapter reviews research literature emphasizing the history of AAC in use with children with autism. A broad overview of autism and verbal behavior is followed by a description of AAC and its subsets. Peer-mediated interventions are discussed as procedures for teaching communication skills to children with autism. The chapter concludes with the specific research questions for the study.

## Autism

Autism is affecting an increasing number of children every year. Approximately 1 child in every 88 is diagnosed with an ASD (CDC, 2012). Although many children with autism develop some communication skills, other children never acquire functional speech (Dawson, 2008). Functional speech can be defined as the ability to express basic wants and needs (Bondy & Frost, 2001). Approximately 30% of individuals with autism live their lives mute until receiving intensive speech training (Klin, 2007). Of that 30%, 5% to 25% of those individuals do not acquire useful speech following intensive speech interventions (Dawson, 2008).

Without any means of communication, children with autism often express themselves through problem behaviors that include aggression toward others and self-injurious behaviors (Durand, 1993, 1999; Frea, Arnold, & Wittinberga, 2001; Reichle & Wacker, 1993; Sigafoos, Drasgow et al., 2003). Children with autism may use these behaviors to avoid non-preferred stimuli or to obtain preferred stimuli. For instance, a child may want food; however, without a means to communicate the need, the child instead yells, and throws self to the floor until the caretaker can accurately guess what the

child wants. As a result, food is provided contingent on yelling and tantruming; thus becoming the mode of communication for the individual with autism. There are a number of resulting issues that occur when an individual with autism does not learn a functional means of communication, such as creating a barrier between children with autism and their family, teachers, and peers, and added stress placed on those working with children with autism (Wetherby, Prizant & Schuler, 2000). One means to remove the social barrier and stress created, is to employ practices based on the methodology of ABA (National Research Council, 2001).

## Applied Behavior Analysis and Verbal Behavior

Applied behavior analysis includes an emphasis on behavioral principles, empirical principles, and analysis of relevant outcomes involving these behaviors (Cooper et al., 2007). Based on behavioral principles, communication is thought of as verbal behavior. Skinner (1957) defined verbal behavior as behavior that is reinforced through the influence of another individual's behavior. Verbal behavior is comprised of operants such as the tact, echoic, intraverbal, and mand. A tact is similar to a label and helps children in identifying things or features in their environment. An echoic is similar to a repetition and helps children in learning vocabulary through modeling. An intraverbal is similar to an appropriate response such as answering a question or filling in the blank and helps children in learning how to socialize. The mand is a type of verbal behavior where the individual's response is controlled by an EO, such as deprivation or satiation (Sundberg & Michael, 2001). The mand is considered by many to be the most important first step in teaching communication (Sundberg, 2007).

## Mand Training

Mand training is an essential beginning point in any language-training program for children with autism (Sundberg, 2007). Mand training involves the use of modeling and transferring stimulus control to the EO in order to teach children how to request. Stimulus control is when behavior occurs in the presence of a particular stimulus and does not occur in the absence of one. An example would include asking for a cookie when you see your mother take out a bag of cookies, and not asking for cookies when they are not present. Establishing operations are environmental events that influence an individual's behavior by changing the reinforcement value of other environmental events, and in turn the number of times the individual produces that behavior (Michael, 2000). An example would include when a cookie becomes a more effective reinforcer, when a child hasn't eaten all day. Another example would include when a cookie becomes a less effective reinforcer, when a child just ate at a buffet. Mand training can be done in either an analog or naturalistic environment. Naturalistic environments are the spaces in which a child functions from day-to-day (McGee et al., 1985). The analog environment involves trials conducted away from the naturalistic environment.

## Problem Behaviors

Problem behaviors can function as a type of mand (Sundberg, 2007). Yelling or engaging in a tantrum may result in the delivery of the desired item. Children learn to produce these disruptive and harmful behaviors to receive preferred items. One method for decreasing problem behaviors in the past was through differential reinforcement of other behaviors. This meant (a) using extinction, and (b) reinforcing (i.e. providing a stimuli, immediately after behavior, that has the likelihood of increasing future behavior)

during the times when the problem behavior was not being exhibited (Homer & Peterson, 1980). The field however was influenced by the idea that problem behaviors and appropriate behaviors were interrelated. In fact, Goldiamond (1974) advocated that challenging behaviors needed to be replaced with socially useful behaviors. For instance, instead of yelling a child could raise their hand.

Many studies have examined the use of mand training to decrease problem behaviors. Kern, Carberry, and Haidara, (1997) evaluated the effects of mand training combined with increasing the delay to reinforcement, and extinction to decrease problem behaviors in a young woman with autism. The problem behaviors in this study were self-injury and aggression. A functional analysis was conducted prior to the study that concluded the participant engaged in self-injury to receive preferred items, and engaged in aggression in order to escape a task or demand. Mand training was used to replace problem behaviors in obtaining food items. Results indicated that the intervention was effective for decreasing self-injury, and ineffective for decreasing aggression. One possible explanation for the ineffectiveness of the intervention to address aggression is that the specific form of aggression may have continued to delay the difficult task. After the initial intervention, a gradual delay procedure was added to the intervention package, which resulted in decreases in aggression.

Drash, High, & Tudor (1999) confirmed previous findings in a study examining the effects of mand training in increasing communicative behaviors and decreasing problem behaviors in young children with autism. Dependent variables included mands, echoic responses, tact responses, error responses, and inappropriate behavior combined with no responses. Problem behaviors included screaming and crying. Mand training

included placing preferred items just out of the reach of the participants and only granting access to them once an appropriate vocalization was made. Mands were acquired by all participants and problem behaviors decreased rapidly for all participants. When an individual with autism doesn't have the capacity to mand vocal-verbally, problem behaviors may be used to obtain preferred objects (Sundberg, 2007). Augmentative and alternative communication can act as an appropriate means to communicate one's needs.

## Augmentative and Alternative Communication

Augmentative and Alternative Communication is defined as systems that either supplement or replace existing communication when speech impairments are present, such as the case with non-verbal children with autism (Mirenda, 2003). Augmentative and Alternative Communication can be divided into unaided systems that do not require any external devices (such as gestures or sign language) and aided systems that require external devices (such as communication boards or computer devices with voice output) (Light et al., 1998). Augmentative and Alternative Communication reduces the demands of motor skills required to produce vocal verbal speech (Romski & Sevcik, 1996). Although one type of AAC has not been proven more effective than others (Sigafoos, Didden, et al., 2003), there are relevant factors that may influence choosing one AAC over another. The following sections will expand on the research associated with the different types of AAC.

### Manual Signs

Manual signs are a form of communication that relies exclusively on body parts to make signs and gestures (Lloyd et al., 1997). Manual signs have the implicit benefit that an external device is not needed, so the able-bodied user would presumably always have

his or her hands available to make the manual signs or gestures.

Schepis et al. (1982) conducted a study with nine participants with autism and mental retardation to examine the effects of incidental teaching procedures to increase the use of manual signs. All participants verbalized zero, one, or two phrases during baseline. The researchers used a multiple baseline design across subjects and times of the day. The dependent variables were number of verbal and non-verbal prompted manual signs (e.g. signs for "Yes", "No", "Want") and the number of vocalizations. Additionally, generalization data were gathered 5 and 17 weeks after the intervention was concluded. Results showed that all nine participants increased signing, and the individuals with autism used physically prompted signs more often compared to those with mental retardation. Maintenance data showed that the behaviors were maintained at follow-up sessions. However, there was no trend for vocalizations.

Bartman and Freeman (2003) utilized physical prompting and fading procedures to study the effects on manual sign frequency with a 2-year-old female with autism. Physical prompting and fading were used as three signs paired with spoken words were taught at a time. Data were taken on the number of physically prompted and unprompted requests, as well as the number of sessions required before the child could emit the signs independently. The child learned to request using signs in a brief period of time.

Carbone, Sweeney-Kerwin, Attanasio, and Kasper (2010) studied the effects of manual sign mand training used with prompt delay and prompting to increase vocal responses in children with autism and developmental disabilities. Using a multiple baseline design across three participants, the researchers recorded the number of unprompted and prompted verbalizations while teaching participants how to use manual

signs to mand. Results indicated that all participants increased their number of verbalizations accompanied by the manual sign. This lends evidence to the notion that AAC can encourage vocal verbal speech.

Manual signing has some inherent advantages in that teachers can use physical prompting and fading procedures naturally (Sundberg & Partington, 1998), and is always with and accessible to the user (Light et al., 1998). Research has demonstrated that manual signing leads to increases in expressive and receptive language compared to control groups using speech alone (Barrera, Lobatos-Barrera, & Sulzer-Azaroff, 1980; Barrera & Sulzer-Azaroff, 1983; Brady & Smouse, 1978; Remington & Clarke, 1983; Yoder & Layton, 1988).

However, one severe limitation of the use of signs is that manual signs are not universally understood. That is, if listening partners are not familiar with the signs, a child has no means by which to communicate through this medium (Bondy & Frost, 1994; Mirenda, 2003). Another limitation specific to individuals with autism is that many children with this disorder have fine motor impairments, which can inhibit their ability to use signs or gestures (Bonvillian & Blackburn, 1991; Jones & Prior, 1985; National Research Council, 2001; Page & Boucher, 1988). Therefore, it may take a significant amount of time to teach a small number of signs that may not be understood in many of the settings in which a child spends time (Mirenda, 2003; Von Tetzchner et al., 2004).

**Picture Exchange Communication System**

The PECS is an instructional system that teaches aided communication through the exchange of graphic picture symbols. Unlike manual signs, more people understand the meaning of pictures with word captions. For instance, a user of the PECS may want an

apple from someone such as a teacher. The user will then take the picture of the apple and hand it to the teacher in exchange for the apple (Frost & Bondy, 2002). The PECS is a visual graphic system, which increases the odds that messages will be universally understood in contrast to manual signs (Bondy & Frost, 1994; Mirenda, 2003). The PECS has six phases that include (a) physical exchange, (b) expanding spontaneity, (c) picture discrimination, (d) sentence structure, (e) answering a direct question and (f) commenting. Physical exchange involves the child exchanging a picture of a preferred item for the tangible preferred item. Expanding spontaneity involves increasing the distance between the child and the communication partner when making requests for preferred items. Picture discrimination involves the child choosing between multiple pictures on the board when requesting an item. Sentence structure involves the child making a sentence with a picture of "I want" and a picture of the preferred item in order to request. Answering a direct question involves the child answering the question, "What do you want?" with the sentence learned from sentence structure. Commenting involves the child commenting on their environment with specific attributes, such as shape and color.

Charlop-Christy, Carpenter, Le, LeBlanc, & Kellet (2002) conducted the first empirical study examining the PECS and its effectiveness on the communicative, social and problem behaviors of three boys with autism. In this study, a multiple baseline across participants was used. There was a 10-min session conducted once per week in free-play and academic settings. Dependent variables included social behaviors, such as cooperative play (percentage of intervals), joint attention (percentage of intervals), initiation (frequency) and eye contact (percentage of intervals). Data were also taken on requesting (frequency) and problem behaviors, which included tantrums, grabbing, out of

seat, and disruptions. Results showed that all three participants met the learning criterion for the PECS and showed increases in verbal speech, cooperative play, joint attention, initiation, and eye contact as well as decreases in problem behaviors. This study also marked one of the few that utilized all six phases of the PECS training.

Kravits, Kamps, Kemmerer, & Potucek (2002) used a multiple baseline design across settings to examine the effects of the PECS on the communication and social skills of a 6-year-old boy with autism. Dependent variables included the communicative skills of spontaneous requests, comments, and expansions. Social skills assessed included social interactions. The PECS was in front of the participant during the baseline phase before training commenced. Social interactions with others were charted using a duration measure, and verbalizations were charted using a frequency count. Results indicated increases in spontaneous language (i.e., requests and comments). Verbalizations increased in two settings, and changes in peer social interaction were observed in one of the two school settings. Only the first 3 phases of the PECS training were implemented in this study.

Ganz & Simpson (2004) examined the effects of the PECS on the requesting behaviors and speech development of three young students with an ASD. The PECS training took place two to five times per week, with 15 trials occurring per session until participants were able to reach 80% proficiency independently for three consecutive 15 min trials. Data were taken on non-word and word vocalizations, as well as the proficiency relative to the PECS phase criteria. Participants were taught phases one to four of the PECS. Results indicated that the PECS was mastered quickly by the participants (as in previous studies) and word vocalizations increased in the number of

words and the complexity of grammar.

Tincani, Crozier, and Alazetta (2006) in the first of two studies looked at how the PECS affected manding and speech development of two boys with autism, ages 10 and 11. Prior to intervention neither of the students used speech to communicate. A changing criterion across subjects design was utilized. Baseline data were taken with the PECS placed in front of each participant with no PECS training. Prompted mands, word vocalizations, and vocal approximations (e.g., /da/, /ba/) were scored as a percentage of correct responding across multiple trials. Results showed increased levels of independent requesting for all participants, with one participant showing some measureable speech. Only the first 3 phases of the PECS training were conducted in this study.

Additional studies have shown that children with an ASD have been able to learn how to request items using the PECS (Hamilton & Snell, 1993; Keen, Sigafoos, & Woodyatt, 2001, Rowland & Schweigert, 2000). As a result of the PECS, children with autism have also shown decreases in problem behaviors (Frea, Arnold, & Wittinberga, 2001) and increases in social interactions with peers (Garrison- Harrell, Kamps, & Kravits, 1997).

The PECS, however, requires the communication partner to be in close proximity. Communicating at distances becomes more difficult, as the child with autism is always put into the position of having to seek out a communication partner to be able to hand a graphic symbol card. There also is a limitation in the number of cards that can be in a three ring binder. That is, the more language a child acquires, the more cumbersome his/her communication system becomes.

**Voice Output Communication Aids**

Voice output communication aids are portable electronic devices that produce synthetic or digitized speech output. Unlike manual signs, VOCAs have the capacity to be understood by a much larger audience. Voice output communication aids contain touch screens or other types of buttons with visual graphics. When a button is pressed, the VOCA emits words, phrases, or sentences that correspond to the graphic on the selected button (Mirenda, 2003). This feature, unique to VOCAs, leads to less miscommunication between the speaker and communication partner because the message produced by the VOCA represents what the speaker pressed. A message such as "I need to use the bathroom" shows the precision of the device (Sigafoos, Didden, et al., 2003). Another benefit of VOCAs is that the voice output can obtain the attention of others, even when a communication partner is across a room (Romski & Sevcik, 1996). This may lead to increased interactions for children with autism, as they can more easily communicate with people across a room as compared to other systems, such as the PECS.

In one of the earliest studies of VOCAs, Van Acker and Grant (1995) investigated the effects of VOCAs on the requesting behavior of three female participants aged 5.2 to 11.5 years old and diagnosed with Rett's syndrome. In a multiple baseline design across participants, data were taken on the number of requests made for each participant. The VOCA was a computer with touch screen and voice output. On the touch screen were three graphic images of the preferred food items. When a participant touched the image of a preferred item, an animated graphic appeared on the screen and the preferred item was then handed to the participant. Requesting behavior increased for all participants following the application of VOCA training. Two of the participants successfully learned

to request all three items, and the other successfully learned to request one item. Generalization data were mixed as two of the participants generalized behaviors to other settings, and one did not.

Schepis et al. (1998) conducted a pivotal study regarding the use of VOCAs with children with autism aged 3 to 5 years old. Schepis and colleagues used a multiple probe design (Horner & Baer, 1978) across time and across subjects to identify the effects of a VOCA on communicative behaviors displayed. The preferred snack and drink items varied every day depending on the routine ongoing in the class. The VOCAs displayed stick figure pictures that stood for messages (e.g. "I need help", "More", "Yes", "No"). During baseline, the VOCA was not present. Data were taken on child-to-adult communication, child-to-child communication, word vocalizations, and nonword vocalizations. After 3 months of intervention, results indicated that all children independently used the VOCAs for many different communicative purposes, including requesting, yes/no responses, and social comments (e.g. "thank you"). Generalization data were not taken.

Sigafoos, Didden, et al. (2003) extended the literature by evaluating the role of speech output on VOCAs on the maintenance of requesting and frequency of vocalizations in three children with developmental disabilities. The three participants were taught to request preferred objects using a Big Mack switch. The Big Mack switch was a colored button VOCA that emitted recorded messages when pressed. Training began with each participant sampling his/her preferred items from a tray. The tray of items was then moved out of the participant's reach. The trainer said, "Let me know if you want more." The trainer waited for the participant to reach for the items. As the child

reached, the trainer physically guided the participant to press the Big Mack, which said "I want more", using the least amount of guidance necessary. Praise was paired with delivery of the item. Acquisition criterion was set at ten independent requests with the Big Mack VOCA. After acquisition, VOCA requesting and verbal vocalizations were compared across two conditions (speaker on and speaker off). Results showed no differences between the two conditions for the three participants. One child began to speak single words during the study, suggesting that the speech output of VOCAs may not inhibit speech, and actually may facilitate it. One possible explanation for the results was that the voice output has no meaning for the participants when first learning to use the VOCA. Generalization data were not taken during this study.

Mirenda, Wilk, and Carson (2000), in a 5-year longitudinal study reported on the use of technology with children with autism. Voice Output Communication Aids were used by 58 children (ages 5 to 17) with an ASD in British Columbia, Canada. Of the 58 participants, 26% were estimated to have average cognitive functioning, and the rest had varying levels of cognitive impairments (mild = 19%; moderate = 36%, and severe = 19%). There were various VOCAs utilized in this study (IntroTalkers [Prentke Romich, Wooster, OH]) and laptop computers with communication software). Prior to VOCA use, 41% had no functional speech (i.e., did not vocally emit basic wants and needs), 50% had some speech (i.e., one to two word utterances), and 9% had no speech (i.e., emitted vocal verbalizations but no clear word forms). After receiving the intervention, results indicated 31 (53%) of the students were rated as successful or very successful, 19 (33%) had limited success, and only 8 (14%) had little or no success using VOCAs to communicate. A significant finding was that 31 students who were rated as successful or very successful

represented varying degrees of cognitive impairments, showing that there may not be a direct relationship between cognitive ability and VOCA use. Furthermore, 7 of those 31 successful students no longer used their VOCA device after the intervention and learned to use vocal verbal behavior. This study provided additional support that VOCAs can provide a model for language.

Olive et al. (2007) conducted a study that extended the literature by looking at the effects of VOCAs using a different training protocol. Using milieu-teaching procedures, the researchers recorded the requesting behaviors in three children with autism. Using a multiple baseline across participants, the experimenters controlled for maturational development. All baseline and intervention sessions were conducted during 5-min play sessions between the child and his teacher or teaching assistant 4 days per week. Teachers and teaching assistants participated in a training session before the study commenced. The VOCA was present during all baseline sessions, but the teachers did not show the children how to use the VOCA. During intervention, when the child made a request using an informal gesture, the adult used most-to-least prompts (e.g., physicals, verbal models, verbal mand-models, gestures, and time delays) to prompt a correct request with the VOCA. Data were taken on correct VOCA usage (independently presses button to request item), incorrect VOCA usage (shows displeasure after pressing button), prompted VOCA (adult prompts child to press button), gestural communicative act (uses gesture or sign to communicate), and verbal communicative act (uses word or word approximation). All three children showed an increase in VOCA use. Total VOCA responding went from 0 behaviors during baseline to an average of 10 during intervention. One participant began vocalizing during the study, increasing from 0 vocalizations during

baseline to an average of 8.8 during intervention. No generalization data were taken.

Although VOCAs have been used successfully with many children with autism, these devices have their limitations. Voice output communication aids are expensive, sometimes costing thousands of dollars, such as the Say It SAM Tablet at $6,675 (Sigafoos, Drasgow, et al., 2003). Voice output communication aids generally weigh 4 to 8 lbs. and require a great deal of physical manipulation to use. This obstacle may limit the amount that an individual uses the device (Beck, Stoner, Bock, & Parton, 2008). In the past, VOCAs were much less portable than systems such as manual signs, and carried with them the social stigma of always holding a large instrument. Sigafoos et al. (2004) conducted a study in which individuals with ASD were taught to locate their VOCA. The VOCA was too large to be with the student at all times. Therefore, the size and lack of immediate access was problematic in the use of such devices. Generalization data were also limited.

**Augmentative and Alternative Communication Comparisons**

In a literature review of AAC interventions used with individuals with developmental disabilities, Lancioni et al. (2007) examined all of the studies that used the PECS and VOCAs as an intervention and studies that compared the effectiveness of the PECS versus VOCAs. The studies selected were published between 1992 and 2006. There were 37 studies selected, and included students diagnosed with various developmental disabilities (e.g., severe intellectual disabilities, autism). The literature that compared the PECS and VOCAs showed neither is overwhelmingly better for all children with autism. There were 173 students that used only the PECS as a communication intervention. Of the 173 students in these PECS studies, 169 were able to increase

communicative behavior, three did not increase communicative behavior, and one did not have any success due to illness. There were 39 students that used only a VOCA as a communication intervention. Of the 39 students in those VOCA studies, 36 were able to increase communication behavior (mainly manding), one showed a minimal increase in communicative behavior, and two did not increase communicative behavior.

Tincani (2004) studied the effects of sign language training as compared to the PECS training on the acquisition of mands. Using an alternating treatment design, two elementary school students with autism were presented with preferred items. Intervention included prompting and fading procedures to teach both sign language and the PECS. Results showed that sign language training produced more independent mands for one student, and the PECS training produced more independent mands for the other student. Sign language training produced more vocal verbalizations, and both interventions generalized to another environment.

Bock, Stoner, Beck, Hanley and Prochnow (2005) conducted one of the first comparative studies between the PECS and VOCAs. Six, 4-year-old boys with developmental delays who were non-verbal and did not have prior AAC systems were recruited. The study was conducted in two self-contained preschools with a GoTalk VOCA, and a traditional PECS board (three-ring binder with Velcro). Data were taken on the number of correct responses, which was defined as the independent usage of the VOCA or PECS, exchanging a picture or pressing a button for a desired item. In a single subject alternating treatment design, ten opportunities to use each or 15 min (whichever came first) was presented to each participant. Both the PECS and VOCAs were taught using the procedures described in the PECS training manual, but were adapted for VOCA

training. During baseline, the PECS and the VOCA were placed directly in front of participants. Three of the children learned how to use the PECS at a quicker rate than the VOCA, and the other three children showed no difference in their acquisition rate. Generalization data were taken one week after intervention, in which participants had a choice to use either the PECS or the VOCA. Three of the children preferred the PECS, two preferred VOCAs, and one was inconclusive.

Beck et al. (2008) extended the Bock and colleagues (2005) investigation by replicating the procedures with three non-vocal children with autism and one with a speech and language impairment. Data were recorded on the phase of the PECS training each child reached, and the type of AAC each child preferred. Results for the PECS, showed that two participants made it to phase III, one made it to phase II, and one only made it to phase I. Results for VOCAs indicated that only one made it to phase II, while the rest did not even reach phase I. One preferred the VOCA, while the other three did not tend to prefer either. However, one conclusion of this study was that portability was the biggest setback for the participants in learning how to use the VOCA. For this reason, Beck et al. (2008) advocated replicating VOCA studies with a device that does not require the physical demands of prior VOCAs.

**iPod-based VOCA**

The iPod touch® has been subject to much research regarding its potential use for children with autism (Hyatt, 2011). Its rapid increase in popularity with the autism community is based on the device's ability to play to the strengths of those with autism (such as visual-spatial skills and learning with technology). Children with autism tend to have positive results when learning from computer or television screens (Charlop-Christy,

Le, & Freeman, 2000). The iPod touch® has a 3.5-inch touch screen and a few physical buttons (home screen, power switch, volume). The iPod touch® and iPhone® have become ubiquitous both in and out of school. Children without autism not only have these devices, but also consider them to have high social value. Children with these Apple devices are "cool" (Sennott & Bowker, 2009). The device itself has the potential to open up a dialogue between those with autism and those without autism. Aside from the social benefits, the iPod touch® is also both portable and affordable; it weighs 4.05 ounces and costs $199.

Proloquo2go™ is an application for the iPod touch® and iPhone® that produces speech when either a picture (with word or phrase) is touched, or a message is typed (or organized via touching word pictures) (Reynolds & Alvarez, 2009). The use of Proloquo2go™ may alleviate many of the concerns of prior generations of VOCAs. Instead of spending thousands of dollars, Proloquo2go™ and an iPod touch®, can be purchased for approximately $400. The portability of the iPod touch® is such that an individual with ASD would never have to locate the device. This may increase the number of children with autism who can use a VOCA because the physical manipulations of it would no longer be problematic. Rather than placing the VOCA on a table or balancing it on one's stomach, the user could simply hold the device in the palm of his or her hand. The social stigma of carrying around a foreign device is addressed as many students without autism use an iPod®.

Kagohara, van der Meer, Achmadi, Green,… and Sigafoos (2010) conducted a case study evaluating the effectiveness of using differential reinforcement and delayed prompting to teach an individual with autism to successfully use an iPod touch® with Proloquo2go™ as a VOCA. The study involved a teenage male with autism, obsessive-compulsive disorder, and Attention Deficit Hyperactivity Disorder, who had previously been taught to use the iPod touch® for communication. The participant however touched the icon with too much force, and therefore did not activate the speech output feature. The intervention consisted of differential reinforcement, least-to-most prompting, and time delay. Results indicated that the behavioral intervention was successful in teaching the participant to activate the speech output feature. This research added to the literature, as there had not been any studies that offered a different hypothesis and solution to potential fine motor difficulty that many individuals with autism have with this technology. No generalization data were taken.

van der Meer et al. (2011) conducted a study that evaluated the effectiveness of an iPod touch® with Proloquo2go™ on the communication skills of two adolescents and one adult with developmental disabilities (autism, Klinefelter syndrome, and severe intellectual disability). Sessions were conducted in the participant's classroom with the trainer and participant present. Preferred items were identified from teacher interviews. Using a multiple baseline design, participants were taught how to request preferred items (snacks and toys). Participants had to discriminate between distracter icons (i.e. social interaction icon). Dependent variables included independent responses (which were

actually independent requests). An additional manipulation phase was added, in which the screen orientation was switched from portrait to landscape. The prompt used to begin sessions was, “Let me know if you want something.” Criterion during acquisition training was 3 successive independent responses. Graduated guidance, time delay, and differential reinforcement were the teaching procedures used. Results indicated that two of the three participants were able to use the VOCA to request preferred items.

Achmadi et al. (2012) conducted a study that evaluated the effectiveness of an iPod touch® with Proloquo2go™ on the communicative skills of two teenage boys with autism. Both participants had prior experience using the VOCA to request items with 1-step. Using a multiple baseline design (with two phases), participants were taught how to make requests for preferred items with a 2-step sequence, and how to unlock and navigate through the application. Preferred items were identified through teacher surveys and the presentation and acceptance of given items. There were four screens participants went through which included a blank screen, wallpaper screen, play and food category screen, and specific play or food item screen. There was a baseline followed by an intervention (2-step request), and then a second baseline followed by a second intervention (unlocking and navigating through the application). Teaching procedures included response prompting, prompt fading, and differential reinforcement. Each session lasted five minutes, and no more than three sessions were completed per day. Results indicated that both participants were able to make a 2-step request, and navigate through the application. This study added to the literature by showing that children with autism could effectively use iPod-based VOCAs with multiple steps.

Lorah et al. (2013) conducted a study that compared the effectiveness of an iPad® with Proloquo2go™ and the PECS on the communication skills of children with autism. Participants included five males with autism with a mean age of 4.5 years. There weren't any participants with experience using the PECS or a VOCA. Sessions were conducted in participants' classrooms with one instructor and each participant. Using an alternating treatment design, each intervention was presented at random across the five participants. Once criterion was met for both devices, device preference was assessed. The dependent variables included prompted and independent mands (which varied depending on device). Interobserver agreement and procedural integrity data were collected. Training procedures included a constant time delay with full physical prompts. Training sessions included 15 trials, and criterion was 80% independence across two consecutive sessions. Results indicated that three participants acquired mands more quickly with the VOCA, and two participants acquired mands more quickly with the PECS. Four participants preferred the VOCA, and one participant preferred the PECS. This study differed from previous comparison studies of the PECS and VOCAs. A majority of participants acquired the ability to use iPod-based VOCAs more quickly than the ability to use the PECS. To date however, peer-mediated interventions have yet to be used to teach children with autism how to use newer iPod-based VOCAs.

## Peer-Mediated Interventions

Peer-mediated interventions are generally classified into six dimensions which include (a) peer modeling, (b) peer initiation training, (c) peer monitoring, (d) peer networking, (e) peer tutoring, and (f) group-oriented contingencies. Peer modeling

involves a peer modeling the appropriate behavior for the child with autism to imitate. The behavior can be modeled in person or via video. Peer initiation training seeks to train typically developing peers how to initiate communication with children with autism through strategies such as establishing eye contact or starting a conversation. Peer monitoring utilizes a buddy system in which peers are given responsibility for keeping the child with autism on task and behaving appropriately. Peer networking involves sensitivity training being administered to the typically developing peer regarding autism as well as creating opportunities for interaction with the child with autism. Peer tutoring involves peers acting as the teacher to provide instruction or intervention. Group oriented contingencies consist of training peers as interventionists within the structured and systematic environment that encourages increases in social and academic goals (i.e. integrated play groups) (Utley et al., 1997).

It is common to have a combination of sub-categories within peer-mediated interventions. This study utilized elements from peer networking and peer tutoring to add a peer-mediated component to the training package. Studies that used peer networking and peer tutoring will be discussed in the following sections.

**Peer Networking**

Peer networking is effective because it helps train typically developing peers to alter their expectations of those with disabilities (McEvoy and Odom, 1987). When children without disabilities understand more about those with disabilities, research has shown that social interactions increase (Kamps, Potucek, Lopez, Kravitz, & Kemmerer, 1997).

Haring and Breen (1992) studied the effects of peer networking on the social skills of two teenagers using a multiple baseline design (autism, moderate mental retardation). The intervention aimed to train typically developing peers the social skill of initiating conversations with participants. Then, trainers reinforced and prompted responses from the participants. Trainers also taught the participants appropriate responses. Results indicated an increase in the frequency of appropriate social interactions, and improved attitudes from the typically developing peers in their ratings of friendship towards individuals with disabilities.

Garrison-Harrell et al. (1997) also studied the effects of peer networking on social and communicative behaviors using a multiple baseline design across three elementary aged participants with autism. The participants were all 6 to 7 years old and non-verbal or had little communicative ability. The intervention included training each typically developed peer how to use augmentative and alternative communication and how to use appropriate social skills. Five peers were assigned for each student with autism in the study and all spent 1 hr with their assigned participant in preferred settings. Results indicated that peers had a higher acceptance of participants, increased the frequency and duration of social interactions across settings. The participants with autism also increased their use of AAC.

**Peer Tutoring**

Pierce & Schreibman (1997) studied the effects of peer implemented pivotal response training (PRT) on the social behaviors of children with autism. Pivotal response training is an intervention based on principals of ABA that teaches the most vital behaviors that affect an individual's overall functioning. Participants included two

children with autism and eight typical peers in a multiple baseline design across subjects and peer trainers. Peers were taught PRT through didactic instruction, modeling, role-playing, and feedback. Results indicated that the children with autism had increased social interactions, social initiations, and varied toy and language use. Generalization was also found across settings, stimuli, and peers.

Kamps, Dugan, Potucek, and Collins (1999) conducted a study evaluating the use of children with autism as peer tutors on the social interactions of typically and non-typically developing children. In this study, the experimenters reversed the usual roles of having typically developing children tutor children with autism. In an ABAB withdrawal design, three elementary aged children with autism tutored six first grade students. Results indicated that all three children with autism increased their social interactions, as well as increased the level of academic achievement for the typically developing peers. A second part of the study utilized the same design with older children with autism as tutors. Results indicated similar levels of success but less pronounced.

Kamps et al. (2002) conducted a two-part study examining the role of peer training embedded within other interventions to facilitate social interactions of students with autism with students without autism. Experiment 1 (relevant to this study) used a reversal design that sought to see the effects and generalization of three conditions: cooperative learning, social skills, and control groups embedded with peer training. Participants included five students with autism and 51 general education peers. Cooperative learning groups focused on training peers as tutors in social studies. Social skills groups focused on initiating and responding to peers through modeling and practice exercises. Dependent variables included the frequency of interactions and frequency of

initiations by the typically developed peer. Results indicated that social interactions increased as well as generalization to non-training settings.

Tsao & Odom (2006) examined the effects of a sibling-mediated intervention in increasing the social behaviors of children with autism. The researchers used a multiple baseline design with four dyads of siblings aged 3 to 6 years old. Sessions took place in the family rooms of the participants and included a peer mediated social skill intervention using modeling and practice. Results indicated that for three of the four sibling dyads, social initiations increased and for all four dyads, length of interactions increased. There was however no evidence of generalization.

Chung et al. (2007) conducted a study looking at the effects of a peer-mediated social skills program on the communication skills of children with autism. The participants included four 6 to 7 year old boys with high-functioning autism. The typical developing peers included three 6 to 10 year old boys recruited via e-mail to staff and faculty at the researcher's university. Lecture and role-play were used to teach the typical peers the target behavior to be taught. In addition to the social skills program, the intervention also included video feedback, positive reinforcement, and a token system. In a basic comparison design, six targeted communication skills were assessed over a 12-week period. The dependent variables included appropriate and inappropriate talking. Results indicated that three of the four children saw increased social communication skills.

Zhang & Wheeler (2011) conducted a meta-analysis of peer-mediated interventions examining 45 single subject design studies from 1977 through 2006. Results indicated that peer-mediated interventions were highly effective for children

under 8 years old diagnosed with an ASD in increasing interactions. Interventions found to be the most effective included older male siblings, took place in the home settings, and utilized peer modeling.

**Peer Mediated Interventions and AAC**

Trottier et al. (2011) studied the effectiveness of a peer-mediated intervention designed to teach students with ASD to use VOCAs to interact with typically developing peers. Participants included two students with ASD and six typically developed peers. The VOCA used was a Vantage Lite™. Using a multiple baseline design, the researchers looked at the role of peer-mediation and total communicative acts. Results indicated an increase in total communicative acts with high social validity ratings.

Trembath et al. (2009) conducted a study to look at the effects of two peer mediated communication interventions for children with autism. Participants included three children with autism and six typically developing peers. The VOCA used with a Talara-32. Using a multiple baseline design the researchers evaluated the effects of a peer-mediated naturalistic teaching with a VOCA. Results indicated that all three children increased their communicative behaviors following both interventions and generalized their behavior to another setting.

Benefits of peer-mediated interventions include an increase in the generalization of communicative skills to same-aged peers (Pierce & Schreibman, 1997). In addition, with school districts facing restricted budgets, peer-mediated interventions reflect an economical intervention that costs districts little to no money (Pierce & Schreibman, 1995). The National Standards Report (2009) classified Peer Training Package interventions as "established" meaning they had the highest level of support to suggest

effectiveness and met evidence based standards.

## Purpose of the Present Investigation

Non-verbal children with autism are candidates for AAC devices (Reichle, et al., 2002). Voice output communication aids are one type of AAC that have had two primary setbacks in the past: lack of portability and high expense (Mechling et al., 2008). Newer iPod-based VOCAs have alleviated these previous concerns, and have shown positive preliminary results for increasing communicative behavior of children with autism (Achmadi et al., 2012, Lorah et al., 2013). There have not been any published studies that used peer-mediated interventions to teach children with autism to use iPod-based VOCAs; and few studies have been published that taught children with autism how to use more sophisticated communication skills when using iPod-based VOCAs (Achmadi et al., 2012).

This dissertation study seeks to extend the iPod-based VOCA research literature by examining the efficacy of using PACA Training (a peer-mediated intervention) to teach children with autism how to use Proloquo2go™ to increase more sophisticated communicative behaviors and socialization. The research questions are:

1. To what extent does the implementation of Proloquo2go™ using PACA training affect the number of independent mands and responses acquired by children with autism?

2. To what extent does the implementation of Proloquo2go™ using PACA training affect the number of verbalizations and problem behaviors emitted by children with autism?

3. To what extent does the implementation of Proloquo2go™ using PACA training affect the social behaviors of children with and without autism?

4. To what extent is the implementation of Proloquo2go™ using PACA training acceptable to the classroom teachers and peer participants?

5. To what extent does the implementation of Proloquo2go™ using PACA training generalize to another setting and maintain after one month?

# CHAPTER 3

# METHOD

## Participants

A previous study conducted by Ferreri & Strasberger (2012), assessed the effects of Proloquo2go™ using PACA training (without a peer component) on (a) requesting one item, (b) requesting one item from a distance, and (c) requesting and discriminating between two items; phases I through III, respectively. The students were selected for participation in the previous study based on the following criteria: (1) had an educational or medical diagnosis of autism, (2) had no or limited vocal verbal behavior, and (3) were not currently using an augmentative or alternative communication system, or were currently using one unsuccessfully or with limitations.

Four (of the original 10) participants who were part of the previous study participated in this present investigation. Primary participants included four males, who ranged in age from approximately 4 years old to 12 years old. The study included students from three classrooms across two schools. Additionally, five typically developing peers participated in this study and were selected based on their willingness and availability to participate. Peer participants were recruited from families of the participant with autism, professionals at summer school, and through an advertisement effort. A letter was distributed to the families of the primary participants and school professionals, as well as an email to all of the teachers. The content of the letter and email were the same; they both described the study, the need for students without disabilities to participate, and offered a $10 per session incentive.

## Primary Participants

### Parker

Parker was an 8-year, 4-month old White male with an educational diagnosis of autism spectrum disorder, and a secondary disability of cognitive impairment. Parker was in his fourth year of services in an early elementary special education room. Prior to the previous study (Ferreri & Strasberger, 2012), Parker's special education teacher reported that he would occasionally babble and use the sign for "more." Parker had previously tried to learn the PECS, but was unsuccessful due to his poor fine motor skills when removing picture cards from the Velcro. Parker did not interact with other children. At the end of the previous study, Parker had progressed through phase III. Therefore, he could request one item, request one item from a distance, and request one item while discriminating between two items. Upon the start of this investigation, Parker primarily used Proloquo2go™ in order to request snack items by touching preferred items at home and school.

### Kyle

Kyle was a 12-year, 11-month old White male diagnosed with an educational label of autism spectrum disorder. Kyle was in his sixth year of services at a specialized school for students with severe special needs. Prior to the previous study, Kyle used the PECS for requesting snack items at school and at home. He was able to exchange single picture cards for preferred items. Upon completion of the previous study, Kyle was in the midst of phase II. Although he did not finish all three phases, Kyle worked on general discrimination skills (phase III) with the speech-language pathologist in between the previous and the current study. Kyle did not use Proloquo2go™ at school or home even

after experiencing success with the program in the previous study. Kyle still used the PECS at home and school to obtain preferred items. His teachers and parents preferred the use of the PECS as an AAC device for Kyle.

**Thomas**

Thomas was a 9-year, 5-month old White male who was diagnosed with an educational label of autism spectrum disorder. Thomas was in his fourth year of services at a specialized school for students with severe special needs. Prior to the previous study, Thomas's teacher reported that he demonstrated little vocal verbal behavior, such as making recurrent noises such as "way-ya." Similar to Kyle, Thomas only progressed through phase II at the end of the previous study, but did general work on discrimination skills (phase III) with the speech language pathologist in between the previous study and the current study. At the beginning of this investigation, Thomas used both the PECS and Proloquo2go™ at home and school for requesting preferred items with a 1-step sequence.

**Juan**

Juan was a 5 year, 8 month old Guatemalan male diagnosed with an educational label of autism spectrum disorder. Juan was in his second year of services in an early special education room. Prior to the previous study, Juan's mom had reported that he would occasionally say "th" when pointing to items. Juan uses the sign for "more" and "please." Otherwise, Juan's special education teacher confirmed that Juan did not display any vocal verbal behavior. Juan used a picture schedule and showed good eye contact, but did not interact with other children. At the end of the previous study, Juan progressed through phase III. At the start of this investigation, Juan used both signing and Proloquo2go™ using a 1-step sequence to obtain preferred items at school. At home,

Juan used Proloquo2go™ to request snack and play items by touching preferred items using a 1-step sequence

## Peer Participants

Five typically developing children were selected to participate in the study. Participants were from approximately 7-years-old to 13-years-old and included one male (Ziggy) and four females (Ester, Marilyn, Lyla, and Eden). None of the participants had a disability and all were achieving at or near grade level academically. Ester (age 13), Marilyn (age 9), Lyla (age 12), and Ziggy (age 8) were White, and Eden (age 7) was Guatemalan. Ziggy, Ester, Marilyn, and Lyla were children of teachers working in the district of the study. Eden was the sister of Juan.

## Setting

The study was conducted in two school buildings. The first building was a specialized school for children with moderate and severe disabilities. Parker, Kyle, and Thomas were enrolled at this school. The school had 15 classrooms that served 150 children aged 3 to 26. The school ran a summer program for three months that was in session three days a week, from 8:30 a.m. to 12:30 p.m. In this building, sessions were conducted in the speech-language pathologist's room. The speech-language pathologist's room was an empty room with two chairs, one table, and a large filing cabinet. There were always three individuals present for each session: the principal investigator (PI), a primary participant, and a peer participant. The classroom personnel included one certified special education teacher with 6 years of experience, and three paraprofessionals (Classroom A) and one certified special education teacher with 20 years of experience, and four paraprofessionals (Classroom B).

The second building was an elementary school that served children with and without disabilities. Juan was enrolled at this school. The school included early childhood classrooms through the fourth grade. The school was granted special funding to run a 1 month summer program, in which each child received 1:1 assistance with academic tasks. In this building, sessions were conducted in the sensory room of the early child special education classroom. The sensory room was an empty room attached to the early child special education classroom with four tables and two chairs. The classroom personnel included one certified special education teacher with 26 years of experience, and six paraprofessionals (Classroom C).

## Materials

The items used during the study included Proloquo2go™, one iMainGo® 2 speaker case, one iPod touch®, data collection sheets, and the preferred items per each primary participant. Preferred items were selected based on the use of a two-part preference assessment (Piazza et al., 1996) and included items such as balls, pretzels, and gold fish crackers. An iPhone® recorded the participants during all phases and conditions of the study.

### iPod touch®

The iPod touch® is a touch screen mobile device that can be used for many different applications including productivity, entertainment, and education. The iPod touch® weighs 4.05 ounces, measures 4.3 by 2.4 inches, and costs $199.99. The iPod

touch® is controlled when the user touches the screen in order to select a command. For this study the application that was downloaded on each device was Proloquo2go™. This application transformed each iPod touch® into an AAC device.

**Proloquo2go™**

Proloquo2go™ is an AAC application for the iPod touch® that costs $189.99. It comes preloaded with seven thousand different vocabulary words with pictures, and includes the ability to create words and phrases with custom pictures. When first loaded Proloquo2go™ displays a home screen with icon categories that include text and a picture. Such categories include “Basics”, “Quick Sets”, “Hi, Bye.” Each category (when touched) displays many different picture and text icons that are reflective of the category name. For example, “Basics” includes the icons “About Me”, “Chat Spaces”, “Comments”, and “Friend Talk.”

For the purposes of this study, Proloquo2go™ was set to start on the main screen. The number of icons displayed was set to four during baseline and intervention. In order to activate an icon on Proloquo2go™, participants needed to touch it. Participants could either touch it quickly or hold down on the icon, and the speech output would be activated. For example, if a participant selected “I want”, the speaker produced the words, “I want” and the screen would then display items that the participants may want, such as

snack or play items. Once the primary participant selected an item, the speaker produced the word matching that item (i.e. ball).

## Dependent Variables

### Independent and prompted mands

An independent mand was operationally defined as independently (with no prompts) completing a 2-step mand sentence sequence by touching (a) I want category and (b) specific item (e.g. goldfish crackers). Across all training phases, a prompted mand always held the same definition as the independent mand, the only difference was that it was physically prompted. Examples of independent mands included touching "I want" and then "goldfish crackers", and touching "I want" and then "ball." Non-examples of independent mands included only touching only touching "I want", touching the incorrect icon (such as "Keyboard"), or not touching the device at all. If an independent mand was not produced, graduated guidance was used so that the primary participant made a prompted mand. An example of a prompted mand included touching "I want" and then "goldfish crackers" with the physical guidance of the PI.

### Independent and prompted responses

An independent response was operationally defined as independently (without prompts) completing a 2-step sequence response to the question, "What do you want?" when asked by a peer (specific to phase V). During phase V, an independent response was defined as touching (a) I want category, and (b) specific item, after the question, "What do you want?" was asked. Examples of independent responses included touching "I want" and then "ball", and touching "I want" and then "goldfish crackers." Non-examples of independent responses included only touching "I want", touching the

incorrect icon (such as “Keyboard”), or not touching the device at all. If an independent response was not produced, graduated guidance was used so that the primary participant made a prompted response. An example of a prompted response included touching “I want” independently and then “ball” with the physical guidance of the PI. Or a prompted response might require the physical guidance of the PI for touching both, “I want” and “ball”.

During phase VI, a peer participant asked the primary participant, “What is your name?” An independent response to this question was defined as touching (a) Hi, Bye Category, and (b) “Hi, my name is (insert participant’s name),” after the peer participant’s question. The only response scored as correct during this phase, included touching “Hi, Bye” and then “My name is (insert participant’s name).” Examples of incorrect responses included only touching “Hi, Bye”, touching the incorrect icon (such as “Keyboard”), or not touching the device at all. If a response was incorrect, graduated guidance was used so that the primary participant made a correct prompted response. Across phases V and VI, a prompted response always held the same definition as the independent response; the only difference was that it was physically prompted.

**Social Initiations**

Prior to the beginning of baseline and after intervention, data on social initiations were taken on the participant with autism and typically developing peer during a 5-minute free play session. The free play session took place in the same location as baseline and intervention data (i.e., the speech language pathologist’s room, adjourning class room). The PI, a primary participant and a peer participant were present. Play items including balls, puzzles, slinkys, and musical instruments. A social initiation was defined

as the primary or peer participant approaching the other, and making either a physical or gestural cue, making some type of verbalization, or using Proloquo2go™ (in the case of the child with autism). Approaching was defined as coming within one foot of a child and having one's body positioned towards that child at a minimum of a 45-degree angle. A physical cue was defined as when a child tapped the other on a body part such as shoulder, chest, or head. A gestural cue was defined as when a child moved his/her hand side to side in a "hello" motion, or waved one or both hands in any direction while making eye contact with the other. Non-examples would include echolalia and shouting with no orientation towards the peer.

**Social Interactions**

Prior to the beginning of baseline and after intervention, data on social interactions were taken during a 5-min free play session. A social interaction was defined as the length of time from the beginning of a social initiation (from either primary or peer participant) to the time period when the participant and peer were more than one foot apart and weren't oriented towards each other at a minimum of a 45 degree angle. Examples of social interactions included, a peer giving a participant a high five, a primary participant directed a peer participant's attention toward a person or thing, or when both participants played with a toy together. Non-examples included instances such as, a participant looked in the general direction of a peer, a participant played with a toy close to a peer, or a participant was yelling near a peer, but not oriented at the peer.

**Problem behaviors**

A problem behavior was defined as any aggressive physical or verbal act. Examples included screaming, hitting, kicking, head banging, or pulling on hair.

Screaming was defined as amplified noise emitted from the child's mouth for longer than 2 s. Hitting was defined as physically striking a peer or other individual with force on any part of the body with hands. Kicking was defined as physically striking a peer or other individual with force on any part of the body with feet. Head banging was defined as striking one's head on a solid surface or other part of body with force. Pulling on hair was defined as physically grabbing a peer or other individual's hair with force. Non-examples of problem behaviors included delayed responses, self-stimulatory behavior, and wandering around the room. Once a problem behavior stopped, there was a 5 s lapse requirement, before a new problem behavior would be scored.

**Verbalizations**

A verbalization was defined as any word, or word approximation, that was emitted from the participant's mouth during baseline, all intervention conditions, generalization, and maintenance trials. Examples included "guh" for goldfish, "reh" for raisin, "mom", and "ball". Non-examples included mouth movements, air noises, echolalia, self-stimulatory behavior and clicks.

## Measurement

Consistent with behavioral research methodology, a coding sheet and operational definitions for behaviors were created specifically for this study. Reliability was assessed through interobserver agreement (IOA) (discussed below) and validity was identified by the degree to which the behavior was operationally defined and the measurement system aligned with the selected behavior.

During trials, a frequency count was taken on the number of (a) independent and prompted mands for phase IV, and (b) independent and prompted responses to the

question, “What do you want?” and “What is your name?”, for phase V and phase VI, respectively. A frequency count was also taken on problem behaviors and verbalizations during each trial.

Prior to the beginning of each phase, data were also taken on social initiations and interactions between participants and peer participants. A free play session was set up with preferred and random play items. During a 5-min session, a frequency count was taken on social initiations (of both the primary participant towards the peer participant and vice versa) and a measure of duration was taken on social interactions between the primary participant and peer participant.

## Experimental Design

A multiple baseline design across participants was used to examine the effects of PACA training and Proloquo2go™ on the acquisition of (a) independent and prompted 2-step sequence mands (phase IV), (b) independent and prompted 2-step sequence responses to the question, “What do you want?” (phase V), and (c) independent and prompted 2-step sequence responses to the question, “What is your name?” (phase VI). Additionally, social initiations, social interactions, problem behaviors, and verbalizations emitted by primary participants were assessed throughout the study.

## Experimental Procedure

### Peer training

Prior to taking baseline data, peer participants were trained to assist with the intervention. Each peer participant had a one on one session with the PI in which he/she was taught (a) how to use Proloquo2go™ and (b) the responsibilities of the

communication partner during PACA training phases IV, V, and VI. The PI taught each peer participant the same 2-step sequences that would be taught to the primary participants in the study through video modeling and formal evaluation. Each peer participant would watch a video detailing the responsibilities of being the communication partner in PACA training. For phase IV, peer participants were taught how to hold the preferred item, when to give (and not give) access to the preferred item, and procedures if the primary participant was not interested in the preferred item. Peer participants were also taught to ignore problem behaviors and allow the PI to intervene. For phases V and VI, peer participants were taught how and what questions to ask, and procedures if the primary participant did not respond to the question. After watching the video, the peer participant had a chance to practice using Proloquo2go™ and was assessed as a communication partner. The PI presented the peer participant with 10 potential scenarios of what could happen during the study. The PI modeled behavior of the primary participant. Examples of scenarios included pressing the correct 2-step sequence, and not pressing any sequence. Peer participants needed to complete evaluation with 100% accuracy to proceed in the study. If the peer participant did not score 100%, incorrect responses were discussed, and the assessment was administered again.

**Preference Assessment**

A two-part preference assessment (Piazza et al., 1996) was conducted to determine the preferred items of each primary participant. The first part of the preference assessment involved a parent interview in a structured format using the Reinforcer Assessment for Individuals with Severe Disabilities (RAISD) by Fisher, Piazza, Bowman, and Amari (1996). The interview questions required the parents to produce a list of

preferred items (e.g., toys, games, play items). Parents were also asked to rank the items in the order they predicted would be most preferred by their child.

The second part of the preference assessment included a paired choice assessment that was identical to the one described by Fisher et. al (1992). The stimuli were selected based on parent interviews. Sequential assessment steps included (a) organizing a sequence so that each stimulus was paired with every other stimulus at least once, (b) placing paired stimuli in front of the primary participant, (c) once an item was selected, giving the primary participant 5 s of access to the item, while the other item was removed. If the primary participant reached for both items, the PI blocked the primary participant's attempt at the items. If no approach was made for either item within 5 s, the PI let the primary participant sample both. The two stimuli were then re-presented for 5 s more, and an approach meant the primary participant was given access to the stimuli for 5 s. If no response was made again, both stimuli were removed.

**Baseline**

During the baseline condition, all participants were observed in an analog setting. Proloquo2go™ was present during all baseline sessions, but the primary participants did not receive training on how to use it in order to complete a 2-step mand sentence sequence. Primary participants had however received training from the previous study in requesting items with a 1-step mand (with two items present on the screen). The main screen was set to four main categories (such as "Hi, Bye" and "I want"). A preferred item was out of reach, but visible to the primary participant. Proloquo2go™ was within reach of the primary participant. Data were taken during sessions that included ten

opportunities to request a preferred item using a 2-step sequence. If an item was requested using the 2-step sequence, the peer participant gave the primary participant access to the item. If the primary participant requested an item through gesturing or by touching Proloquo2go™ with the incorrect sequence, the primary participant was not given access to the item. Participants were given 5 s to complete the correct sequence. To mark the end of a session, Proloquo2go™ was taken away whether the sequence was completed correctly or incorrectly. The PI did not interact with the primary participants unless a problematic behavior emerged.

**Intervention**

Proloquo2go™ was present during all intervention sessions. Peer assisted communication application training was used as a training procedure to teach primary participants how to communicate with Proloquo2go™. Each session consisted of ten opportunities. Intervention included three phases in which primary participants had the opportunity to request items using a 2-step sequence and respond to the questions, "What do you want?" and "What is your name?" using a 2-step sequence. There was always at least a 5-min break in-between sessions; and no more than three sessions were conducted per day with each primary participant. The details of each condition are presented below.

**PACA training Phase IV.** During phase IV, the PI and a peer participant taught each primary participant how to perform a 2-step mand sentence sequence. A peer participant was the communication partner interacting with each primary participant. The PI was the trainer who stood behind the primary participant and served as the prompter

during training. To begin training, Proloquo2go™ was set to the main screen with four icons. Proloquo2go™ was placed in front of each primary participant as he sat at a table. The peer participant placed the preferred item in front of the primary participant but out of reach. As the primary participant reached for the preferred item (or Proloquo2go™), the PI directed the primary participant's finger through the 2-step sequence by directing the primary participants finger to (a) "I want" category and (b) specific item (e.g., "juice"). Graduated guidance (a variation of most to least prompting) along with time delay (2 to 5 s) was utilized until the primary participant could independently respond at 80% accuracy for three consecutive sessions. Prompt levels were determined based on the primary participant's behavior during trials (such as touching the wrong button sequence or touching too lightly). Immediately after the speech output was generated (i.e. "I want juice"), the item was given to the primary participant. Items were not given to the primary participant until the 2-step mand sentence sequence was complete. If a primary participant touched the wrong 2-step sequence; only touched a 1-step sequence; or didn't touch a sequence at all, the participant was physically prompted to touch the correct sequence.

**PACA training Phase IVa.** If a primary participant was unable to reach criterion after a minimum of 6 sessions, the PI introduced the additional sub-phase IVa. As previously detailed, phase IV required the participant to correctly emit 2-steps in a sequence. Phases IVa broke up the original 2-step sequence into a 1-step sequence. A correct response in phase IVa required the participant to press only the "I want" button. If a primary participant touched the wrong 1-step sequence, or didn't touch a sequence at all,

the participant was physically prompted to touch the correct sequence. Once the primary participant independently emitted the correct response at 80% accuracy (or higher) for three consecutive sessions, he moved to phase IV again.

**PACA training Phase V.** During phase V, the peer participant and PI taught each primary participant how to respond to a question using a 2-step sequence. The same training procedures were used as in phase IV. Primary participants were asked, "What do you want?" by the peer participant. As the primary participant reached for Proloquo2go™, the PI directed the primary participant's finger through the 2-step response sequence by directing the primary participant's finger to (a) "I want", and (b) specific item, such as "juice". No items were placed in front of the primary participant as behavior was prompted by the question, "What do you want?" If a primary participant touched the correct 2-step sequence, the preferred item selected was given to that participant. If a primary participant touched the wrong 2-step sequence; only touched a 1-step sequence; or didn't touch a sequence at all, the primary participant was physically prompted to touch the correct sequence.

**PACA training Phase VI.** During phase VI, the peer participant and PI taught each primary participant how to respond to a different question using a 2-step sequence. Primary participants were asked, "What's your name?" by the peer participant. Immediately after the peer participant asked the question, the PI directed the peer participant's finger through the 2-step response sequence by directing the primary participant's finger to (a) "Hi, Bye" category, and (b) "My name is …" If primary participant performed the 2-step sequence correctly, the peer participant gave the primary participant a highly preferred item. No items were placed in front of the participant as

behavior was prompted by the question, "What is your name?" Each primary participant's Proloquo2go™ application was programmed with that participant's name. If a participant touched the wrong 2-step sequence; only touched a 1-step sequence; or didn't touch a sequence at all, the primary participant was physically prompted to touch the correct sequence.

## Generalization

After intervention data was collected, the PI probed for generalization of learned behaviors in another setting. All generalization probes were conducted in the natural setting within the participants' classroom. Proloquo2go™ was placed in front of participants just as it was during baseline and intervention conditions. During snack time, a phase V session was conducted in which participants had the opportunity to respond to the question, "What do you want?" with a 2-step mand sequence. A peer granted the participant access to the preferred item. Prompting was not used during the generalization probes. Based on limited time, generalization probes were not conducted with phases IV and VI. Phase V was the most advanced communicative phase that the highest number of primary participants met criterion on; therefore, it was selected for generalization probes.

## Maintenance

Follow-up sessions occurred 4 weeks following the implementation of PACA training for teaching manding and responding using Proloquo2go™. Participants had access to Proloquo2go™ in between the intervention and maintenance conditions. Follow-up sessions were taken in the original training environment and assessed Phase V

communicative skills. Follow-up probes were gathered in order to evaluate response maintenance of acquired communication skills.

## Interobserver Agreement

Interobserver agreement was obtained by comparing the PI's data with data collected by a secondary investigator for at least 30% of the sessions across primary participants, phases and conditions. Interobserver agreeement was scored using a point-by-point agreement ratio for each of the primary participants (Kazdin, 1982). The number of agreements was divided by the number of agreements plus disagreements and multiplied by one hundred to obtain a percentage. The secondary investigator was a special education teacher with 7 years of experience who had extensive experience in collecting behavioral-based data. Mean IOA for Parker during baseline, phase IV, phase V, and phase VI was 100%, 100%, 100%, and 88%, respectively. Mean IOA for Thomas during baseline, phase IV, baseline 2, phase IVa, and phase IV was 90%, 90%, 100%, 100%, and 100%, respectively. Mean IOA for Juan during baseline, phase IV, baseline 2, phase IVa, phase IV, and phase V was 100%, 80%, 100%, 90%, 90%, and 100% respectively. IOA data were not collected for Kyle, because his parents did not grant permission to videotape his sessions.

## Procedural Integrity

Procedural integrity is the degree to which the procedures carried out in the research are implemented as intended (Peterson, Homer, & Wonderlich, 1982). The PI randomly selected 1/3 of all experimental analysis sessions, across all primary participants, phases and conditions, to determine the accuracy of the PI and peer participant's implementation of the procedures. A yes/no checklist (see appendix C)

detailing the procedures was used to evaluate procedural integrity. A percentage was calculated across trials to determine the procedural integrity in the study. Mean percentage of procedural integrity during baseline, phase IV, phase V, and phase VI was 100%, 96%, 100%, and 92%, respectively.

# CHAPTER 4

# RESULTS

## Parker

### Stimulus Preference Assessment

The results from Parker's preference assessment are displayed in Figure 1. The five items included in Parker's preference assessment included a veggie tale toy, goldfish crackers, pretzels, a book, and Mr. Potato Head toy. He selected the veggie tale toy, goldfish crackers, pretzels, Mr. Potato Head, and book, 88%, 88%, 50%, 25% and 0% of the time when it was available; respectively.

### Independent and Prompted Mands

Figure 2 shows Parker's baseline and intervention results. Baseline data were collected until there was a steady state of responding; intervention began after three sessions of baseline. During baseline, Parker independently manded using PACA training an average of 20% of the time, (no range). Therefore, Parker had a level of 20%, with low variability and a flat trend. In phase IV, Parker independently manded using PACA training an average of 67% of the time, (range, 20% to 100%), and was prompted to mand an average of 33% of the time, (range, 0% to 80%). Therefore, Parker had a level of 67%, with low variability and an upward trend. The immediacy of change was slow to moderate. Parker met criterion for phase IV during the sixth training session.

### Independent and Prompted Responses

During phase V, Parker independently manded using PACA training an average of 90% of the time, (no range), and was prompted to mand an average of 10% of the time, (range, 10% to 20%). Therefore, Parker had a level of 90%, with low variability and an

upward trend. Parker met criterion for phase V after completion of the third session. Figure 3 shows the percentage of preferred items Parker selected during Phase V. Parker selected a preferred item 100% of the time, suggesting he was effectively communicating his needs. In phase VI, Parker independently manded using PACA training average of 66% of the time, (range, 20% to 90%), and was prompted to mand an average of 34% of the time, (range, 10% to 80%). Therefore, Parker had a level of 66%, with low variability and an upward trend. Parker met criterion for phase VI during the fifth session. Generalization data were collected for PACA training phase V during session 19. Parker independently responded 100% of the time during the generalization assessment. Maintenance data for PACA training phase V were collected for sessions 20 through 22, where independent manding averaged 77% of the time, (range, 50% to 90%).

**Social Initiations**

Parker did not make any social initiations before baseline, or after PACA training.

**Social Interactions**

Parker did not engage in any social interactions before baseline, or after PACA training.

**Problem Behaviors**

Parker did not engage in any problem behaviors during baseline, or any phases of PACA training.

**Verbalizations**

Parker did not produce any verbalizations during baseline, or any phases of PACA training.

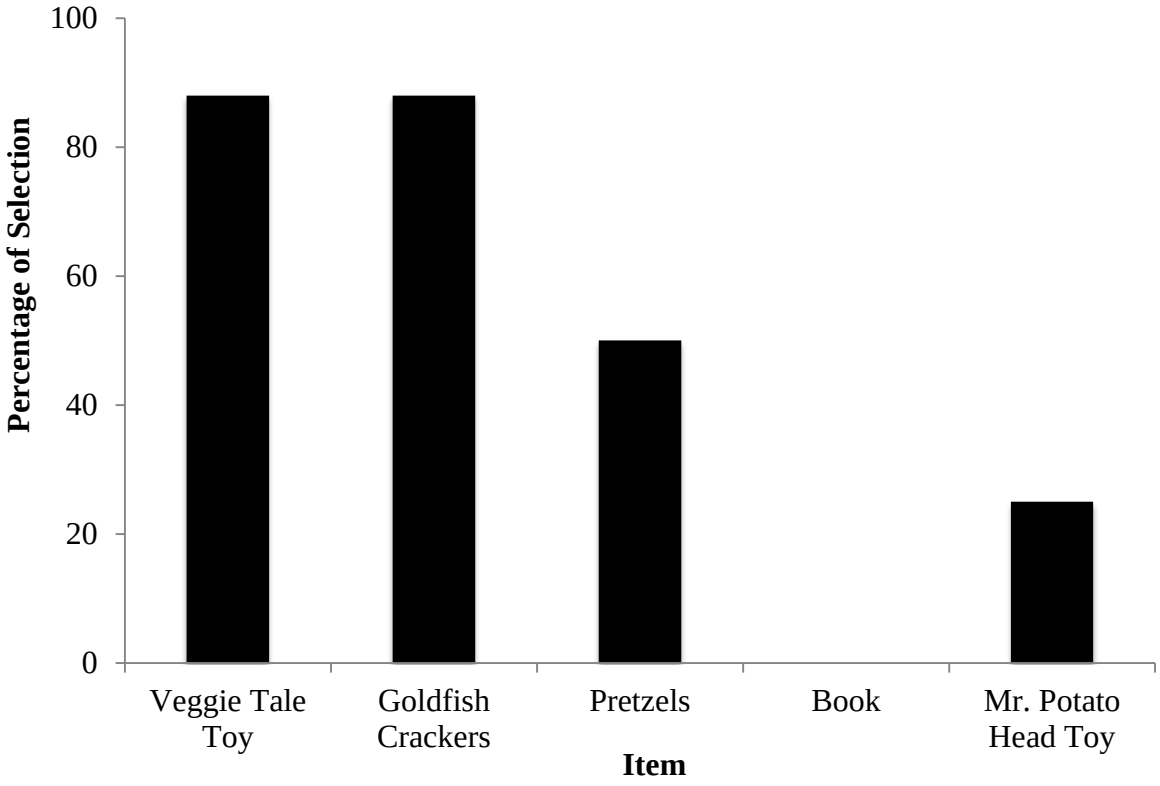


Figure 1. Parker's stimulus preference assessment. This figure displays the percentage of times Parker selected an item, when it was available.

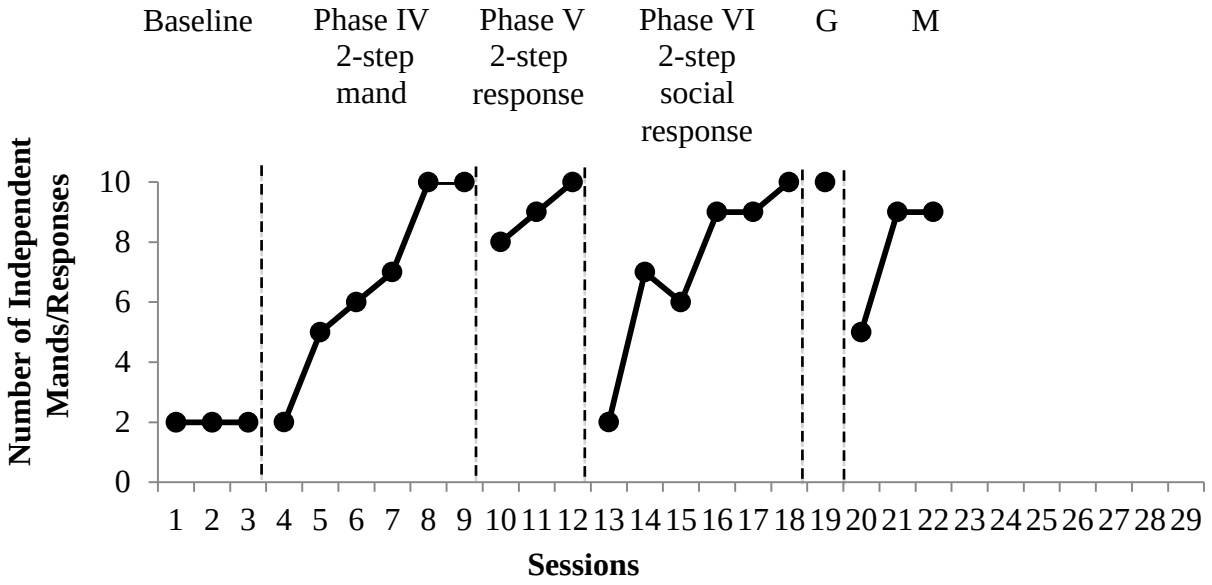


Figure 2. The number of independent mands and responses through the use of Proloquo2go™ and PACA training for Parker. Baseline and phase IV display the number of independent 2-step mands. Phase V displays the number of independent 2-step responses. Phase VI displays the number of independent 2-step social responses. The assessment of generalization and maintenance are depicted by a "G" and "M", respectively.

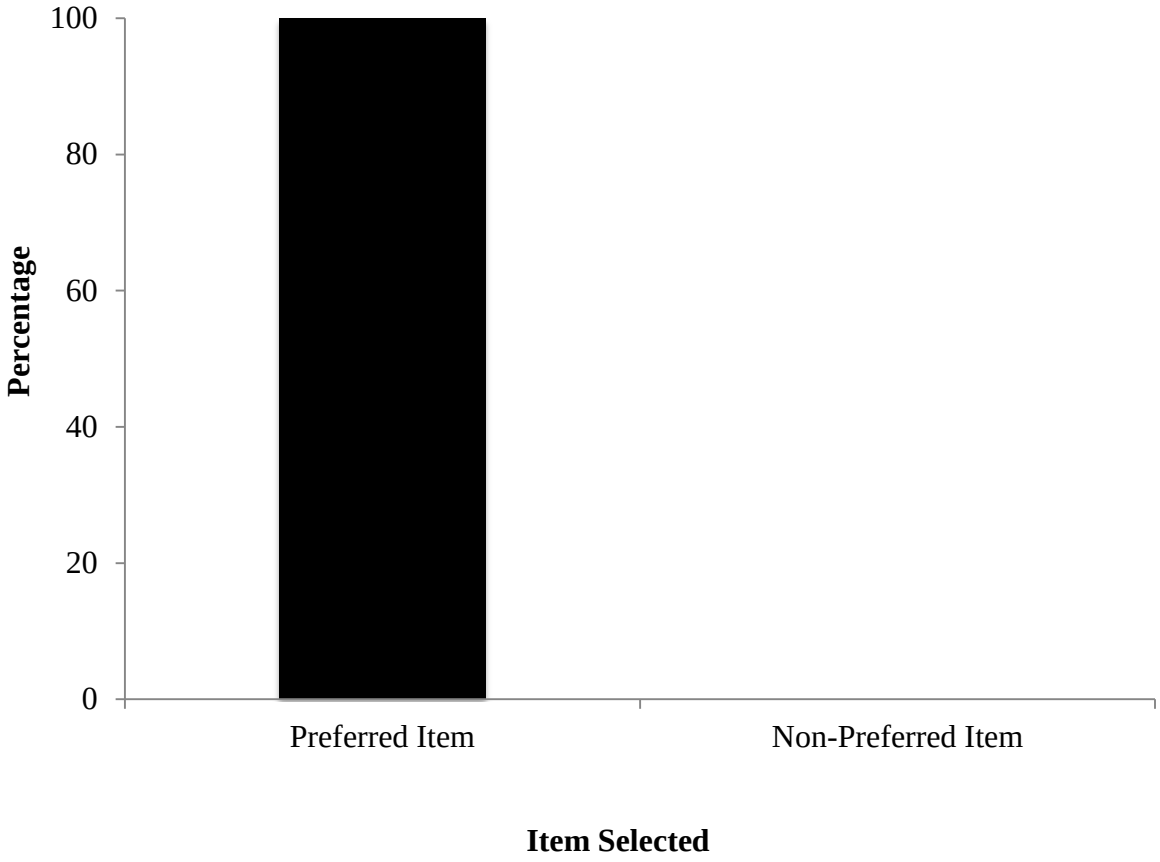


Figure 3. Parker's percentage of preferred items selected. This figure displays Parker's percentage of preferred items selected during phase V of PACA training.

## Kyle

### Stimulus Preference Assessment

The results from Kyle's preference assessment are displayed in Figure 4. The five items included in Kyle's preference assessment included string, a flashlight, pretzels, harmonica, and a slinky. He selected the string, the flashlight, pretzels, the harmonica, and the slinky, 13%, 13%, 63%, 75%, and 88% of the time when it was available; respectively.

### Independent and Prompted Mands

Figure 5 shows Kyle's baseline and intervention results. Baseline data were collected for six sessions with Kyle. During baseline, Kyle independently manded using PACA training an average of 17% of the time, (range, 10% to 30%). Therefore, Kyle had a level of 17%, with low variability and a flat trend. In phase IV, Kyle independently manded using PACA training an average of 90% of the time, (range, 70% to 100%), and was prompted to mand an average of 10% of the time, (no range). Therefore, Kyle had a level of 90%, with low variability and an upward trend. The immediacy of change was rapid. Kyle met criterion for phase IV during the third training session.

### Independent and Prompted Responses

In phase V, Kyle independently manded using PACA training an average of 90% of the time, (range, 80% to 100%), and was prompted to mand an average of 10% of the time, (range, 10% to 20%). Therefore, Kyle had a level of 90%, with low variability and a flat trend. Kyle met criterion for phase V during the third session. Figure 6 shows the percentage of preferred items Kyle selected during Phase V. Kyle selected a preferred item 83% of the time, suggesting he was effectively communicating his needs. In phase

VI, Kyle independently manded using PACA training average of 68% of the time, (range, 30% to 100%), and was prompted to mand an average of 22% of the time, (range, 0% to 10%). Therefore, Kyle had a level of 68%, with low variability and an upward trend. Kyle met criterion for phase VI during the fifth session. Generalization data were collected for PACA training phase V during session 18 where Kyle independently responded 100% of the time. Maintenance data were collected for PACA training phase V during sessions 19 through 20, where Kyle independently manded on average 95% of the time, (range, 90% to 100%).

**Social Initiations**

Kyle did not make any social initiations before baseline, or after PACA training.

**Social Interactions**

Kyle did not engage in any social interactions before baseline, or after PACA training.

**Problem Behaviors**

Kyle did not engage in any problem behaviors during baseline, or any phases of PACA training.

**Verbalizations**

Kyle did not produce any verbalizations during baseline, or any phases of PACA training.

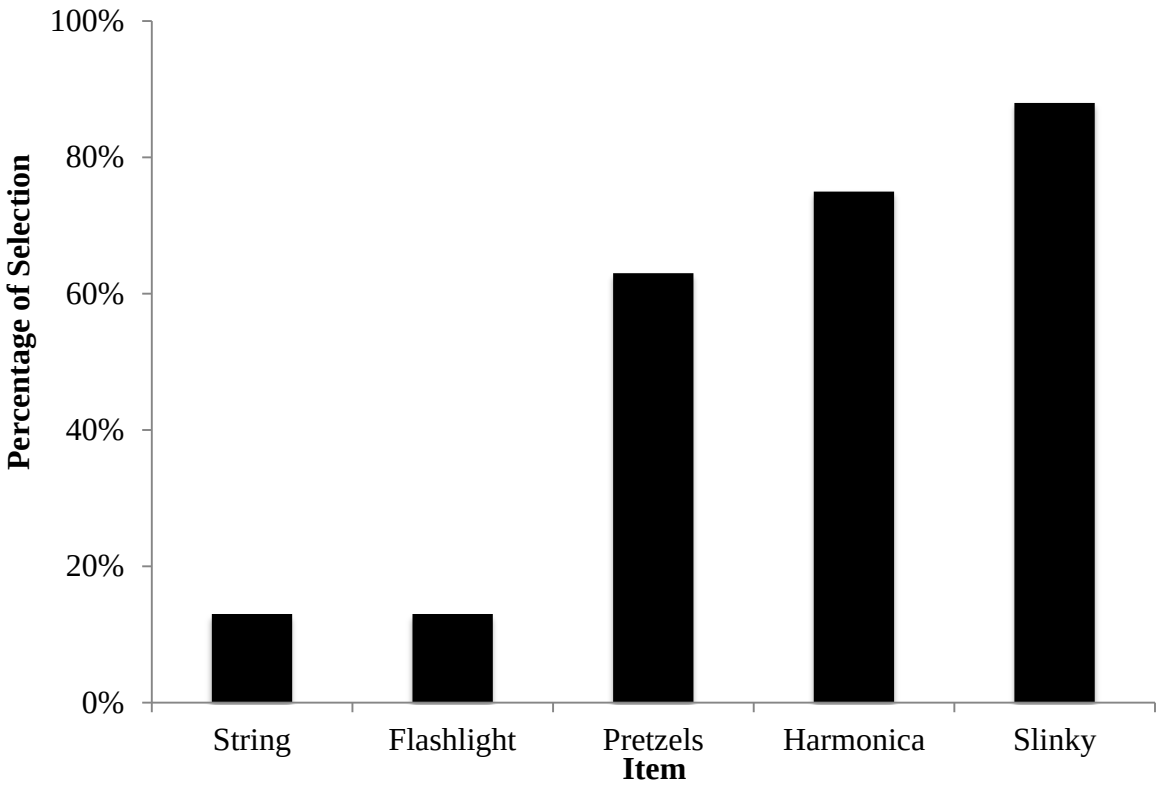


Figure 4. Kyle's stimulus preference assessment. This figure displays the percentage of times Kyle selected an item, when it was available.

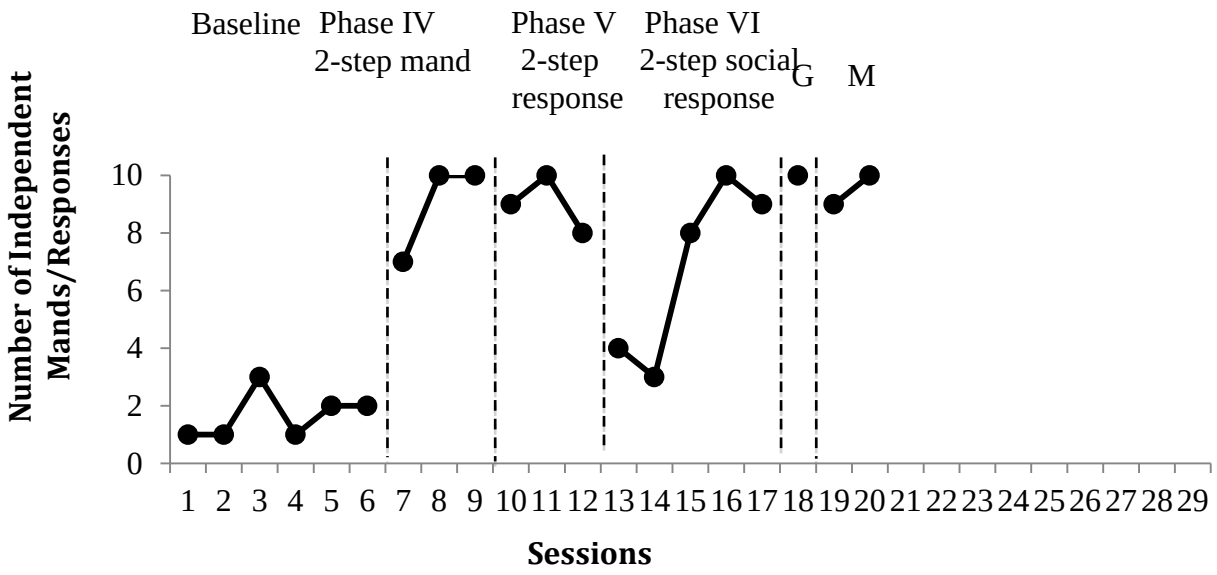


Figure 5. The number of independent mands and responses through the use of Proloquo2go™ and PACA training for Kyle. Baseline and phase IV display the number of independent 2-step mands. Phase V displays the number of independent 2-step responses. Phase VI displays the number of independent 2-step social responses. The assessment of generalization and maintenance are depicted by a "G" and "M", respectively.

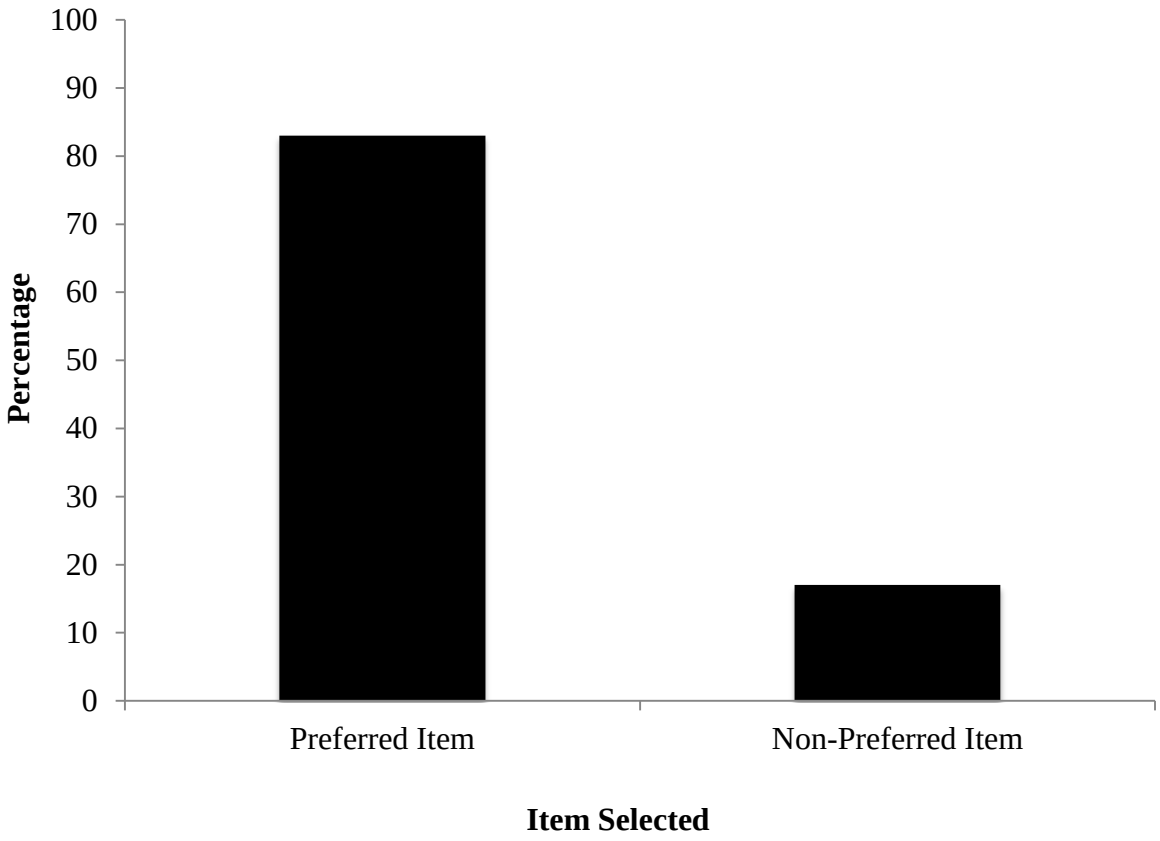


Figure 6. Kyle's percentage of preferred items selected. This figure displays Kyle's percentage of preferred items selected during phase V of PACA training.

## Thomas

### Stimulus Preference Assessment

The results from Thomas's preference assessment are displayed in Figure 7. The five items included in Thomas's preference assessment included a handheld ball, pretzels, a slinky, cucumber slices, and a toy car. He selected the handheld ball, pretzels, the slinky, and cucumber slices, 38%, 50%, 63%, and 100% of the time when it was available; respectively. He never selected the toy car.

### Independent and Prompted Mands

Figure 8 shows Thomas's baseline and intervention results. Baseline data were collected for seven sessions with Thomas. In baseline, Thomas independently manded using PACA training an average of 4% of the time, (range, 0% to 10%). Therefore, Thomas had a level of 4%, with low variability and a flat trend. In phase IV, Thomas independently manded using PACA training an average of 43% of the time, (range, 10% to 60%), and was prompted to mand an average of 57% of the time, (range, 40% to 90%). Therefore, Thomas had a level of 43%, with medium variability and a cylindrical (upward then downward) trend. There was a slow and unsustained immediacy of change. Thomas did not meet criterion for phase IV after seven sessions. A decision was made to return to baseline, and then break down the 2-step mand into a 1-step mand (phase IVa). A 1-step mand in phase IVa was described as independently selecting "I want." Once Thomas met criterion for phase IVa, the original phase IV was implemented in the return to baseline, Thomas independently manded using PACA training an average of 10% of the time, (range, 0% to 20%). Therefore, Thomas had a level of 10%, with low variability and a downward trend. In phase IVa, Thomas independently manded using PACA

training an average of 49% of the time, (range, 20% to 80%), and was prompted to mand an average of 51% of the time, (range, 20% to 80%). Therefore, Thomas had a level of 49%, with low variability and an upward trend. There was a slow immediacy of change. Thomas met criterion for phase IVa during the seventh training session. In phase IV, Thomas independently manded using PACA training an average of 30% of the time, (range, 20% to 40%) and was prompted to mand an average of 70% of the time, (range, 60% to 80%). Therefore, Thomas had a level of 30%, with low variability and a flat trend. Thomas did not meet criterion for phase IV. Generalization data were collected for PACA training phase IV during sessions 28 through 29 where Thomas independently manded 50% of the time. Maintenance data for PACA training phase IV were not collected due to time restraints.

**Independent and Prompted Responses**

Thomas was unable to meet criterion for phase IV of PACA training and did not reach phases V and VI.

**Social Initiations**

Thomas did not make any social initiations before baseline, or after PACA training.

**Social Interactions**

Thomas did not engage in any social interactions before baseline, or after PACA training.

**Problem Behaviors**

Figure 9 displays the number of problem behaviors Thomas exhibited during baseline and all phases of PACA training. During baseline, Thomas engaged in one

problem behavior. In phase IV, Thomas engaged in four problem behaviors. In phase IVa, Thomas engaged in zero problem behaviors. In the second phase IV, Thomas engaged in two problem behaviors. Problem behaviors included screaming and head banging (which was described as hitting one's head with light intensity onto the palm of one's hand).

**Verbalizations**

Thomas did not produce any verbalizations during baseline, or any phases of PACA training.

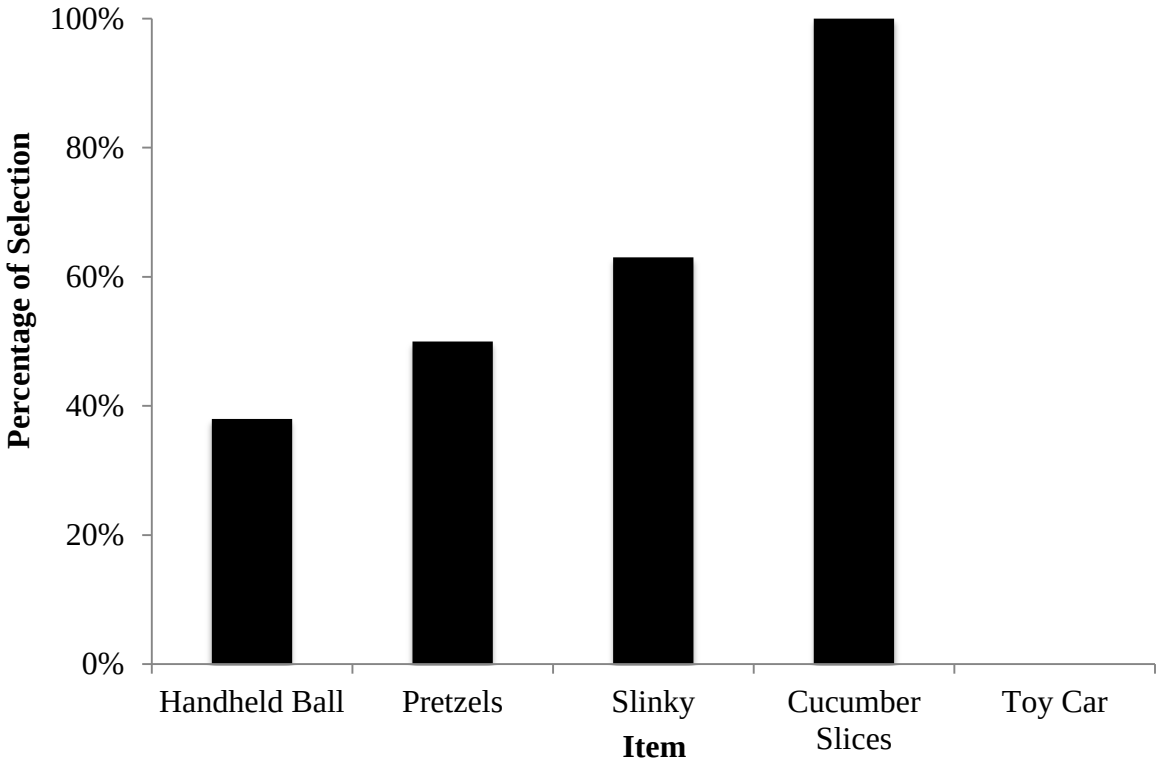


Figure 7. Thomas's stimulus preference assessment. This figure displays the percentage of times Thomas selected an item, when it was available.

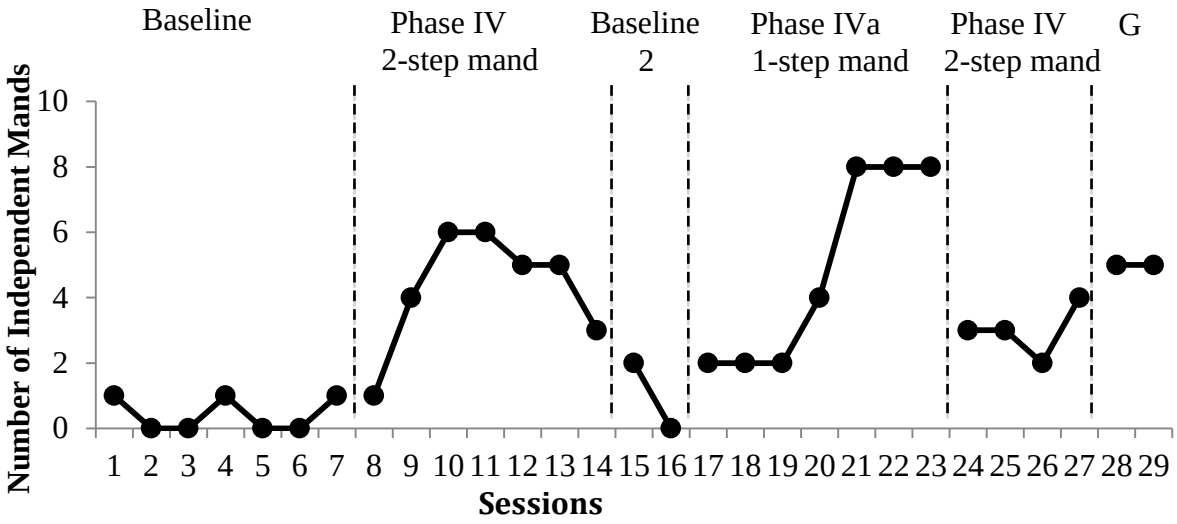


Figure 8. The number of independent mands through the use of Proloquo2go™ and PACA training for Thomas. Baseline and phase IV display the number of independent 2-step mands. Phase IVa displays the number of independent 1-step mands. The assessment of generalization is depicted by a "G".

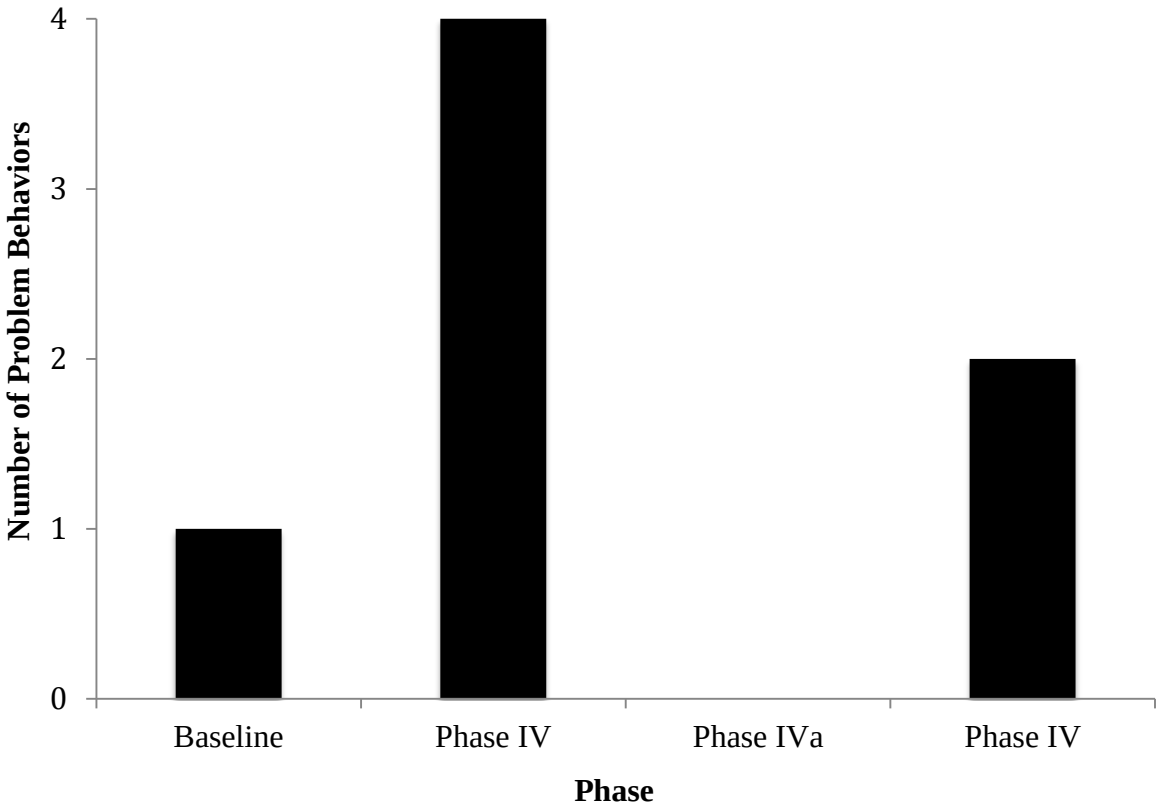


Figure 9. Thomas's number of problem behaviors. This figure displays Thomas's number of problem behaviors during baseline, phase IV, phase IVa, and phase IV of PACA training.

## Juan

### Stimulus Preference Assessment

The results from Juan's preference assessment are displayed in Figure 10. The five items included in Juan's preference assessment included M & M's, Popcorn, Doritos Nacho Cheese chips, a book, and a fruit toy. He selected the M & M's, popcorn, Doritos Nacho Cheese chips, the book, and the fruit toy, 63%, 100%, 38%, 13%, 38% of the time when it was available; respectively.

### Independent and Prompted Mands

Figure 11 shows Juan's baseline and intervention results. Baseline data were collected for nine sessions with Juan. In baseline, Juan independently manded using PACA training an average of 6% of the time, (range, 0% to 10%). Therefore, Juan had a level of 6%, with low variability and a flat trend. In phase IV, Juan independently manded using PACA training an average of 35% of the time, (range, 10% to 50%), and was prompted to mand an average of 65% of the time, (range, 50% to 90%). Therefore, Juan had a level of 35%, with medium variability and a flat trend. Juan did not meet criterion for phase IV after six sessions. The PI returned to baseline, and then broke down the 2-step mand into a 1-step mand (phase IVa). A 1-step mand in phase IVa was described as independently selecting "I want." Once this was mastered, phase IV was implemented again. In the return to baseline, Juan independently manded using PACA training an average of 13% of the time, (range, 0% to 30%). Therefore, Juan had a level of 13%, with low variability and a downward trend. In phase IVa, Juan independently manded using PACA training an average of 80% of the time, (no range), and was prompted to mand an average of 20% of the time, (no range). Therefore, Juan had a level

of 80%, with low variability and a flat trend. The immediacy of change was rapid. Juan met criterion for phase IVa during the third training session. In phase IV, Juan independently manded using PACA training an average of 65% of the time, (range, 20% to 80%) and was prompted to mand an average of 35% of the time, (range, 20% to 80%). Therefore, Juan had a level of 65%, with low to medium variability and a flat trend. Juan met criterion for phase IV during the forth training session.

**Independent and Prompted Responses**

In phase V, Juan independently manded using PACA training an average of 80% of the time, (range, 20% to 90%), and was prompted to mand an average of 17% of the time, (range, 10% to 30%). Therefore, Juan had a level of 80%, with low variability and a flat trend. Juan met criterion for phase V during the third session. Figure 12 shows the percentage of preferred items Juan selected during Phase V. Juan selected a preferred item 100% of the time, suggesting he was effectively communicating his needs. Data collection ceased before there was time to start phase VI with Juan. Generalization data were collected for PACA training phase V during session 29 where Juan independently responded 20% of the time. Maintenance data for PACA training phase V were not collected due to time restraints.

**Social Initiations**

Figure 13 displays the number of social initiations made by Eden to Juan before baseline data and after PACA training. Before baseline data were taken, Eden made two social initiations to Juan. After intervention data were taken, Eden also made two social initiations to Juan. Juan did not make any social initiations to Eden before baseline, or after intervention.

**Social Interactions**

Before baseline data were taken, Eden made two social initiations to Juan. One of the social interactions lasted 5 s, and the other social interaction lasted 6 s. During the first social interaction, Eden grabbed Juan's hands and swung back and forth with him while smiling. During the second social interaction, Eden attempted to throw a ball to Juan. Juan tried, but did not successfully catch the ball. After intervention, Eden also made two social initiations to Juan. Each of these social interactions lasted 4 s. During the first social interaction, Eden grabbed Juan's hands and swung back and forth with him while smiling. During the second social interaction, Eden grabbed Juan's hand and directed him towards a toy train.

**Problem Behaviors**

Juan did not engage in any problem behaviors during baseline, or any phases of PACA training.

**Verbalizations**

Juan did not produce any verbalizations during baseline, or any phases of PACA training.

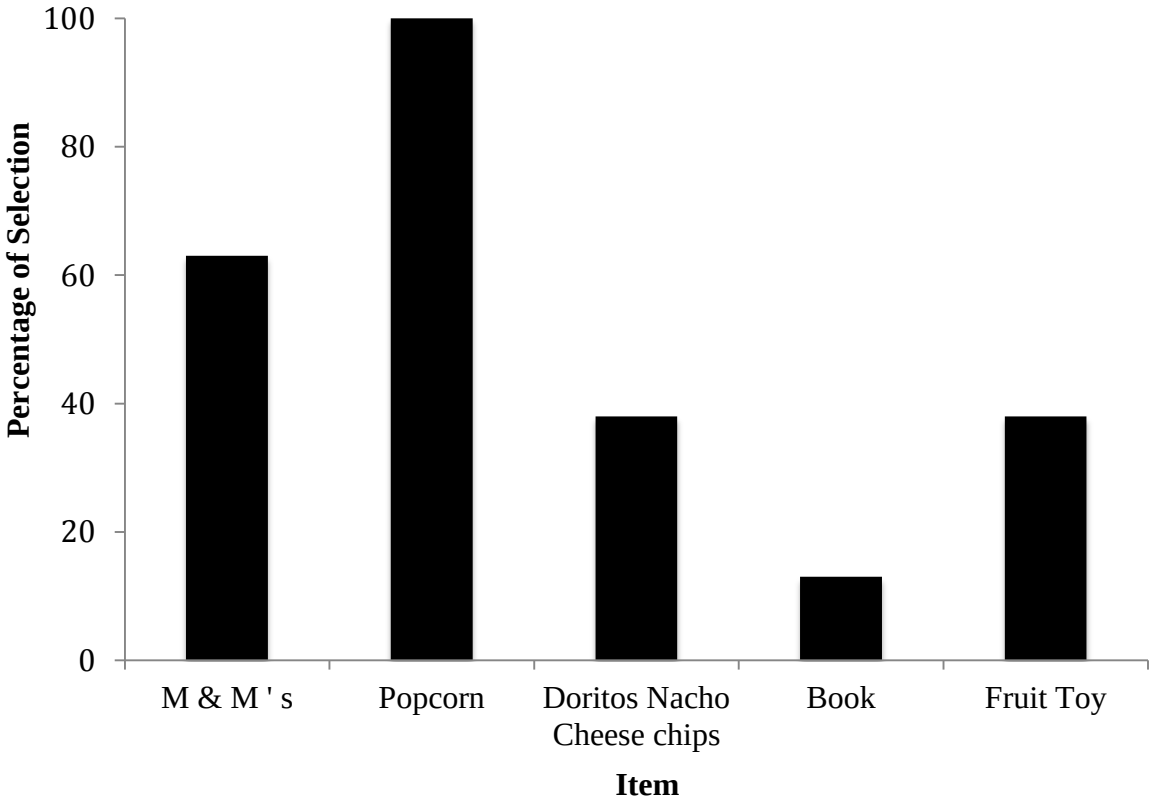


Figure 10. Juan's stimulus preference assessment. This figure displays the percentage of times Juan selected an item, when it was available.

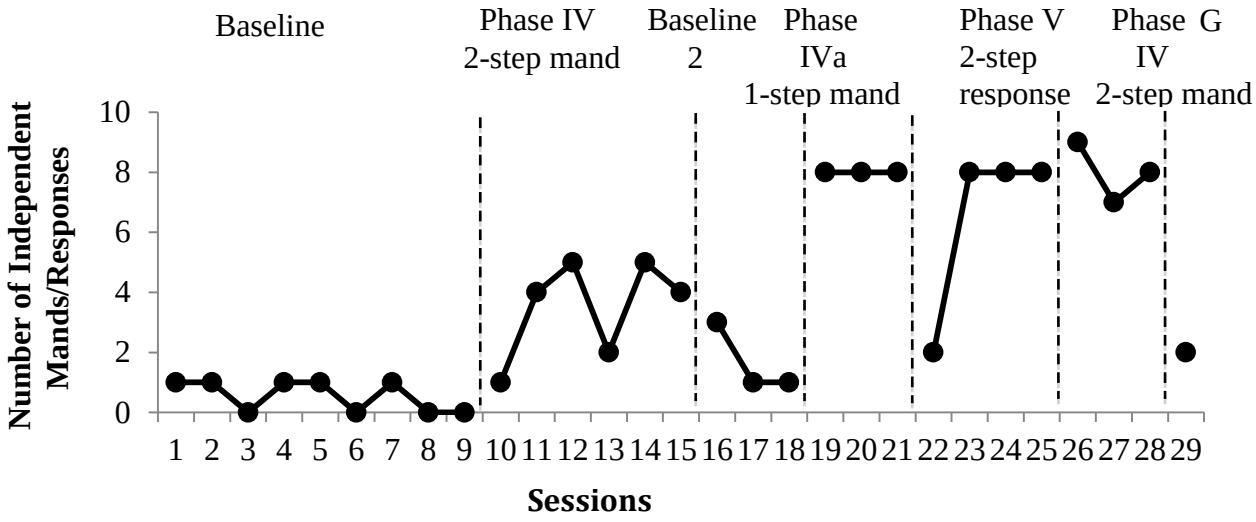


Figure 11. The number of independent mands and responses through the use of Proloquo2go™ and PACA training for Juan. Baseline and phase IV display the number of independent 2-step mands. Phase IVa displays the number of independent 1-step mands. Phase V displays the number of independent 2-step responses. The assessment of generalization is depicted by a "G".

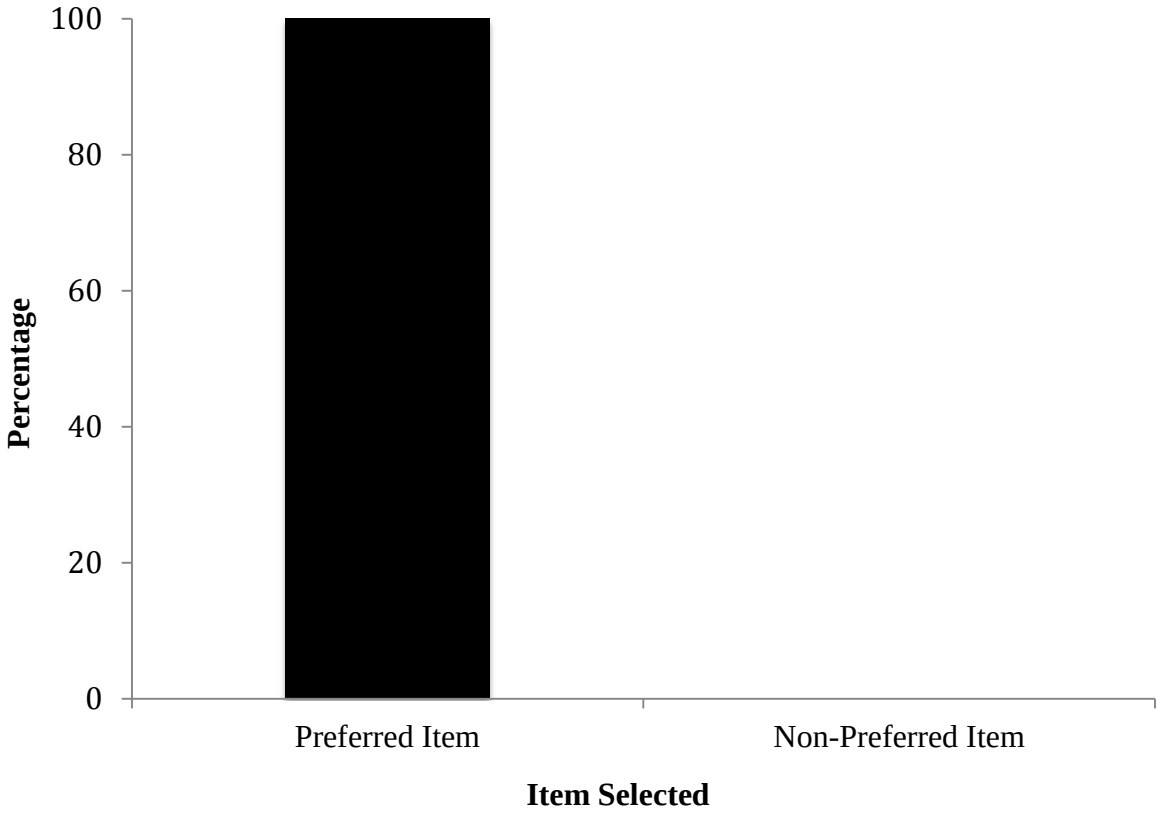


Figure 12. Juan's percentage of preferred items selected. This figure displays Juan's percentage of preferred items selected during phase V of PACA training.

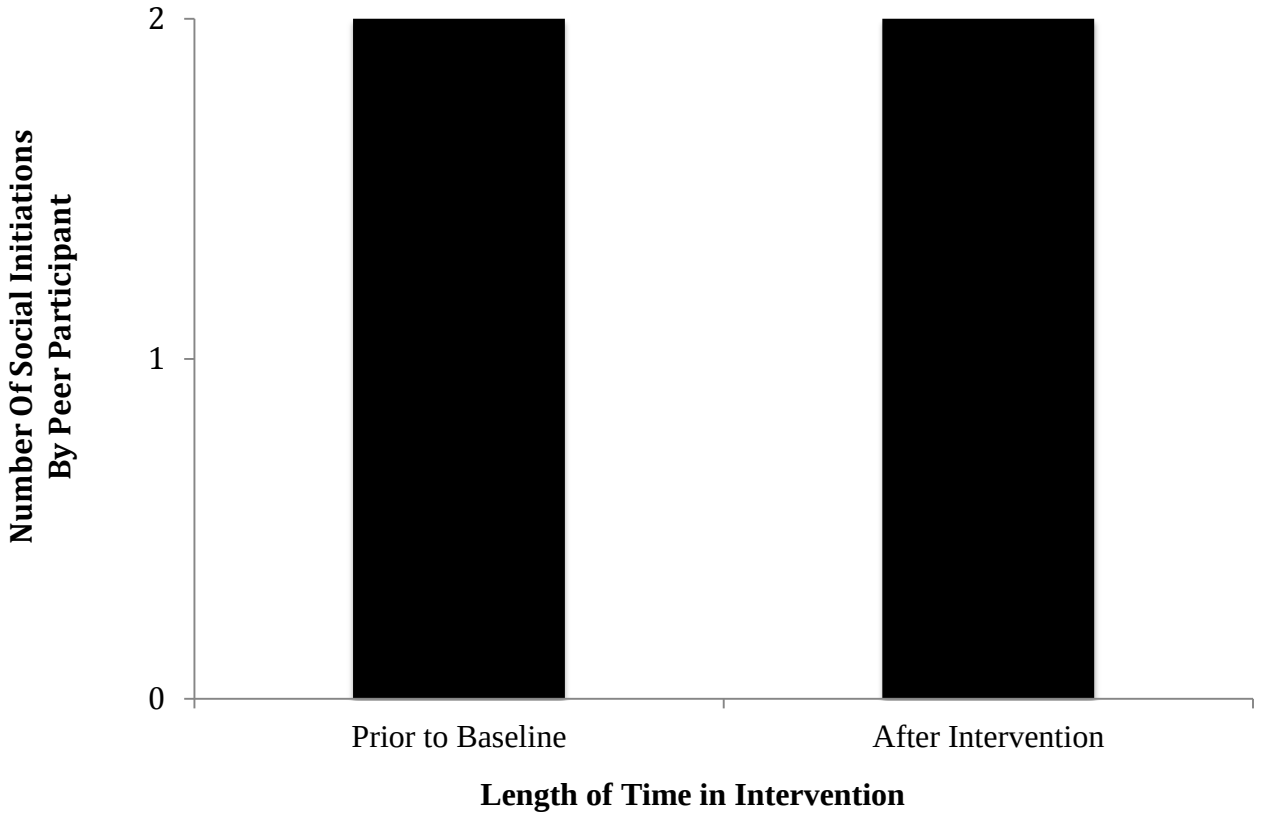


Figure 13. Number of social initiations made by Eden to Juan. This figure displays the number of social initiations made by Eden to Juan prior to baseline and after PACA training.

## Overall Analysis

### Independent and Prompted Mands

**PACA training Phase IV.** During baseline, Parker, Kyle, Thomas, and Juan independently manded using PACA training an average of 12% of the time (range, 0% to 30%). During phase IV, Parker, Kyle, and Juan independently manded using PACA training an average of 74% of the time (range, 20% to 100%), and were prompted to mand an average of 26% of the time (range, 0% to 80%). The mean number of sessions required to meet criterion for phase IV for Parker, Kyle, and Juan was 4.3 sessions. Thomas was unable to meet criterion for phase IV.

**PACA training Phase IVa.** Thomas and Juan were unable to meet criterion for phase IV. The PI implemented a second baseline followed by phase IVa. The criterion required for phase IVa was a 1-step mand (as opposed to a 2-step mand). During the return to baseline, Thomas and Juan independently manded using PACA training an average of 8% of the time (range, 0% to 20%). During phase IVa, Thomas and Juan independently manded using PACA training an average of 65% of the time (range, 20% to 80%), and were prompted to mand an average of 35% of the time (range, 20% to 80%). The mean number of sessions required to meet criterion for phase IVa for Thomas and Juan was five sessions.

### Independent and Prompted Responses

**PACA training Phase V.** During phase V, Parker, Kyle, and Juan independently manded using PACA training an average of 87% of the time (range, 20% to 100%), and were prompted to mand an average of 13% of the time (range, 0% to 80%). Parker, Kyle, and Juan all met criterion for phase V in three sessions. Parker, Kyle, and Juan selected a

preferred item 94% of the time. Thomas was unable to meet criterion for phase IV, and therefore no data were collected for phase V.

**PACA training Phase VI.** During phase VI, Parker and Kyle independently manded using PACA training an average of 87% of the time (range, 20% to 100%), and were prompted to mand an average of 13% of the time (range of 0% to 80%). Parker and Kyle both met criterion for phase VI in five sessions. Thomas did not meet criterion for phase IV, and therefore no data were taken on phase VI. Juan met criterion for phase V, but due to time constraints no data were collected on phase VI.

**Generalization.** Generalization probes for PACA training phase V demonstrated that Parker, Kyle, and Juan independently responded an average of 73% of the time. Generalization probes for PACA training phase IV demonstrated that Thomas independently manded 50% of the time.

Generalization probes were taken in each participant's classroom during the course of the respective summer programs. Teachers and paraprofessionals were working with small groups in classrooms A, B, and C. Therefore, conducting generalization probes in the classroom environment was not distracting for other students in the classroom. There was a moderate level of noise present during each session. Generalization probes were collected at a table with both the PI and peer participant. Two of the four participants successfully performed the communicative skills of PACA training Phase V in a novel environment, which was likely a sign of generalization.

**Maintenance.** Maintenance data demonstrated that Parker and Kyle independently responded an average of 86% of the time. Maintenance data were not collected for Thomas and Juan due to time constraints.

Maintenance data were taken in the speech language pathologist's office for two of the four participants (Parker, Kyle). The procedures during maintenance data collection adhered to the same procedures as baseline data collection. Parker and Kyle were both successful in demonstrating the communicative skills of PACA training Phase V (2-step response to "What do you want?").

**Social Initiations.** None of the primary participants (Parker, Kyle, Thomas, or Juan) made any social initiations. Data were taken on social initiations before the baseline condition, and after all intervention conditions. One of the peer participants made social initiations during the study. Eden (Juan's sister) made two social initiations towards Juan before baseline data were taken. Eden also made two social initiations towards Juan after intervention data were taken. PACA training did not impact the number of social initiations made from primary participants towards peer participants, or from peer participants towards primary participants.

**Social Interactions.** Parker, Kyle, and Thomas did not engage in any social interactions before baseline or after PACA training with their respective peer participants. Juan and Eden had two social interactions before baseline that lasted an average of 5.5 s. Juan and Eden also had two social interactions after PACA training that lasted an average of 4 s.

**Problem Behaviors.** Parker, Kyle, and Juan did not engaged in any problem behaviors during baseline, or any phases of PACA training. Thomas was the only primary participant to display any problem behaviors during the study. Thomas displayed one problem behavior in baseline (one scream), four problem behaviors during phase IV

(three hand bangs, one scream), zero problem behaviors in phase IVa, and two problem behaviors during the repeated phase IV (two screams).

**Verbalizations.** None of the primary participants (Parker, Kyle, Thomas, or Juan) produced any verbalizations during baseline, or any phases of PACA training.

## Social Validity Surveys

### BIRS

The results of the teachers' ratings on the BIRS (Elliott & Treuting, 1991) are presented in Table 1. Three classroom teachers completed the survey. Teacher A had Parker in her classroom. Teacher B had Kyle and Thomas in her classroom. Teacher C had Juan in her classroom. The survey included 24 questions, rated on a 6-point Likert scale (with 6 representing high acceptability or effectiveness and 1 representing low acceptability or effectiveness).

Generally, classroom teachers reported the intervention as being both acceptable and effective. The average rating across all items on the BIRS, for the three classroom teachers, was 4.9 (agree). The average rating for all items on the BIRS for teacher A was 5.7 (strongly agree) with a range of 4-6. The average rating for all items on the BIRS for Teacher B was 3.9 (agree) with a range of 3-5. The average rating for all items on the BIRS for Teacher C was 5.1 (agree) with a range of 4-6. In the strongly disagree to disagree category (0-2), there were no items with a mean rating. In the neutral category (3), there were no items with a mean rating. In the agree to strongly agree category (4-6), there were 100% of the items with a mean rating. Specifically (when rounded), 29% of the items had a mean rating of 4 (agree), 54% of the items had a mean rating of 5 (agree), and 17% of the items had a mean rating of 6 (strongly agree). The highest mean ratings

were provided on “problem warrants intervention”, “no negative side effects”, “appropriateness for variety of children”, and “fairness of intervention” (mean of 5.7 for all four respectively). The lowest mean ratings were provided on “produced improvement equal to peers”, “positive change noted”, and “behavior no longer a problem” (mean of 3.7 for all three respectively).

Table 1. Mean scores for teacher satisfaction of the intervention across items on the BIRS

| BIRS Item | Teacher A (Parker) | Teacher B (Kyle/Thomas) | Teacher C (Juan) | Teacher Average |
|---|---|---|---|---|
| Intervention acceptability | 6 | 4 | 6 | 5.3 |
| Generalizability of intervention | 6 | 4 | 5 | 5 |
| Intervention effectiveness | 6 | 4 | 5 | 5 |
| Referral of intervention to others | 6 | 5 | 5 | 5.3 |
| Problem warrants intervention | 6 | 5 | 6 | 5.7 |
| Suitability of intervention | 6 | 4 | 6 | 5.3 |
| Willingness to use again | 6 | 5 | 5 | 5.3 |
| No negative side effects | 6 | 5 | 6 | 5.7 |
| Appropriateness for variety of children | 6 | 5 | 6 | 5.7 |
| Consistent with previous interventions | 6 | 4 | 4 | 4.7 |
| Fairness of intervention | 6 | 5 | 6 | 5.7 |
| Reasonability of intervention | 6 | 4 | 6 | 5.3 |
| Pleased with intervention procedures | 6 | 4 | 6 | 5.3 |
| Appropriateness of intervention | 6 | 4 | 6 | 5.3 |
| Beneficial for child | 6 | 4 | 5 | 5.3 |
| Produced quick improvement | 4 | 3 | 5 | 4 |
| Produced lasting improvement | 6 | 4 | 5 | 5 |
| Produced improvement equal to peers | 4 | 3 | 4 | 3.7 |
| Positive change noted | 4 | 3 | 4 | 3.7 |
| Maintenance of behavior change | 6 | 3 | 4 | 4.3 |
| Generalization of behavior change | 6 | 3 | 4 | 4.3 |
| Social comparability after intervention | 6 | 3 | 4 | 4.3 |
| Behavior no longer a problem | 4 | 3 | 4 | 3.7 |
| Other behaviors improved | 6 | 3 | 5 | 4.7 |
| Average across subjects and items | 5.7 | 3.9 | 5.1 | 4.9 |

**PACA Training Peer Questionnaire**

The results of the PACA Training Peer Questionnaire are presented below in Table 2. Two peer participants completed the survey (Ziggy and Lyla). Both peer participants felt that their participation in the study was a positive experience for themselves and the primary participants. Lyla said, "I have had a lot of fun meeting different kids." Both peer participants learned something from their participation in the study. Ziggy said, "I learned how people with autism do stuff." Both peer participants also felt confident saying they would participant in a similar future study if the opportunity presented itself. In general, both peer participants felt they learned both a great deal about individuals with autism as well as appropriate ways in which to interact with individuals with autism.

Table 2. Summary of responses from PACA Training Peer Questionnaire

| Questionnaire Item | Summary of Responses |
|---|---|
| Question #1.<br>1. How would you describe your experience helping in this study? | Positive Experience: 100%<br>Negative Experience: 0% |
| Question #2.<br>What did you learn from participating in this study? | Lyla: "I learned how to cooperate with kids a little bit different and help them learn."<br>Ziggy: I learned how people with autism do stuff." |
| Question #3.<br>Would you like to participate in a similar project in the future? Why? | Yes: 100%<br>No: 0% |
| Question #4.<br>Do you think the training was a good way to help kids with autism? Why? | Yes: 100%<br>No: 0% |

**PACA Training Teacher Questionnaire**

The results of the PACA Training Teacher Questionnaire are presented below in Table 3. Two classroom teachers completed the survey (A and B).

Question #1: How do you feel about using same aged peers without disabilities to help children with autism learn to communicate and socialize? Why? Both classroom teachers felt that the peer-component of PACA training was a beneficial addition to the intervention package. Teacher A said, "Yes, I feel it is beneficial because peers are excellent models for expected behaviors. Teacher B said, "I think it is beneficial, because an appropriate model for socialization and communication is modeled by someone their age."

Question 2: Do you prefer to use the PECS or Proloquo2go (or similar iPod/iPad communication app) in your classroom? Why? Teachers generally felt comfortable using either the PECS, or a combination or the PECS and VOCAs. Teacher A said, "We use both depending on student. The PECS is a great backup." Teacher B said, "We used PECS as part of our daily routine so the students are familiar. Also, I feel like the PECS is less complicated."

Question 3: What is the biggest challenge to using Proloquo2go (or similar iPod/iPad communication app) with your students? The biggest challenges faced by teachers using VOCAs with children with autism were their expense and their technological operation. Teacher A said, "Making sure we have the items that he needs in there is a challenge. He uses many pictures that we need to input." Teacher B said, " Proloquo2go is very advanced for the level of my ASD students. They need more concreteness. In addition, Proloquo2go is expensive. Not all parents can afford it".

Question 4: What resources do you use to learn how to teach your students to use Proloquo2go (or similar iPod/iPad communication app)? Classroom teachers turned to the Internet and local school personnel in order to learn how to train their students to use VOCAs. Teacher A said, “I use the internet, the speech and language pathologist, students’ parents, and the student.” Teacher B said, “I use modeling and social stories to teach my students how to use the apps appropriately.

Table 3. Summary of responses from PACA Training Teacher Questionnaire

| Questionnaire Item | Percentage of participants/Summary of Responses |
|---|---|
| Question 1:<br>How do you feel about using same aged peers without disabilities to help children with autism learn to communicate and socialize? Why? | Positively: 100%<br>Negatively: 0% |
| Question 2:<br>Do you prefer to use the PECS or Proloquo2go (or similar iPod/iPad communication app) in your classroom? Why? | PECS- 50%<br>VOCA- 0%<br>PECS & VOCA- 50% |
| Question 3:<br>What is the biggest challenge to using Proloquo2go (or similar iPod/iPad communication app) with your students? | Teacher A: "Making sure we have the items that he needs in there is a challenge."<br>Teacher B: "Proloquo2go is expensive." |
| Question 4:<br>What resources do you use to learn how to teach your students to use Proloquo2go (or similar iPod/iPad communication app)? | * Internet<br>* Speech and Language Pathologist<br>* Modeling<br>* Social Stories |

# CHAPTER 5

# DISCUSSION

This section discusses (a) the extent to which the results answer the research questions, (b) implications of the results for using PACA training with children with autism, (c) limitations of the study, and (d) suggestions for future research.

## Research Questions

### Question 1

To what extent does the implementation of Proloquo2go™ using PACA training affect the number of independent mands and responses acquired by children with autism?

**Overall analysis.** Proloquo2go™ using PACA training increased the communication skills, to varying levels, acquired by children with autism. This is supported by the visual analysis of the intervention data (see Figures 2, 5, 8 and 11). The results reflect that Proloquo2go™ using PACA training can be effective for requesting an item with a 2-step sequence (phase IV), and responding to the questions, "What do you want" (phase V) and "What is your name?" (phase VI) for children with autism, ages 5 through 9. These results align with previous research that supported the use of Proloquo2go™ with children with autism (Achmadi et al., 2012, van der Meer et al., 2011, Kagohara et al., 2010). Through the use of PACA training, some children with autism were able to acquire the ability to mand for preferred items, and respond to two questions with same-aged peers. Specifically, this study extended the research by

successfully training for more sophisticated communication skills when using Proloquo2go™ (van der Meer & Rispoli, 2010). These advanced communication skills included responding to the question, "What do you want?" and selecting a preferred item that wasn't in sight, and responding to the question, "What is your name?" With the recent surge of using the iPod touch® and iPad® with children with autism (Gosnell, Costello, & Shane, 2011), these results represent an extension of previous research. Preliminary evidence shows that children with autism can be trained both through the use of same-aged peers, and to learn more sophisticated communicative skills with this new technology.

Peer assisted communication application training included three phases that were similar to the PECS training (Frost & Bondy, 2002). Phase IV and phase V of PACA training lined up with the PECS training ("I want" followed by preferred item, and responding to the question, "What do you want?"). Phase VI of PACA training differed from phase VI of the PECS training. It required participants to respond to the question, "What is your name?" as opposed to the commenting (e.g. "I see a red apple") required in the PECS training. Both training procedures were also similar in that each phase built on the prior phase's sophistication (Frost & Bondy, 2002). For both trainings, phase IV and phase V were a 2-step mand followed by a 2-step response. The PECS and PACA training differed from one another, in that PACA training didn't require eye contact, approaching an adult, or exchanging a picture card.

Additionally, PACA training included phases that taught participants intraverbal behavior (phase V) and tact behavior (phase VI). In phase V, participants responded to

the question, “What do you want?” with “I want (insert preferred item).” In phase VI, participants responded to the question, “What is your name?” by labeling themselves with the tact, “My name is (insert participant’s name).

Results of the current study that used a PECS-like training procedure support previous studies that used the PECS effectively to teach communicative skills. (Lancioni, O’Reilly, Oliva, & Coppa, 2001; Schepis et al., 1998; Sigafoos et al., 2004; Son, Sigafoos, O’Reilly, & Lancioni, 2006). The study also extends previous research by applying this similar training sequence to iPod-based VOCAs and extending iPod-based VOCA research by moving beyond just mand training to more sophisticated types of communication, including intraverbal and tact training.

**PACA training Phase IV.** Three of the participants met criterion for phase IV (2-step mand), and one of the participants met criterion for a revised phase IVa. These results confirm previous research that suggested that Proloquo2go™ is an effective communicative device for many children with autism, albeit not all (van Der Meer et al., 2011). The participant (Thomas) who was not able to progress through any of the original three phases (IV, V, and VI) of PACA training did however experience some success with Proloquo2go™. Using response shaping, Thomas was able to produce a 1-step mand (phase IVa) for a preferred item.

Thomas progressed through phase IVa of PACA training. Thomas’s experimental analysis showed that Proloquo2go™ using PACA training might not be successful for all participants. It’s possible with more time Thomas would have been able to meet criterion for phase IV although there is no evidence to support this. When Thomas failed to meet

criterion after seven sessions, the PI returned to baseline and then implemented a similar criterion (1-step mand). He was able, as previously stated, to reach criterion for a 1-step mand, but not a 2-step mand. This also suggests that simplifying the criterion of phase IV of PACA training may not be a successful strategy for some children with autism to master more sophisticated communication skills.

One factor that may have influenced Thomas' ability to perform a 2-step mand was response effort. Response effort refers to how the physical demands necessary to emit a behavior can effect whether the individual will produce that behavior (Neef, Shade, and Miller, 1994). In the case of Thomas, when the reinforcement only required a 1-step mand, he was apt to perform the required response. However, when the task demand changed in phase IV of PACA training, the response effort was potentially too high. The high response effort of the behavior may also provide an explanation for the challenging behaviors Thomas presented. Previous research supports that when response effort is too high when using VOCAs, problem behaviors can increase. Conversely, when response effort is lower when using VOCAs, problem behaviors can decrease (Homer, Sprague, O'Brien, & Heathfield, 1990).

Another possible explanation for Thomas's inability to produce a 2-step mand was the response effort when participants were prompted. During PACA training, participants were taught using graduated guidance. If a participant did not produce an independent 2-step mand, that participant was prompted to produce the 2-step mand. The participant received a reinforcer during both the prompted and unprompted condition. There were only two differences between the conditions. During the prompted condition, it took longer for the participant to receive a reinforcer, and the response effort was lower.

That is, the participant had to exert less physical effort while being prompted through the behavior. This would be in line with previous research that suggests independent responses may be less likely when behavior is under the stimulus control of available prompts with no difference in reinforcement (Karsten & Carr, 2009). However, it is also possible that another teaching procedure, such as video modeling would have been more effective for Thomas in learning to use a VOCA (Banda et al., 2010). It's also possible to facilitate communication; a different AAC device could have been more effective such as manual signs, or the PECS (Beck et al., 2008, Tincani, 2004).

The use of graduated guidance, time delay, and differential reinforcement as part of PACA training extends previous research that utilized these procedures with children with autism (Duker et al., 2004). All four participants were able to use the iPod-based VOCA for a communicative purpose. Although two of the participants weren't able to reach criterion for all three phases of PACA training, both were still able to successfully use Proloquo2go™ to some extent. Results of the study further support the use of training procedures guided by the principles of ABA (Duker et al., 2004). This study furthers past research by including these training procedures in their use with iPod-based VOCAs.

**PACA training Phase V.** Three of the participants met criterion for phase V (2-step response). During phase V (2-step response) of PACA training, there were four icons present on the screen. This included two preferred items and two neutral (or non-preferred items). This was in line with the recommendation to include distracter items on the screen to provide more evidence of discriminated requesting (Achmadi et al., 2012). Data were taken on the percentage of times participants selected a preferred item, and the percentage of times participants selected a non-preferred item. For the three participants

who met criterion for phase V, all selected a preferred item (vs. a non-preferred item) over 80% of the time. This indicated that these three participants were able to effectively discriminate between reinforcing and non-reinforcing items on the screen. This extends previous research by including a discrimination component within PACA training.

Juan progressed through phase V of PACA training. Juan had difficulty with completing phase IV of PACA training. Once phase IV was broken down into smaller steps (first "I want" and then "I want" and "preferred item"), Juan was able to meet criterion for phase IV and then phase V of PACA training. This suggests that some children with autism may benefit from simplifying the criterion of phase IV of PACA training in order to master more sophisticated communication skills. The summer school ended before Juan could attempt to complete phase VI of PACA training.

**PACA training Phase VI.** Two of the four participants met criterion for phase VI (2-step social response). This indicated that some children with autism were able to produce social responses with Proloquo2go™ using PACA training. The use of newer VOCAs to target communicative skills other than requesting was regarded as an important step in future research (Kagohara et al., 2013). This study helped to fulfill this gap in the research by training children with autism to use more sophisticated communicative skills with iPod-based VOCAs. Children with autism began the first steps of holding a conversation with a same-aged peer by answering the question, "What is your name?" with the response, "My name is (insert participant's name, i.e. Parker)." This supports the notion that some children with autism are able to navigate through

Proloquo2go™ and discriminate between icon categories, which in this case included a requesting category and a social category.

Parker and Kyle progressed through phase VI of PACA training. Parker's success with Proloquo2go™ using PACA training was also significant, because he also had a secondary disability of cognitive impairment (CI). This means that the sub-category of students who have a co-morbidity of an ASD and a CI may be able to use Proloquo2go™ and PACA training successfully. These results are similar to previous research that indicates students with autism and cognitive impairments have the capacity to use the iPod touch® (Kagohara et al., 2013). This research helps extend the research base by indicating that children with both an ASD and a CI can learn more sophisticated communicative skills.

While using Proloquo2go™, Kyle enjoyed manipulating the screen of the device to put it into both horizontal and landscape mode. He was able to successfully use the device in either orientation. In each orientation, the icons changed size and dimension. Despite this visual change, Kyle was still able to correctly select the desired sequence during each phase. Therefore, some children with autism may exhibit a level of comfort with the Proloquo2go™ application, and effectively navigate the intricacies of the technology without specific interventions to teach such behaviors.

**Question 2**

To what extent does the implementation of Proloquo2go™ using PACA training

affect the number of verbalizations and problem behaviors emitted by children with autism?

**Verbalizations.** There were not any verbalizations produced during this study. Verbalizations were neither encouraged nor inhibited. The number of verbalizations remained at zero during control and testing conditions for all four participants. Prior research confirms that there have been too few studies on the impact of VOCAs on verbalizations to make a substantive conclusion (Schlosser, Sigafoos, and Koul, 2009). This study adds to the research base that natural speech was not encouraged through the use of VOCAs. It's possible with longer exposure to Proloquo2go™ using PACA training, verbalizations could have been produced with the repetition from the speech output of the device. For the purposes of this study however, there is not any evidence to support the notion that PACA training and Proloquo2go™ had any affect on verbalizations.

**Problem behaviors.** One of the four participants (Thomas) displayed problem behaviors during the course of the study. Thomas displayed one problem behavior in baseline, four problem behaviors in phase IV of PACA training, and two problem behaviors in the second phase IV of PACA training. Thomas experienced the most difficulty with PACA training and Proloquo2go™. It was not surprising that he experienced the only and highest levels of problem behaviors during baseline and intervention conditions. Thomas had a decrease in problem behaviors during phase IVa, in which he was able to meet criterion. These results suggest that problem behaviors may occur as a result of not acquiring the skills taught with PACA training, and therefore not

receiving preferred items. This supports previous research that suggested response demands could result in problem behaviors (van Der Meer et al., 2011).

Research has shown that mand training decreases problem behaviors in individuals with autism (Durand, 1999). Participants in this study (with the exception of Thomas) did not demonstrate any problem behaviors during baseline. There have not been enough studies conducted to reach a firm conclusion on the effects of iPod-based VOCAs on problem behaviors with individuals with autism (Quillen, 2011).

**Question 3**

To what extent does the implementation of Proloquo2go™ using PACA training affect the social behaviors of children with and without autism?

**Social initiations.** None of the primary participants made any social initiations during the study. One of the peer participants (Eden) made two social initiations during the study. Eden made two social initiations prior to baseline, and two social initiations after intervention. Therefore, Proloquo2go™ using PACA training did not affect the social initiations of either primary or peer participants. This suggests that PACA training alone is not enough to encourage either children with autism or children without disabilities to approach one another. One explanation is that the primary participants gravitated more towards the play items and the iPod touch®, than the peer participants. Before the baseline condition, Parker and Thomas both picked up the slinky and began playing with it. Kyle and Juan both began selecting random buttons on Proloquo2go™.

After the intervention condition, Parker began taking the puzzle pieces off of the completed puzzle. Kyle began selecting random button sequences on Proloquo2go™. Thomas and Juan both started playing with the toy ball. The communicative ability of the children with autism, therefore, may have influenced the success of using a peer-mediated intervention (Odom and Strain, 1986).

The characteristics of the same-aged peers were also a factor in the number of social initiations made in the study. Previous research has shown that peer-mediated interventions are affected by the personal attributes of same-aged peers, including their age and communicative level (Carter & Maxwell, 1998). Therefore, it's possible that the peer participant's in the current study did not have the comfort level or social knowledge to interact with the primary participants (with the exception of the sibling pair). This may be because same-aged peers do not receive the same social rewards they do from interacting with children with autism, as they do typically developing children (Garfin & Lord, 1986).

**Social interactions.** One of the primary participants (Juan), and one of the peer participants (Eden) had social interactions during the study. Prior to baseline, Juan and Edens' social interactions lasted 5 s and 6 s, respectively. After intervention, Juan and Edens' social interactions both lasted 4 seconds each, respectively. Therefore, Proloquo2go™ using PACA training did not have any significant impact on the social interactions of primary and peer participants. The peer component of PACA training did not produce a significant effect in increasing socialization between children with autism and children without disabilities. The only pair of children to interact socially (Juan and

Eden) was siblings. This suggests that PACA training lacks the components necessary to encourage social skills without explicit training.

Prior research has shown that support is necessary in order for same-aged peers to successfully interact with children with autism (Kohler & Strain, 1999). The collateral effects of PACA training therefore did not include increases in social initiations or social interactions. If PACA training would have included more components intended to encourage social skills, it's possible these skills would have increased during the study. Components could have included a) eye contact from primary and peer participant, b) physical orientation towards each participant, and c) reciprocity in the form of praise (i.e. "Good job!" or smiling). The lack of social behaviors therefore, may have been more a result of the training protocol, than the iPod-based VOCA. Social behaviors may have increased, as in studies using the PECS (Charlop-Christy et al., 2002), if the additional components were required in order to gain access to the reinforcer. Another factor explaining the lack of affect on social interactions was the context in which the study was conducted (Odom & Strain, 1986). The study was conducted in analog settings, and did not include any naturalistic settings. Previous studies have shown that peer-mediated interventions are effective when implanted in a naturalistic setting (Goldstein, Kaczmarek, Pennington, & Shafer, 1992, McGee, Almeida, Sulzer-Azaroff, & Feldman, 1992). Although there were generalization data collected in peer participants' classrooms, there was not a naturalistic component in the intervention package. It's possible that if the study was conducted in a more naturalistic setting, the number of social initiations and social interactions could have been affected.

**Question 4**

To what extent is the implementation of Proloquo2go™ using PACA training acceptable to the classroom teachers and peer participants?

**Classroom teachers.** Classroom teachers provided a 4.9 (agree) out of 6 on the Behavior Intervention Rating Scale (BIRS) (Elliott & Treuting, 1991) for Proloquo2go™ using PACA training. Results (presented in Table 1) show that teachers found the intervention to be both acceptable and effective. In a review of the literature, few studies were found to include a social validity measure (Kagohara et al., 2013). This study extended previous iPod-based VOCA research by assessing the social validity of the intervention.

The highest mean ratings were providing on "Problem warrants intervention," "No negative side effects," "Appropriateness for variety of children," and "Fairness of intervention." This suggests that classroom teachers found Proloquo2go™ using PACA training to be a viable intervention for a serious need for children with autism. The lowest mean ratings were provided on "Produced improvement equal to peers," "Positive change noted," and "Behavior no longer a problem." This suggests that classroom teachers did not feel that Proloquo2go™ using PACA training was an intervention that produced necessary growth. This attitude may be attributed to the both the short duration of the intervention, and the severe needs of the students. Teacher training also was not part of the intervention. This may explain some of the responses of teachers on the BIRS.

Teachers did not observe any part of the study, aside from the generalization data taken within their classrooms in the midst of teaching a class. Teachers may need explicit professional development in order to appreciate the importance and significance of an intervention (van Der meer et al., 2011).

Based on the PACA Training Teacher Questionnaire, classroom teachers felt very positive about the inclusion of peers as a training partner in the intervention. Classroom teachers preferred either the PECS, or a combination of the PECS and VOCAs. There was not any classroom teacher that exclusively preferred VOCAs. This suggests that classroom teachers may not be comfortable enough with VOCAs to rely solely rely on them. Based on the usage of Proloquo2go™ between the previous study and the current study, only one of the primary participants used Proloquo2go™ regularly. There may be a lack of training and professional development for parents and teachers on how to operate and train children to use newer VOCAs. Some of the biggest challenges reported included this lack of knowledge on the operation of Proloquo2go™ and the expense of it. For many districts, it is not possible to afford buying Proloquo2go™ and an iPod touch® when the PECS is a viable alternative. In order to locate VOCA training, classroom teachers used the Internet and other school personnel. It's possible that university programs could incorporate AAC training protocols in curriculum for future educators to alleviate this skill deficit.

**Peer participants.** Based on the PACA Training Peer Questionnaire, peers reported their participation in the study was a positive experience. Peers reported learning

both how to interact with children with autism, and how children with autism function. Although peers reported to learn a lot, their social behavior towards children with autism did not change. This suggests that the intervention did not include the necessary components to translate the "feeling of learning a lot" to the increase in social initiations and social interactions with children with autism.

Peers also reported their interest in participating in future studies. This questionnaire provided evidence that PACA training was beneficial for the peer. Peers reported a high level of enjoyment, knowledge, and the eagerness to participate in a similar experience in the future. The data suggests that the inclusion of peers may be mutually beneficial for children with autism and children without disabilities alike.

The inclusion of a peer component in PACA training supported previous research that same-aged peers were effective in training children with autism to use VOCAs for communicative skills (Trottier et al., 2011, Trembath et al., 2009). The implications may be that school districts could utilize peers in the education of children with autism. This study also extends prior research by including both a greater number of same-aged peers, and a greater number of children with autism (Trottier et al., 2011).

**Question 5**

To what extent does the implementation of Proloquo2go™ using PACA training generalize to another setting and maintain after one month?

**Generalization.** Two of the four participants were able to perform the communicative skills learned from PACA training in an environment in which they had not been previously assessed, suggesting generalization had occurred. Specifically,

Parker and Kyle were able to generalize the 2-step response (phase V) to another setting (classroom). This suggests PACA training may be effective for promoting generalization to other settings. Results from this study support previous research that peer-mediated interventions promote generalization skills (Odom, Chandler, Ostrosky, McConnell, & Reaney, 1992). Preliminary evidence suggests that the peer component may have positively impacted children with autism's ability to generalize their communicative skills acquired to another setting.

Thomas and Juan were unable to generalize the communicative skills targeted with PACA training to another setting (classroom). Thomas was unable to generalize the 1-step mand (phase IVa) to another setting (classroom). This suggests that PACA training may not be effective for all children with autism in promoting generalization to other settings. Juan was unable to generalize the 2-step response (phase V) to another setting (classroom). From observational data, it appears that Juan may have had difficulty generalizing the 2-step response to another setting, because of sensory issues. During the generalization probes in the classroom, Juan was covering his ears a majority of the time. The analog setting, in which baseline and intervention data were collected was quiet. The generalization setting, in comparison was quite loud. This suggests that environmental complications, such as noise level, could affect the performance of children with autism when using Proloquo2go™ using PACA training.

**Maintenance.** Two of the four participants were able to maintain their communicative skills learned from PACA training. Specifically, Parker and Kyle were able to maintain the 2-step response (phase V) after a one-month follow up. This suggests that PACA training can be effective for maintaining communicative skills after a period

of time. Maintenance data were only taken on two of the four participants, because of time constraints. The results therefore are only indicative of half of the primary participants, and reflect that 100% of the participants were able to maintain their acquired communicative skills. The current study extends Proloquo2go™ research by including a generalization and maintenance measure (van Der Meer et al., 2011).

## Limitations and Future Research

Despite the effectiveness of the intervention, a number of limitations were present in the current study. One limitation of the study was the design. The experimenters did not return to baseline after each phase of PACA training in order to provide experimental control for phases V and VI. The only phase in which experimental control was provided was phase IV. The experimenters also did not control for sequential effects by switching the order of phases V and VI for some of the participants. These methodological decisions weakened the argument that Proloquo2go™ using PACA training (phase V and VI) was effective at increasing communicative behavior. These decisions were however made based on prior PECS literature. Most studies examining the efficacy of the PECS training did not return to baseline after each phase, and did not control for sequential effects (Charlop-Christy et al., 2002, Kravits et al., 2002, Ganz & Simpson, 2004, Tincani et al., 2006), Bock et al., 2005, Beck et al., 2008). The structure of a PECS-training procedure is built upon each phase becoming more sophisticated. This, in part, explains why returning to baseline is not conducive to the training.

A second limitation was that the generalization probes were collected on a behavior that was not assessed during baseline. Specifically, the behavior (2-step

response) was assessed during generalization probes (with the exception of Thomas). The 2-step response was assessed, as it was the highest phase (phase V) that the most participants reached. In addition, the PI wanted to collect data on the participants' ability to perform a more sophisticated communicative skill in another setting. In future studies, each phase could be designed as its own experiment in order to collect generalization data.

A third limitation was the time constraints of the study. The study took place over the course of 3 months. With more time, the criterion could have been expanded to include manding for more items, discriminating between more than four items, and working on more responses to different social questions. Researchers could have also increased the number of communication steps (i.e. 3 or 4-step response), and included more explicit training to navigate through the application (i.e. touching the back button). These skills are especially important to older individuals with autism who require a more expanded vocabulary for every day and vocational use. Furthermore, by including the use of more picture icons and screen sequences, communication partners would be better able to understand the exact needs of the user (Sigafoos & Reichle, 1992). Future research should address the need to train children with autism a more expanded vocabulary with iPod-based VOCAs.

A fourth limitation was the lack of more explicit social skills training to the peer participants. Only one pair of participants had any social interactions, and this pair consisted of siblings. Furthermore, the number of social initiations and length of social interactions was largely unaffected by PACA training. Future research could look at including more comprehensive peer training. More explicit training could include skills such as a) keeping eye contact, b) body position, c) smiling, and d) giving praise.

The lack of a teacher-training component posed a fifth limitation to the current study. Applications, such as Proloquo2go™ and technology, such as the iPod touch® can be difficult to operate without extensive knowledge and practice. This makes the emergence of glitches quite troublesome for teachers who have a very basic knowledge of the device (Kagohara et al., 2013). By including a teacher training component in the intervention, maintenance and social validity scores may have been positively influenced. Future research should look at evaluating the effectiveness of parent and teacher training of iPod-based VOCAs.

A sixth limitation was the characteristics of the primary participants. Verbalizations, problem behaviors, social initiations, and social interactions were unaffected by the intervention in this study. One explanation for the lack of affect of the intervention on these dependent variables is the minimal amount of research that has been done (Schlosser et al., 2009, Quillen, 2011). Another explanation for the lack of affect of the intervention on verbalizations and problem behaviors was the primary participants' characteristics. None of the primary participants exhibited any verbalizations during baseline, and only one primary participant exhibited problem behaviors. This suggests that the population targeted may not have had the capacity for natural speech production, and did not produce significant challenging behaviors (Blischak, Lombardino, & Dyson, 2003). Future research could include more targeted selection criterion to recruit a more representative sample of the ASD population.

The primary participants' prior experience with Proloquo2go™ constituted a seventh limitation of the study. Much of the previous research includes participants who

have prior experience with Proloquo2go™ (Kagohara et al., 2010, van der Meer et al., 2011, Achmadi et al., 2012). Although baseline data confirmed that none of the primary participants were able to make a 2-step mand for a preferred item, it is possible that prior training helped guide learning more quickly. Future research could seek to include participants that do not have experience using iPod-based VOCAs.

An eighth limitation was the iPod touch® auto-lock feature was set to always be on. This meant that the participant did not have to press the home button and move a lock on the bottom portion of the screen from left to right. This was done in regards to the time constraints of teaching each of the participants an additional skill. However, it is an important skills, as it could lengthen the battery life considerably allowing participants to use the device for the full day without the need for a battery charge. Achmadi et al. (2012) successfully trained two adolescents to accomplish this task in the operation of the iPod touch®. The exclusion of such criteria in this study inhibited the total independence of children with autism when communicating with such devices. Future research could include more explicit training in the operation of the technology by the participants.

## Conclusion

The current study evaluated the use of PACA training on the communicative and social behaviors of four children with autism. All four children were able to use Proloquo2go™ for some communicative purpose. Specifically, two of the four children met criterion for phases IV, V, and VI of PACA training; three of the four children met criterion for phases IV, and V of PACA training; and one child met criterion for a revised

phase IVa of PACA training. Parker and Kyle were able to generalize and maintain their communication skills learned from PACA training to a new setting. Thomas and Juan were not able to generalize their communication skills from PACA training to a novel environment.

Social initiations, social interactions, and verbalizations were not affected by the implementation of PACA training. Problem behaviors were not affected for three of the four participants. The problem behaviors of one of the participants increased when he failed to meet criterion for phase IV. Social validity measures indicated that teachers and same-aged peers found the intervention to be both effective and acceptable. Although, the inclusion of a peer and teacher-training component, and a naturalistic component to the intervention package may have increased social validity measures even higher.

Results of this study extended the iPod-based VOCA literature in many ways. First, the researchers used a PECS-like training procedure with foundations in ABA, and included a discrimination (preferred vs. non-preferred) phase. This study furthers past research that showed the effectiveness of these teaching protocols with newer iPod-based VOCAs (Achmadi et al., 2012, Kagohara et al., 2010). Second, the study extended the iPod-based VOCA literature by including a social validity, generalization, and maintenance measure (van der Meer et al., 2011). Third, this study advanced the literature by progressing beyond mand training, to intraverbal and tact training. The researchers trained for more complex communication skills including responding to the questions, "What do you want?" (intraverbal training) and "What is your name?" (tact training). Fifth, this research extended past VOCA research to show that children with an ASD and a CI can effectively communicate with an iPod-based VOCA. Finally, this

study showed that a peer-mediated intervention could be used to teach children with autism how to communicate with iPod-based VOCAs. This finding may give school districts an opportunity to help multiple populations. That is, many schools already have effective peer buddy systems in place (Laushey & Heflin, 2000). Significantly, this study may provide evidence that peers could communicate with non-verbal children with autism within these programs.

# APPENDICES

APPENDIX A

PARENT/GUARDIAN PREFERENCE ASSESSMENT

**Reinforcement Assessment for Individuals with Severe Disabilities (RAISD)**

Student's Name: _____

Date: _____

Recorder: _____

*The purpose of this structured interview is to get as much specific information as possible from the informants (e.g., teacher, parent, caregiver) as to what they believe would be useful reinforcers for the student. Therefore, this survey asks about categories of stimuli (e.g., visual, auditory, etc.). After the informant has generated a list of preferred stimuli, ask additional probe questions to get more specific information on the student's preferences and the stimulus conditions under which the object or activity is most preferred (e.g., What specific TV shows are his favorite? What does she do when she plays with a mirror? Does she prefer to do this alone or with another person?)*

We would like to get some information on _____'s preferences for different items and activities.

1. Some children really enjoy looking at things such as a mirror, bright lights, shiny objects, spinning objects, TV, etc. What are the things you think _____ most likes to watch?

   _____

   Response(s) to probe questions:

   _____

2. Some children really enjoy different sounds such as listening to music, car sounds, whistles, beeps, sirens, clapping, people singing, etc. What are the things you think _____ most likes to listen to?

   _____

   Response(s) to probe questions:

   _____

3. Some children really enjoy different smells such as perfume, flowers, coffee, pine trees, etc. What are the things you think _____ most likes to smell?

   _____

   Response(s) to probe questions:

   _____

4. Some children really enjoy certain food or snacks such as ice cream, pizza, juice, graham crackers, McDonald's hamburgers, etc. What are the things you think _____ most likes to eat?

---

Response(s) to probe questions:

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5. Some children really enjoy physical play or movement such as being tickled, wrestling, running, dancing, swinging, being pulled on a scooter board, etc. What activities like this do you think _____ most enjoys?

---

Response(s) to probe questions:

---

6. Some children really enjoy touching things of different temperatures, cold things like snow or an ice pack, or warm things like a hand warmer or a cup containing hot tea or coffee. What activities like this do you think _____ most enjoys?

---

Response(s) to probe questions:

---

7. Some children really enjoy feeling different sensations such as splashing water in a sink, a vibrator against the skin, or the feel of air blown on the face from a fan. What activities like this do you think _____ most enjoys?

---

Response(s) to probe questions:

---

8. Some children really enjoy it when others give them attention such as a hug, a pat on the back, clapping, saying "Good job", etc. What forms of attention do you think _____ most enjoys?

---

Response(s) to probe questions:

---

9. Some children really enjoy certain toys or objects such as puzzles, toy cars, balloons, comic books, flashlight, bubbles, etc. What are _____'s favorite toys or objects?

---

Response(s) to probe questions:

10. What are some other items or activities that _____ really enjoys?

Response(s) to probe questions:

After completion of the survey, select all the stimuli which could be presented or withdrawn contingent on target behaviors during a session or classroom activity (e.g., a toy could be presented or withdrawn, a walk in the park could not). Write down all of the specific information about each selected stimulus on a 3" x 5" index card (e.g., likes a female adult to read him the 'Three Little Pigs' story.) Then have the informant(s) select the 16 stimuli and rank order them using the cards. Finally, list the ranked stimuli below.

1. _____ 9. _____
2. _____ 10. _____
3. _____ 11. _____
4. _____ 12. _____
5. _____ 13. _____
6. _____ 14. _____
7. _____ 15. _____
8. _____ 16. _____

Notes:

APPENDIX B

DATA COLLECTION FORM FOR PACA TRAINING

Student Name: Data Collector Name:

| Date | Time | Session | Phase | Pro. Mands | Ind. Mands | Problem behaviors | Verbalizations. | Item Select (Phase V) |
|---|---|---|---|---|---|---|---|---|
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APPENDIX C

PROCEDURAL INTEGRITY FOR PACA TRAINING

**Procedural Integrity Form**

PACA Training (Phase IV)

| | Yes | No |
|---|---|---|
| 1. The instructor presents communication application with four icons on screen within reach and in front of participant. | | |
| 2. The instructor uses graduated guidance to train participant how to use communication application in order to request using a 2-step sequence.<br>a. Uses time delay<br>b. Uses most-to-least physical prompting<br>c. Uses prompts based on behavior at beginning of each trial | | |
| 3. The peer gives participant preferred item if…<br>a. "I want" is touched followed by<br>b. Preferred item being touched | | |
| 4. The peer does not give peer preferred item if…<br>a. Peer reaches for item<br>b. Only "I want" it touched<br>c. A different main category is touched<br>d. Participant does nothing | | |
| 5. The instructor removes communication application to signify the end of a trial. | | |

PACA Training (Phase V)

| | Yes | No |
|---|---|---|
| 1. The peer begins each trial with the question, "What do you want?" with all items out of participant's sight. | | |
| 2. The instructor presents communication application with four icons on screen within reach and in front of participant. | | |
| 3. The instructor uses graduated guidance to train participant how to use communication application in order to respond and request using a 2-step sequence.<br>a. Uses time delay | | |

| | | |
|---|---|---|
| b. Uses most-to-least physical prompting<br>c. Uses prompts based on behavior at beginning of each trial | | |
| 4. The peer gives participant preferred item if…<br>a. "I want" is touched followed by<br>b. Preferred item being touched | | |
| 5. The peer does not give peer preferred item if…<br>a. Peer reaches for item<br>b. Only "I want" it touched<br>c. A different main category is touched<br>d. A different sub category is touched<br>e. Participant does nothing | | |
| 5. The instructor removes communication application to signify the end of a trial. | | |

PACA Training (Phase VI)

| | Yes | No |
|---|---|---|
| 1. The peer begins each trial with the question, "My name is _____, what is your name?" with a preferred item out of sight. | | |
| 2. The instructor presents communication application with four icons on screen within reach and in front of participant. | | |
| 3. The instructor uses graduated guidance to train participant how to use communication application in order to respond and request using a 2-step sequence.<br>a. Uses time delay<br>b. Uses most-to-least physical prompting<br>c. Uses prompts based on behavior at beginning of each trial | | |
| 4. The peer gives participant preferred item if…<br>a. "Hi, Bye" is touched followed by<br>b. "Hi, my name is _____." | | |
| 5. The peer does not give peer preferred item if…<br>a. Peer reaches for item<br>b. Only "Hi, Bye" it touched<br>c. A different main category is touched<br>d. A different sub-category is touched<br>e. Participant does nothing | | |
| 6. The instructor removes communication application to signify the end of a trial. | | |

APPENDIX D

PARENT PERMISSION FOR CHILD TO PARTICIPATE

MICHIGAN STATE
UNIVERSITY

May 25th, 2012

Dear Parent or Guardian,

I am conducting a research study to measure the effects of using peers to assist with the training of a communication application called Proloquo2go ™ (http://www.proloquo2go.com) on the communication and social behaviors of children with an autism spectrum disorder (ASD). I hope this will be useful to parents, teachers, and the students by providing information about the effectiveness of Peer Assisted Communication Application Training for individuals with an ASD. At this time, I am looking for students to participate who I previously worked with last spring. Therefore, this letter is to request your consent for your child to be included in the study and for the results to be used as data in my study on the effectiveness of this intervention.

By giving your consent, you grant permission for your child to participate in the study as well as grant permission for your child's teacher to provide information to researchers about the ways your child interacts with others in regards to communicative behavior. Your child will be taught by a peer and myself how to use the program Proloquo2go™ in order to request preferred items with a sentence, answer the question "What do you want", and answer the question "What is your name?" The investigator will teach this procedure over the course of the summer. All data collected during the course of this study will be kept in a locked and secure filing cabinet in Erickson Hall at Michigan State University with access permitted to the researchers and the MSU Institutional Review Board only. The confidentiality of the participants will remain secure both during and after the study. The real names of the participants will never be used in any documentation, and all recorded materials will be stored on a password protected hard drive. For this study I also request your permission to video tape the sessions. You have the option to allow your child to participate in the study without being video taped. All sessions will occur in the child's school, either in the classroom or a separate room. This procedure is being conducted for research purposes and is free of charge and the results of the assessment will be provided to you upon request.

Your child may benefit from participating in this research study by demonstrating an improvement in communicative behavior. This may be helpful in guiding future interventions used by educators that work with your child. During the instructional sessions, your child will have opportunities to communicate with researchers in a fun and

safe manner. Allowing the child to participate will help us evaluate whether this intervention is effective and if it is effective, will provide your students with a means to communicate.

The potential risks include the possibility that engaging in a new activity within a new environment may be distressing for your child. However, this is not an expected outcome, as the procedures are designed to be fun for your child. The only other known risks for your child involve privacy and confidentiality, which will be protected to the greatest extent allowable by law.

The data for this project will be kept confidential unless there is a danger to anyone involved. All data will be collected with paper and pencil or laptop computers. Data will be stored in a locked file cabinet in a locked office or on password protected computers inside protected files. Members of the research team will be the only people to have access to data with identifying information. The results of this study may be published or presented at professional meetings but the identities of all research participants will remain anonymous. You can indicate your consent for participation by signing the letter and returning it to a member of the research team. If, after you sign and return the letter, you change your mind, simply let a member of the research team know and you will not be asked to participate. You can refuse to participate at any time, without prejudice or penalty. There is no penalty for refusing to participate.

If you have concerns or questions about this research study, such as scientific issues, how to do any part of it, or to report an injury, please contact the researcher (Sean Strasberger: (248) 417-2434, or email strasbe2@msu.edu or contact Dr. Summer Ferreri: (517) 432-2013, email sferreri@msu.edu, or regular mail at Counseling, Educational Psychology, and Special Education 340 Erickson Hall Michigan State University East Lansing, MI 48824). If you have any questions or concerns about your role and rights as a research participant, would like to obtain information or offer input, or would like to register a complaint about this study, you may contact, anonymously if you wish, the MSU's Human Research Protection Program at 517-355-2180, Fax 517-432-4503, or e-mail irb@msu.edu or regular mail at 207 Olds Hall, MSU, East Lansing, MI 48824.

Sincerely,

Sean K. Strasberger
Doctoral Student
Counseling, Educational Psychology,
and Special Education
Michigan State University
East Lansing, MI 48824
(248) 417-2434
strasbe2@msu.edu

**PERMISSION FOR CHILD'S PARTICIPATION**

**I consent to the participation of my child in the research project entitled "Effects of the iPod Touch Proloquo2go Application on Communicative and Problem Behaviors of Children with Autism in Applied Contexts." I have read the attached letter and the project has been thoroughly explained to me by Sean Strasberger.**

**I acknowledge that I have had the opportunity to obtain additional information regarding the project and that any questions I have raised have been answered to my full satisfaction. Furthermore, I understand that I am free to withdraw my consent at any time and to discontinue participation in the project without prejudice.**

**Finally, I acknowledge that I have read the consent form. I sign it freely and voluntarily. A copy has been given to me.**

**Child's Name: _____ Age: _____**

**Relationship to child: _____**

**Signed: _____ Date: _____**
**(Parent or guardian)**

☐ **Permission to video tape sessions**

APPENDIX E

TEACHER CONSENT FOR PARTICIPATION

MICHIGAN STATE
UNIVERSITY

May 25th, 2012

Dear School Professional,

I am conducting a research study to measure the effects of using peers to assist with the training of a communication application called Proloquo2go ™ (http://www.proloquo2go.com) on the communication and social behaviors of children with an autism spectrum disorder (ASD). I hope this will be useful to parents, teachers, and the students by providing information about the effectiveness of Peer Assisted Communication Application Training for individuals with an ASD. At this time, I am looking for students to participate who I previously worked with last spring. Therefore, this letter is to request your consent to participate in this research study.

By agreeing to participate, you agree to let me work with the students I worked with last spring for this study. Students who previously experienced any success with our previous training protocol are candidates for this study. Your student will be taught by peers and myself how to use the program Proloquo2go™ in order to request preferred items with a sentence, answer the question "What do you want", and answer the question "What is your name?" The study will take place over the course of the summer. All data collected during the course of this study will be kept in a locked and secure location with access permitted to the researchers and the MSU Institutional Review Board only. The confidentiality of the participants will remain secure both during and after the study. The real names of the participants will never be used in any documentation, and all recorded materials will be stored on a password protected hard drive. For this study I also request your permission to video tape the sessions. You have the option to allow your student to participate in the study without being video taped. All sessions will occur at a local school. This procedure is being conducted for research purposes and is free of charge and the results of the assessment will be provided to you upon request.

Your student may benefit from participating in this research study by demonstrating an improvement in communicative and social behavior. This may be helpful in guiding future interventions used by educators that work with your students. During the instructional sessions, your students will have opportunities to communicate with researchers in a fun and safe manner. Allowing the students to participate will help us evaluate whether this intervention is effective and if it is effective, will provide your students with a means to communicate.

The potential risks include the possibility that engaging in a new activity within a new environment may be distressing for the student. However, this is not an expected outcome, as the procedures are designed to be fun for your students. The only other known risks for your students involve privacy and confidentiality, which will be protected to the greatest extent allowable by law.

The data for this project will be kept confidential unless there is a danger to anyone involved. All data will be collected with paper and pencil or laptop computers. The results of this study may be published or presented at professional meetings but the identities of all research participants will remain anonymous. You can indicate your consent for participation by signing the letter and returning it to a member of the research team. If, after you sign and return the letter, you change your mind, simply let a member of the research team know and you will not be asked to participate. You can refuse to participate at any time, without prejudice or penalty. There is no penalty for refusing to participate.

If you have concerns or questions about this research study, such as scientific issues, how to do any part of it, or to report an injury, please contact the researcher (Sean Strasberger: (248) 417-2434, or email strasbe2@msu.edu or contact Dr. Summer Ferreri: (517) 432-2013, email sferreri@msu.edu, or regular mail at Counseling, Educational Psychology, and Special Education 340 Erickson Hall Michigan State University East Lansing, MI 48824). If you have any questions or concerns about your role and rights as a research participant, would like to obtain information or offer input, or would like to register a complaint about this study, you may contact, anonymously if you wish, the MSU's Human Research Protection Program at 517-355-2180, Fax 517-432-4503, or e-mail irb@msu.edu or regular mail at 207 Olds Hall, MSU, East Lansing, MI 48824.

Sincerely,

Sean K. Strasberger
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Department of Counseling, Educational Psychology and Special Education
Michigan State University
(248) 417-2434
strasbe2@msu.edu

**CONSENT FOR PARTICIPATION**

**I consent to participation in the research project entitled "Effects of the iPod Touch Proloquo2go Application on Communicative and Problem Behaviors of Children with Autism in Applied Contexts." I have read the attached letter and the project was thoroughly explained to me by Sean Strasberger.**

**I acknowledge that I have had the opportunity to obtain additional information regarding the project and that any questions I have raised have been answered to my full satisfaction. Furthermore, I understand that I am free to withdraw my consent at any time and to discontinue participation in the project without prejudice.**

**Finally, I acknowledge that I have read the consent form. I sign it freely and voluntarily. A copy has been given to me.**

**Printed Name: _____**

**Signed: _____ Date: _____**
**(Teacher)**

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