Training Parents of Children with Autism to Implement the Picture Exchange Communication Intervention by Using Bug-in-Ear

by

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ABSTRACT

The Centers for Disease Control and Prevention Autism and Developmental Disabilities Monitoring Network has reported that 1 in 68 children have been diagnosed with autism spectrum disorder (ASD), which is one of the fastest growing disability categories. Social communication disorder is considered one of the main characteristics of individuals with autism, influencing development and social outcomes across the lifespan. Interventions are needed to replace unconventional communicative behavior in children with ASD.

Augmentative and alternative communication (AAC) is a system that has been used with individuals with autism who subsequently have demonstrated effective communication skills. The AAC system consists of unaided interventions that do not require any external equipment beside parts of the body (e.g., sign language, gestures, and manual signs) and aided interventions that require external materials such as pictures and electronic devices. One of the AAC strategies found to be effective for persons with autism is the Picture Exchange Communication System (PECS). PECS is a low-tech system that has been used to develop communication skills in different settings such as home, school, and clinical centers. This study intends to investigate the effects of parents' training and the use of PECS to help their children with ASD develop communication skills while the investigators provide parents with immediate feedback using Bug-in-Ear (BIE) technology.

Specifically, this study sought to find out: (1) Do parents acquire mastery of PECS stages after training? (2) Does the use of BIE for training parents reduce errors during PECS implementation with their children with autism? (3) Do children with

autism acquire communication skills by using PECS with their parents? (4) Do participants with ASD maintain the acquired skills over time? and (5) What is the perception of parents regarding PECS as measured by the *Treatment Acceptability Rating Form-Revised* (TARF-R)?

Two parents and their children with ASD (one child per family) were recruited for this study. A multiple baseline design across participants was used during the parents' training, and a changing criterion design was used for the children with ASD. Parents were trained using BIE to implement PECS with their children with ASD. An interobserver agreement, procedural integrity, and social validity were also assessed during the study.

Results indicated that both parents implemented the PECS process accurately within 90% and above through the use of BIE. Moreover, both children successfully acquired independent picture exchanges along with their parents who implemented PECS training. Also, both children with autism generalized PECS skills to another setting; they also maintained the acquired skills over one month. These findings extend the existing evidence on PECS by training parents as primary implementers of PECS. The study provides practitioners with insight into the feasibility and necessity of parent-implemented PECS training.

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CHAPTER I

INTRODUCTION

According to the Centers for Disease Control and Prevention, autism spectrum disorders (ASD) is a group of developmental disabilities that includes difficulties in different areas such as socialization, communication, and behavior. The autism characteristics appear before the age of three and are accompanied by abnormalities in cognitive skills including functional behaviors, learning, attention, and sensory processing (Centers for Disease Control and Prevention, 2014). The Autism and Developmental Disabilities Monitoring Network has reported that the prevalence of autism is increasing more than previously recognized (Centers for Disease Control and Prevention, 2009). The range is 1 child with autism for every 68 children, and boys five times more likely to have the disorder than girls (Centers for Disease Control and Prevention, 2016). Although the symptoms of autism appear as early as age two, most children with autism are diagnosed after age four (Centers for Disease Control and Prevention, 2016). Koul, Schlosser, and Sancibrian (2001) reported that approximately 50% of children with autism have speech or communication difficulties.

Individuals with autism often have social communication impairments that lead them to display a variety of problem behaviors. These impairments need to be addressed using effective strategies to promote positive communication skills (Lord et al., 2005). Children who have severe communication impairments are more vulnerable to face challenges in their environment with their families (Boonen et al., 2014). These individuals usually engage in prelinguistic behaviors to gain or maintain access to the preferred items. These prelinguistic behaviors involve reaching, pointing, and guiding a

communication partner's hands to the desired object (Sigafoos et al., 2004). Such communication forms are problematic to both children with autism and to the communication partner because some of these communications are difficult for communication partners to understand and interpret (Keen, Sigafoos, & Woodyatt, 2001). Therefore, these paralinguistic behaviors need to be replaced with more socially appropriate and efficient forms using evidence-based practice.

Several interventions exist for students with ASD. The interventions that researchers have shown to be effective in developing positive outcomes through rigorous evaluations are called evidence-based practices (EBP) (Boutot & Myles, 2011). EBP has demonstrated a significant increase in skills acquisition and functional communication skills for children with autism (Boutot & Myles, 2011). For example, discrete trial training is an intervention of teaching in simplified and structured steps instead of teaching an entire skill in one teaching setting (Lovaas, 1987; Smith, 2001). Another EBP strategy, the pivotal response training that teaches the individuals with autism functional social-communicative, language, positive social behaviors, and adaptive behaviors within naturalistic teaching through the use of a play-based and child-initiated format (e.g., Koegel, Koegel, Harrower, & Carter, 1999; McFadden, Kamps, & Heitzman-Powell, 2014).

There are a variety of interventions that are available to support social communication skills for children with autism to enhance their communication at home with family, school, and community (National Research Council, 2001). These interventions target functional and spontaneous communication for long-term effects that are used to develop expressive language, receptive language, and non-verbal

communication skills (National Research Council, 2001). Augmentative and alternative communication (AAC) is a system that has been used successfully to improve communication skills in individuals with autism (Beukelman & Mirenda, 2005). The AAC system consists of unaided interventions that do not require any external equipment besides parts of the body (sign language, gestures, and manual signs) and aided interventions that require external materials such as picture-based methods and electronic devices (Beukelman & Mirenda, 2005).

The Picture Exchange Communication System (PECS) is a communication system that was developed by Bondy and Frost in 1985 to improve communication skills in young children with autism (Frost & Bondy, 2002). Therapists utilized PECS to teach the communication exchange skills that included requesting and commenting by giving the picture card to the communication partner (Bondy & Frost, 1994). The range of PECS treatment effectiveness is estimated from 50 - 90% depending on the type of outcomes measured (Hart & Banda, 2010). Fifty-nine percent of children who had PECS training developed independent speech, and 30% of children developed speech in conjunction with PECS (Charman & Stone, 2006).

Children with autism impact their families, leading their parents to be stressed from the challenges and limiting their ability, to problem solve for the long-term dependency of their children with autism (Boutot & Myles, 2011). Thus, parental involvement is an important factor that reduces their stress with their children with ASD and improves the parents' skills and knowledge (Boutot & Myles, 2011). Parental involvement to implement interventions is widely known to be an effective factor for the

child's development and is considered the best practice for young children with ASD (Benson, Karlof, & Siperstein, 2008).

Statement of the Problem

Individuals with autism confront many diverse issues including social-communication. One of the biggest issues that they face in their life is difficulty with communication skills such as responses, engaging in complete conversations, manding, and gestures.

Children with autism have actual difficulties with communication and language skills involving speech and gestures (Rapin, 1997). Some children with autism have issues with verbal auditory communication, either keeping them from understanding language completely or limiting their understanding of others' speech (Rapin, 1997). However, other children with autism are able to communicate with others on a more basic level, often characterized by poor grammar and scattered speech (Rapin, 1997). In addition, some children with autism develop speech later, quickly escalating from silence to complete thoughts; however, their communication may later become repetitive and non-obvious (Rapin, 1997). Also, children with communication impairment engage in prelinguistic behaviors to gain their desired items such as reaching, pointing, or guiding their caregiver to the desired items (Sigafoos et al., 2004). Other children use behaviors that are not socially acceptable, such as hitting or screaming to access their desired items (Sigafoos et al., 2004). These forms of communication behavior could be problematic for a caregiver who is trying to understand their needs (Sigafoos et al., 2000). Therefore, individuals with autism who have communication impairments need to be taught more socially appropriate communication skills by using appropriate interventions.

Boyd (2002) reported that parents of children with autism face challenges regarding caring for their children. They are more stressed when they have children with low functioning autism. In addition, depression was found as the most negative impact on parents of children with autism because of the long-term dependency on their families (Hastings et al., 2005).

Parents are the most important people in the lives of children with ASD and are fundamental to the social and communication development of their children. By training parents to implement PECS, children may obtain more consistent benefits from PECS without extra costs, and parents may significantly improve the targeted communicative responses of their children in natural contexts (Park, Alber-Morgan, & Cannella-Malone, 2011).

Parents face challenges in dealing with their children's disorder (Boutot & Myles, 2011) and realizing their needs. The challenges are faced because they did not get a chance to be trained in the use of communication interventions that address these difficulties. Parents of children with autism who lack specialized training in proper communication skills may further hinder their child's progress and development, placing them at risk of isolation from their society. Thus, parents' involvement is necessary and considered the best practice for several reasons including parental support and training to use interventions, develop generalization of skills, reduce their own challenges in meeting their children's needs, and foster parental collaborations at home and at schools to ensure the long-term development of necessary skills (Benson et al., 2008).

PECS has been widely used to develop various skills including functional communication skills. The majority of the studies showed positive outcomes for the

target behavior where individuals with autism were able to use PECS independently and have their needs met (e.g., Conklin & Mayer, 2011; Ganz, Simpson, & Corbin-Newsome, 2008; Jurgens, Anderson, & Moore, 2009; Lund & Troha, 2008).

Several studies were conducted with training practitioners to implement PECS with individuals with autism and other developmental disabilities (Barnes, Dunning, & Rehfeldt, 2011; Charlop, Malmberg, & Berquist, 2008; Ganz et al., 2013; Hill, Flores, & Kearley, 2014; Homlitas, Rosales, & Candel, 2014; Howlin, Gordon, Pasco, Wade, & Charman, 2007; Magiati & Howlin, 2003; Wood, Luiselli, & Harchik, 2007). The results of these studies demonstrated that practitioners are able to master the criteria of PECS implementation and implement PECS effectively.

However, few studies were conducted with training parents to implement PECS with their children with autism and other developmental disabilities (Carson, Moosa, Theurer, & Cardy, 2012; Chaabane, Alber-Morgan, & DeBar, 2009; Greenberg, Tomaino, & Charlop, 2012; Park et al., 2011; Stiebel, 1999). These studies were conducted to examine the parents' effect toward their children with disabilities. The finding of studies with parents training provided promising implications and improvisation of communication and generalization skills in their children with autism.

Few studies had been conducted using a Bug-in-Ear (BIE) technology device to provide training to teachers or therapists to implement intervention with students with disabilities and receive immediate feedback from an investigator (e.g., Goodman, Brady, Duffy, Scott, & Pollard, 2008; Ottley & Hanline, 2014). The BIE device can be helpful in providing one way or two-way communication between the coach and trainer during training (Ottley & Hanline, 2014). However, no studies have been conducted focusing on

training parents to implement PECS intervention with their children with autism while using BIE. BIE can provide immediate feedback, thus reducing any errors that could happen when parents implement interventions with their children with autism.

Purpose of the Study

The purpose of this study is to examine the effectiveness of parent training of PECS and its impact on communication skills with their children with autism. Specifically, the study is intended to evaluate parental effectiveness when implementing PECS with their children with autism. In addition, it will evaluate the effect of using BIE to train parents and provide immediate feedback to parents to implement PECS.

Research Questions

1. Do parents acquire mastery of PECS stages after training?
2. Does the use of BIE for training parents reduce errors during PECS implementation with their children with autism?
3. Do children with autism acquire communication skills by using PECS with their parents?
4. Do participants maintain the acquired skills over time?
5. What is the perception of parents regarding PECS as measured by the *Treatment Acceptability Rating Form-Revised* (TARF-R) (Reimers, Wacker, Cooper, & DeRaad, 1992)?

Definition of Terms

Applied Behavior Analysis (ABA): Analysis that involves a variety of techniques to increase appropriate behaviors and bring meaningful and positive changes in behaviors for individuals with problem behaviors (Cooper, Heward, & Heron, 2007).

Augmentative and Alternative Communication (AAC): Communication systems that include strategies and devices used to develop all forms of communication to help individuals with communication impairments express their thoughts, needs, wants, and ideas. Individuals with communication difficulties rely on AAC to supplement existing speech and facilitate independent communication (Beuklman & Mirenda, 2006).

Autism Spectrum Disorder: A developmental disability that impairs the individual's ability to communicate and socially interact with others, and includes displaying restricted repetitive behaviors, interests, and activities that cause significant impairment in social, occupational, and other areas of functioning (APA, 2013).

Communication: Process of exchanging information between two or more people that involves four components: sender of the message, receiver of the message, shared content of communication, and shared intent of the communication (Kuder, 2013).

Echolalia: The literal repetition of sounds uttered by another person, which is non-communicative and lacks the ability to provide appropriate communication (Prizant & Duchan, 1981). Echolalia may occur immediately after another person speaks or could occur after a delay by the repetition of words or phrases heard after one day, a week, or a month (Kuder, 2013). Sometimes the individuals repeat exactly what they heard and often changes the structure of the original phrase from another person (Kuder, 2013).

Evidence-based Practice (EBP): Treatments and approaches that have statistically shown significant effectiveness as interventions for specific problems. After intervention implementation, individuals with disabilities acquired long-term skills for issues that occur in behavior and social communication (National Research Council, 2001). Most evidence-based treatments have been studied in several large-scale clinical trials

involving thousands of patients, including careful comparison of the effects of treatments and approaches (Simpson, 2005).

Functional Communication: The actual use of language to achieve a specific purpose and to make a particular statement. Functional communication influences other behaviors, providing an appropriate and natural social context. Literacy skills can be promoted by functional communication such as reading and writing (Reichle, 1997; Calculator & Jorgensen, 1991).

Mand: A demand that is a type of verbal operant behavior that involves requesting or asking for something with or without the presence of the item. Mand is under functional control motivated for a specific behavior by receiving the item as a consequence of the request (Cooper et al., 2007).

Nonverbal Communication: The use of body language such as gestures or using pictures to communicate needs and interests to transfer and exchange messages to others (Matsumoto, Frank, & Hwang, 2013).

Picture Exchange Communication System (PECS): A pictorial system that uses picture cards for individuals with communication impairments, allowing them to initiate communication functions such as requesting, rejecting, and commenting by giving picture cards to the communication partner (Bondy, Tincani, & Frost, 2004).

Social Communication: An interaction with a variety of communication partners including expressive and receptive language such as eye contact, facial expressions, and body language that are influenced by sociocultural and individual factors (Curenton & Justice, 2004; Inglebret, Jones, & Pavel, 2008). Social communication can be observed and measured in the natural environment that includes many factors (e.g., attention,

interest, comfort level) with different people (e.g., parents, teachers, siblings) (Charman & Stone, 2006).

Visual Strategies: A visual approach that is used to enhance the communication process. Visual strategies consist of different forms including body language such as (e.g., facial expression, eye contact) by interpreting the body language to communication means. Also, special design tools are used to meet specific needs and help others understand their requests such as PECS (Linda, 2011).

CHAPTER II

REVIEW OF THE LITERATURE

This chapter provides relevant literature on the topic of autism in general including the concept of autism core characteristics, the severity levels for autism, and then a description of a specific difficulty that is related to communication skills, and the status of current research on aided AAC interventions, especially with PECS intervention. The first part of this chapter discusses autism concepts and prevalence. Also, this part discusses the core impairment of autism specifically on communication difficulties including (a) severity levels of communication, (b) echolalia, (c) functional communication, and (d) strategies that have been used to develop communication skills for individuals with autism. The second part of this chapter covers information on augmentative and alternative communication; (a) Aided and Unaided Communication Devices, and (b) AAC and functional communication skills. The third part of this chapter involves information regarding the (PECS): (a) the concepts and protocol of PECS, (b) PECS's effect on functional communication skills, (c) training parents to implement PECS, and (d) training practitioners to implement PECS. Then, the training using BIE is discussed. Finally, the purpose of this study is discussed, and specific research questions are provided.

Autism

Autism is a complex neurodevelopmental disability characterized by impairment in social interaction, impairment in social communication, and overt dependence on routines, stereotyped behavior, and sensitivity to activities or interests (American Psychiatric Association, 2013). The CDC's Autism and Developmental Disabilities

Monitoring Network (2014) reported that 1 in 68 children have been diagnosed with ASD. The CDC data (2014) further showed that ASD is five times more common among boys than girls: 1 in 42 boys versus 1 in 189 girls. Autism usually appears in infancy or childhood and is generally evident before age three (American Psychiatric Association, 2013; Hyman, 2000; Kuder, 2008). Autism is characterized as the fastest growing developmental disability directly influencing the behaviors of children and that indirectly is impacting parents and caregivers in terms of coping and adaption (Samadi, McConkey, & Kelly, 2013).

ASD influences social communication and behaviors, and it limits the development of language, motor, and cognitive skills (American Psychiatric Association, 2013; Boutot & Myles, 2011). This disability affects several aspects of a child's behavior including deficits in social interactions such that young children with ASD have a lack of meaningful interaction with parents or caregivers (Folstein, 1999, Shire et al., 2015; Wetherby, Watt, Morgan, & Shumway, 2007). Also, children with ASD are not interested in playing with other children and do not follow the typical manner of play development (Boutot & Myles, 2011; Wolfberg, 2004). Individuals with ASD have limited skills with joint attention, in that they may not be able to follow the point or gaze of another person (Munday, Fox, & Card, 2003). Additionally, they have a restricted range of facial expressions and may experience difficulty describing their internal emotional states, which may lead them to engage in problem behaviors (Losh & Capps, 2006). Individuals with autism also may engage in self-stimulatory behavior like unusual or repetitive body movements such as hand flapping, spinning, or tapping (American Psychiatric Association, 2013; Bodfish, Symons, Parker, & Lewis, 2000; Boutot & Myles, 2011).

According to the DSM-5 (2013), there are three severity levels for ASD. The severity levels are characterized by the degree of support a child requires. Level 3 requires very substantial support, level 2 requires substantial support, and level 1 requires minimal support. Individuals with autism who require very substantial support have severe difficulties in verbal and nonverbal social communication skills, which lead them to have severe impairments in functional skills, very limited social interactions, and extreme difficulty with change. The individuals with autism who require substantial support have a noticeable impairment in verbal and nonverbal social communication skills and abnormal responses to social interaction, inflexibility of behavior, difficulty with change, and their self-stimulatory behavior that is obvious to the casual observer. Individuals with autism who require supports have noticeable impairments causing difficulty with social interactions, trouble switching between activities, and issues with independence (DSM-5, 2013).

Communication

Social-communication disorder is considered the main feature of individuals with autism influencing development and social outcomes across the individual's lifespan (Ingersoll et al. 2001; Kamps et al., 2015). Many children with autism do not develop spoken language. An estimated 25-30% of children with autism are nonverbal or have limited verbal skills (Tager-Flusberg & Kasari, 2013; Walenski, Tager-Flusberg, & Ullman, 2007). Communication difficulties include trouble initiating interactions, maintaining reciprocity, expressing and receiving social conversation, and responding to others to engage in successful interactions (Kamps et al., 2015; Kuder, 2013).

The severity of communication disabilities varies across individuals with ASD, ranging from mild to severe (Olgetree & Oren, 2006). Some children with ASD may have limited spoken language or display minimal verbal skills (Anderson, Moore, & Bourne, 2007; Tager-Flusberg & Kasari, 2013), and their vocalizations include non-speech sounds (Tager-Flusberg & Kasari, 2013). On the other hand, some children have the ability to communicate, but they acquire language slowly during the preschool years (Anderson et al., 2007; Rapin, 1997). Other children with ASD have the ability to interact with others on a limited level, and that interaction is often characterized by poor grammar and scattered speech (Crissey, 2011; Rapin, 1997; Tager-Flusberg & Kasari, 2013). It is estimated that, by the time they enter primary school, about two-thirds to three-fourths of all children will know some words, and at least half of them will be able to use phrases in speech (Tager-Flusberg & Kasari, 2013; Turner, Stone, Pozdol, & Coonrod, 2006).

Echolalia

Some individuals with autism speak in an idiosyncratic manner using repetition, which is called echolalia (Hall, 2009). Echolalia is defined as repetition of phrases heard previously (Hall, 2009). Echolalia is considered an impairment in communication and is a form of self-stimulatory behavior in children with ASD (Cunningham & Schriebman, 2008). During early language development, echolalia appears in children with autism (Bodfish et al., 2000). There are different types of echolalia: immediate, delayed, and mitigated (Kuder, 2008). Immediate echolalia occurs immediately after another person speaks, and the individual with ASD repeats the phrase heard previously (Kuder, 2008). Delayed echolalia is a repetition of the phrase or word that may have been heard days or weeks, or may be years previously (Kuder, 2008). However, mitigated echolalia is an

exact repetition of what is heard, but children with ASD who engage in echolalia cannot change the structure of the phrase, or they may just repeat the last word of the phrase (Kuder, 2008).

Intervention Strategies

There are a variety of intervention techniques that have been used with individuals with ASD and other developmental disabilities to enhance social communication skills. These techniques include discrete trial instruction (Lovaas, 1987; Smith, 2001),;verbal behavior that includes echoes, mands, tacts, function, and intraverbals (Sundberg & Michael, 2001); pivotal response training (e.g., Koegel et al., 1999; McFadden et al., 2014); social communication emotional regulation transactional support (SCERTS) (Prizant, Wetherby, Rubin, & Laurent, 2003); social stories (Gray & Garand, 1993; Gray, 2000); video modeling and self-modeling (e.g., Wert & Neisworth, 2003); social problem solving (Elias, Butler, Bruno, Papke, & Shapiro, 2005); peer-mediated instruction (e.g., Trottier, Kamp, & Mirenda, 2011); and direct instruction (Fallon, Light, McNaughton, Drager, & Hammer, 2004; Ganz & Flores, 2009). One strategy that has been gained wide acceptance to improve communication skills is augmentative and alternative communication (AAC).

Augmentative and Alternative Communication

AAC is a profession, science, technology, and a set of various devices, that include all forms of communication (other than oral speech) that are used to enable individuals with severe disabilities to express thoughts, needs, wants, and ideas by utilizing clear communication and engaging in community activities at home and in school (Johnston, Reichle, Feeley, & Jones, 2012). According to the American Speech-

Language-Hearing Association (ASHA, 2005), the AAC system typically consists of four main components: symbols, aids, strategies, and techniques. Symbols refer to the model of communication such as using sign or spoken language appropriate to the type of disability (ASHA, 2005; Kuder, 2013), for instance, individuals with motor disorders who have adequate literacy skills would benefit from utilizing letters and words as a model for communication. On the other hand, individuals with severe motor skills, who do not have such skills in literacy, using pictures and photographs may have the advantage of developing communication. Symbols can be concrete, abstract, or language-centered (Heller & Bigge, 2010). The concrete symbols could be objects, pictures, or gestures to present something. However, the abstract symbols refer to speech, manual signs, or are arbitrary. The language symbol is considered the final level of communication that includes the use of grammatical rules. Aids refer to the use of a device that individuals may use beyond their bodies to assist their communication with other people (ASHA, 2005). Strategies refers to the way in which a symbol is more efficient and effective in expressing the message transmission system (ASHA, 2005). And finally, techniques describe the way of transmitting the message, which includes two basic kinds of AAC techniques, aided and unaided (Kuder, 2013).

Types of AAC

Unaided and Aided Communication Devices

An unaided communication system is the teaching of communication skills without external support devices. Unaided AAC involves techniques such as gestures, body language, facial expressions, sign language, and speech to assist individuals with communication difficulties in expressing their communication needs. In this system, there

are no concerns regarding electricity or the use of technology. When using unaided communication, individuals must have the ability to demonstrate different types of movement to provide an understandable message to others (Heller & Bigge, 2010).

Aided forms of augmentative communication require the use of devices or items beyond the body to help individuals develop a readable message for another person. In aided communication systems, therapists can select one of three options according to the needs of the individual with communication difficulties. The types of aided communication are a no-tech communication system, a low-tech communication system, and a high-tech communication system (Johnston et al., 2012). The no-tech communication system involves aided items that do not include technology such as photographs, written words, pencil and paper, and using a communication board (Johnston et al., 2012). The low-tech communication system utilizes a simple electronic component such as a simple battery-operated device that is controlled by a switch and not a computerized system to develop communication skills for individuals with communication difficulties. However, the high-tech communication system includes a computerized program and the software of a dedicated AAC device designed with features essential to develop communication.

AAC and Functional Communication Skills

There are a good number of studies that have been conducted to examine the use and implementation of AAC with individuals with autism. These studies have been particularly conducted in learning about the experience and significant benefits when language is augmented, especially through visual modality (Mirenda, 2001). A number of studies have been conducted using aided AAC interventions with children with

communication disorders in order to increase communication and language skills. Investigators in all of the studies reported that the communication and language skills of children with autism had been developed through the use of AAC (i.e., Binger, Kent-Walsh, Ewing, & Taylor, 2010; Binger & Light, 2007; Harris, Doyle, & Haaf, 1996; Kent-Walsh, Binger, & Malani, 2010).

There are currently two systematic reviews that have been conducted on AAC interventions to develop speech communication skills for individuals with communication difficulties. Millar, Light, and Schlosser (2006) conducted a review on both aided and unaided AAC interventions that targeted the speech production of individuals with developmental disabilities. The review identified 23 studies that included 67 individuals with developmental disabilities. The results did not show any decrease in speech production with individuals when using AAC intervention, while 11% did not demonstrate changes in their speech skills, and 89% of the participants demonstrated an increase in their speech skills. The results of this review suggest that individuals with developmental disabilities may gain speech skills by using AAC contrary to the traditional beliefs. The other review, by Schlosser and Wendt (2008), was conducted to determine the effects of AAC interventions on speech development in children with autism or pervasive developmental disorder. This review included 11 studies. Nine of the 11 studies were of a single-subject experimental design, and two were group design studies. The 11 studies reviewed involved 98 participants. The results of the reviewed studies indicated that ACC can increase speech production in children with communication difficulties.

In addition, AAC has been found to be an effective intervention for a range of different communication skills such as inverted yes/no, request, and acquisition. For example, Kent-Walsh, Binger, and Buchanan (2015), conducted a study to investigate the effects of aided modeling to ask inverted yes/no questions using AAC, the speech-generating device (SGD) system. This study was conducted with three children between 4-6 years old. All the participants had previous experience using AAC. The study yielded positive results for all participants. The children's skills improved from non-providing sentences with a high level of accuracy into rule-governed sentences using aided AAC.

While there is extensive support in the literature for AAC, Achmadi et al. (2014) compared three types of AAC intervention (manual sign, picture exchange, and speech-generating device) to examine how quickly the participants made requests for toy play. This study was conducted with a sample of four boys between 4-5 years-old with developmental disabilities who had limited expressive communication skills. The findings indicated that participants can be trained to use different types of the AAC systems to develop functional communication skills. Three of the four participants reached the criteria for all AAC types, and they learned acquisition skills using picture exchange faster than the other types of AAC. However, in the preference assessment during follow-up sessions, when children were asked to select the preferred type of AAC, they selected SGD.

Similarly, Son, Sigafoos, O'Reilly, and Lancioni (2006) conducted a study in which they compared two types of AAC intervention (PECS and SGD) to develop acquisition skills with three children with autism. Two girls and one boy who were between 3-5 years-old were included in this study. Two of the participants were diagnosed with

autism and one was diagnosed with Pervasive Developmental Disorder. In this study, children were taught two types of AAC to request their wants and to measure their acquisition and preferred strategy of AAC. The results demonstrated that the children were able to develop requesting skills using both types of AAC. However, there was no obvious preference for a specific AAC intervention. Another strategy that has been widely used to develop communication skills in individuals with autism and other developmental disabilities is known as the picture exchange communication system.

Picture Exchange Communication System

The picture exchange communication system (PECS) is a training system that was developed to teach functional communication skills to individuals with autism (Bondy & Frost, 1994). The PECS intervention is a behavioral analytic communication intervention that uses prompts and reinforcing strategies to teach children who have limited language skills or are non-verbal to exchange a picture card of preferred items or activities to develop independent communication skills (Bondy & Frost, 1994; Kravits, Kamps, Kemmerer, & Potucek, 2002). The PECS is considered an aided AAC technique that may facilitate the daily functional needs for children with ASD (Bondy et al., 2004). There are no prerequisite skills that are required such as imitation or attentional abilities or any additional language system for communication with using PECS, and it requires motor movements to exchange pictures (Charlop-Christy, Carpenter, Le, Leblanc, & Kellet, 2002).

PECS has been widely used to improve various deficiencies of communication and functional skills. The majority of studies conducted on the efficacy of PECS have demonstrated that the intervention has positive outcomes on speech development (e.g.,

Ganz et al., 2008; Ganz & Simpson, 2004); social communication skills (e.g., Lerna, Esposito, Conson, Russo, & Massagli, 2012; Lerna, Esposito, Conson, & Massagli, 2014); requests (e.g., Lund & Troha, 2008); mands (i.e., requesting); speech (Tincani, Crozier, & Alazett, 2006); functional communication (Gordon et al., 2011); independent initiations including attempting to communicate with others without prompting (Conklin & Mayer, 2011); and verbal behavior, play, and social functioning (Jurgens et al., 2009). However, a majority of studies indicate that PECS has been primarily implemented by researchers (e.g., Carré, Le Grice, Blampied, & Walker, 2009; Charlop-Christy et al., 2002; Conklin & Mayer, 2011; Ganz & Simpson, 2004; Ganz et al., 2008; Gordon et al., 2011; Jurgens et al., 2009; Lerna et al., 2014; Lerna et al., 2012). Thus, more research is warranted to test if PECS could be implemented by practitioners and/or parents. PECS include many components and stages.

PECS Protocol

The PECS training protocol is divided into six phases. However, in prior implementation of PECS phases, a reinforcer assessment is needed for identifying the most preferred items for the child to enhance communication skills. This assessment can be done informally by asking the caregivers to fill out a form of preference assessment (Fisher et al., 1992). The indicated preferred items help increase child motivation as well as promote acquisition of effective communication skills. Although the PECS protocol involves six phases, each phase develops different functional communication skills, and each phase builds on the previous phase.

Phase I of the PECS teaches individuals with communication difficulties how to communicate and how to request items, which is a fundamental skill of expressive

language. In this phase, a highly preferred item with one picture card of the preferred item is used, and the child should learn how to pick up the picture of the preferred item, reaching towards the communication partner, and releasing the picture to the communication partner. The communication partner should entice the child towards the preferred item. When the child reaches for the item without picking up the picture, the physical prompter should physically guide the child to pick up, reach, and release the highly preferred item. The communication partner immediately gives the child a reward along with an appropriate comment, such as "Oh, you want M&Ms!" when he/she receives the picture. Through multiple practices, this procedure teaches the child to initiate a communication independently (Bondy & Frost, 2001).

Phase II of the PECS teaches children how to seek requests, a process called Distance and Persistence. In this phase, the child independently requests an item from an increased distance from the communication book and partner. The child needs to move to his communication book, pick up the picture, reach out to the communication partner, and exchange it for the preferred item. The prompter is still available in this phase to provide assistance if needed. The child is encouraged to use a greater distance to achieve a generalization of the skill that he/she learned. Also, in this phase the child is still using one picture card (Bondy & Frost, 2001). In addition to seeking requests in this phase, the child learns the importance of eye contact with the communication partner (Bondy & Frost, 2008).

Phase III of the PECS is intended to establish picture discrimination between two pictures on a board. In this phase, the child is required to discriminate between two items on a board and choose what item he wants or what activities he wants to try. The child

needs to select the appropriate picture of a preferred item from the communication book and then move to the communication partner to exchange the picture of the preferred item. When the child has mastered the criteria and learned to discriminate between two pictures, a third picture and item can be added. This procedure is repeated as appropriate. In this phase, the child should learn one-to-one coordination between the picture symbols and the items (Bondy & Frost, 2001). Phase III is divided into two Phases: IIIA and IIIB.

In Phase IIIA, the learner should discriminate between a highly preferred item and a non-preferred item that the preferred item is the correct response. In this phase, the trainer provides the two pictures at one time on the board of the communication book and entices the learner with both items. Then, the learner selects picture and carries it to the communication partner to exchange the picture for the preferred item. The communication partner should immediately hand the item to the learner and label it. In this phase, no verbal prompt is provided to the learner. Then, the number of pictures should be increased gradually. In Phase IIIB, the process is the same of Phase IIIA, but the number of pictures is increased so that the learner must be able to discriminate between numerous options. The pictures should include both highly and less preferred items.

An error correction procedure should be implemented when the learner gives the wrong picture. The error correction procedure is used for Phase IIIA and IIIB if needed. The error correction procedure involves four steps including modeling, prompting, switching, and repeating. When the learner gives the wrong picture, the communication partner responds “Ok, take it.” When the learner reaches for the preferred item, the communication partner blocks access and uses the error correction procedure. First, the

communication partner picks up the correct picture, shows it to the learner, and labels it. Second, the learner is prompted to give the correct picture using physical prompts if needed. Third, when the learner gives the correct picture, the communication partner labels the object and provides the item to the learner. Then, the communication partner uses a non-relative direction (e.g., “touch your head.”). Fourth, the communication partner entices the learner by interacting with the objects and waits for the learner to give a picture. If the learner gives the correct picture, the communication partner immediately provides the object. However, if the learner does not hand the correct picture, the communication partner repeats the error correction procedure.

Phase IV focuses on sentence structure in the form of the “I want” sentence. This phase teaches the child to develop a complete sentence to ask for what he/she wants. The child uses a sentence strip with an “I want” symbol and a picture of the desired item to learn the chaining format to create a sentence (e.g., “I want water.”). In this phase, the child is asked to create a multi-word phrase by going to the communication book, picking up the “I want” symbol and putting it in the sentence strip, and then picking up the picture of the desired item and putting it in the sentence strip, and then removing the sentence strip from the communication book and moving to the communication partner to give the sentence strip to him or her in order to receive the desired item (Bondy & Frost, 2001).

Phase V teaches responding to "'What do you want?" The child in this phase learns to respond to the question "What do you want?" by exchanging the sentence strip. The purpose of this phase is to motivate the child to request items as prompted by words spoken by someone else. The child learns to respond to a simple question. This phase

starts to shape the child's receptive language and provides continuing practice for requesting skills by providing a complete sentence (Bondy & Frost, 2001).

Phase VI is the teaching of the use of additional sentence starters. This is the final phase during which the child learns to introduce new sentences to display communication through the use of pictures for "I see," "I hear," and "I smell." In this phase, the child begins to develop cognitive skills by introducing commenting behaviors, while the previous phases focused on requesting behaviors (Bondy & Frost, 2001).

Effects of PECS on Functional Communication Skills

Several literature reviews were conducted to examine the PECS effects on communication skills of individuals with autism and other developmental disabilities (Flippin, Reszka, & Watson, 2010; Hart & Banda, 2010; Ostryn, Wolfe, & Rusch, 2008; Preston & Carter, 2009; Tincani & Devis, 2011). These reviews were conducted to examine the effectiveness of PECS on functional communication skills including speech, joint attention, generalization, and the spontaneous use of PECS cards. The results of these reviews demonstrated that PECS is an effective intervention to develop functional communication for individuals with ASD and other developmental disabilities. Also, the results indicated that PECS is an appropriate and effective intervention among different ages, ethnicities, and communication levels.

Studies were conducted with using PECS with individuals with autism and other developmental disabilities to develop different functional communication skills. For example, Charlop-Christy et al. (2002) conducted a study to evaluate the effects of PECS on different essential skills that children should possess. These skills include acquisition, speech, social communication, and reducing problem behaviors. PECS training was

implemented and assessed with three boys with autism in several settings. The settings included a therapy room, an empty classroom, their home, and their school to promote generalization skills in everyday life. The results demonstrated that all three children with autism mastered PECS phases within a short period of time. Also, the communication skills of the children increased in different areas, and they developed speech with the use of pictures for communication.

Three studies examined the effects of PECS in helping individuals with autism to develop requesting and communication skills (Ganz & Simpson, 2004; McDonald, Battaglia, & Keane, 2015; Paden, Kodak, Fisher, Gawley-Bullington, & Bouxsein, 2012). McDonald et al. (2015) implemented Phase IV of PECS using a fixed interval-based prompting (FIBP) procedure as a modification to the PECS protocol with a child with autism to increase his requesting skills. The FIBP was used to increase the likelihood of improving the participant's initial requesting skills with spontaneous access to a PECS book. After six months of follow up, the child mastered the criteria and was able to spontaneously request his needs and wants.

In another study conducted by Ganz and Simpson (2004), PECS was used to increase the proficiency of functional communication and increase the number of words used to make verbal requests and decrease the non-word vocalizations. This study was conducted with three children with autism. The participants were taught Phases I–IV of PECS (i.e., picture exchange, increased distance, picture discrimination, and sentence construction). The results showed increases in the number of spoken word requests, the complexity of grammar, and how rapidly the participants mastered the criteria. In addition, Paden et al. (2012) implemented PECS with two children with autism to

evaluate the differential reinforcement of alternative behavior (DRA) plus prompting to increase peer-directed mands for preferred items. The therapist in this study utilized a least-to-most prompting procedure in which the therapist gave the participants highly preferred items for 5 seconds to initiate responses. If no response happened, the therapist prompted the students by guiding them to complete the peer-directed mand. The results indicated that nonverbal children can be taught to exhibit peer-directed mands using PECS. Both participants engaged in peer-directed mands and responses to mands from the therapist.

On the other hand, Ganz, Parker, and Benson (2009) examined the collateral effects of PECS on communication and maladaptive behavior. This study was implemented with three boys with autism. The participants rapidly learned to use the PECS to request preferred items and generalize across people. However, the results did not show a clear effect of PECS on maladaptive behaviors with the children with autism.

Overall, the results of the studies presented in this review and many other studies available in the literature have documented that children with autism rapidly acquire the use of PECS and develop functional communication skills (Ganz, Simpson, 2004; Magiati & Howlin, 2003; Tincani, 2004; Yoder & Stone, 2006).

In some studies, investigators provided PECS training to practitioners or parents to assist them to implement PECS with their children with autism and other developmental disabilities. However, few studies were found with training parents to implement PECS with their children with autism. Furthermore, only one review was conducted to evaluate the mastery of PECS training by parents and practitioners and their

effects of developing communication skills of children with ASD (Alsayedhassan, Banda, & Griffin-Shirley, 2016).

Training Practitioners to Implement PECS

Several studies exist that examine the effect of training practitioners to implement PECS with individuals with autism (Barnes et al., 2011; Charlop et al., 2008; Ganz et al., 2013; Hill et al., 2014; Homlitas et al., 2014; Howlin et al., 2007; Magiati & Howlin, 2003; Wood et al., 2007). For example, Barnes and colleagues (2011) provided training for direct-care teachers to evaluate the effects of verbal instructions and instructional video in PECS through Phases I to III to develop acquisition skills. A pretest was conducted in which the participants were given a PECS manual to read and prepare one week before measuring their baseline knowledge. During training, investigators also provided participants with handouts that included a description of PEC phases. The teachers also watched portions of Frost and Bondy's introductory video (Bondy, Frost, & Becker-Cottrill, 1998). After the training sessions, posttest sessions were conducted identical to the pretest sessions. The results showed that the participants' performance increased from the pre-test to post-test but that they did not master the criteria of the study. Similarly, researchers in two studies trained teachers to implement PECS using a behavioral skills training package (BST) (Miltenberger et al., 2004) that combines verbal instruction, modeling, rehearsal, and feedback (Homlitas et al., 2014; Wood et al., 2007). Both of these studies implemented single-subject multiple-baseline design across participants. Homlitas et al. (2014) conducted a study in which they trained three teachers to evaluate the effectiveness of using PECS in the classroom. During the baseline phase, the participants were asked to implement PECS using one five-trial block with no

feedback provided from the investigators. However, during training sessions, the trainers provided verbal instruction and then modeled the PECS procedure or the teachers in one five-trial block. Then, the teachers practiced Phase I of PECS, and the experimenters provided feedback. The same training process was implemented for Phases II and IIIA. Wood et al. (2007) used a similar procedure for PECS training with teachers. Four teachers participated in this study as well as one male with autism who received the training from the trained teachers. Teachers received training in Phase I of PECS using only the 13-step instructional sequence. However, the 13-step instructional sequence was not described clearly. All of the teachers then implemented PECS at different times with an adult with autism to help investigators observe their performance of PECS. The results of both studies demonstrated that teachers mastered the criteria of PECS implementation. On the other hand, neither study provided results for children with autism on the use of PECS.

Hill et al. (2014) conducted a study with pre-service teachers by reviewing the PECS procedure and modeling. The purpose of this study was to investigate the effect of instruction and monitoring teachers' use of PECS in classroom settings with students with communicational disabilities. Three pre-service teachers received the training to implement PECS with four students with developmental disabilities. The teachers' training was conducted using three teaching strategies across six 3-hour sessions in which the investigators reviewed the PECS process with the teachers, and researchers modeled the PECS procedure with a graduate student and provided corrections as needed to ensure treatment fidelity. Then, teachers implemented PECS with the students with developmental disabilities. The teachers implemented PECS effectively, and the students

demonstrated increased communication skills using PECS. However, this study did not provide visual analysis of results and the percentage of procedural integrity for the teachers' performance.

Two studies were conducted to examine the effects of training on practitioners' implementation of PECS after attending two-day training sessions (Howlin et al., 2007; Magiati & Howlin, 2003). The purpose of these two studies was to evaluate the effect of expert training for teachers of children with autism. In the Howlin et al. (2007) study, the investigators included all staff working in classes (14 teachers, 22 teaching assistants, 10 care staff, and 1speech language therapists) who attended a two-day PECS workshop and received consultation from experts. Also, 34 students with developmental disabilities who had no or minimal spoken language participated in the study. After the staff members attended the PECS workshop, the consultants visited each class after one week, one month, and five months. They then provided recommendations and demonstrated strategies for the teachers to help them implement PECS effectively in their classrooms. The teachers received written summaries of a PECS plan to use PECS with children in different sessions. The children's results showed an increase in language, initiations, and PECS usage (Howlin et al., 2007). On the other hand, Magiati and Howlin (2003), conducted a study with three different groups: immediate treatment, delayed treatment, and no treatment. The participants were 47 staff members who attended a two-day PECS workshop after which trainers made consultation visits. Children in this study demonstrated an increase in the use of PECS from Phase I to IV (Magiati & Howlin, 2003). However, neither study provided results for the implementers' performance of PECS, but rather only focused on the children's results.

Researchers examined the effects of training therapists in PECS. Ganz et al. (2013) provided PECS training to three therapists to implement a PECS intervention. A combination of training strategies was used to provide an effective training (explaining the purpose of the study, verbal instruction, rehearsing, feedback). A multiple-baseline design across participants was used in this study. There were multiple steps utilized to conduct training during each 30-45-minute training session. The therapists were required to practice the PECS process with the researchers. Then, the therapists were asked to set their own goals for the number of PECS opportunities and were taught to collect the data for their clients. The investigators taught the therapists how to graph data and review their PECS data weekly. The therapists were then supported to prepare at least five pictures for the target instruction. The therapists achieved 100% procedural integrity. The clients' use of PECS increased from the baseline sessions, but they did not master the criteria (Ganz et al., 2013).

Training Parents to Implement PECS

Parent training is a necessary practice using interventions with young children with autism (National research Council, 2001; Rogers, 2006). Several studies have been conducted using different interventions for training parents, and the results demonstrated that parents are able to learn interventions at a high level of fidelity and are able to implement these interventions at home (Rogers, 2006; Siller & Sigman, 2002). Also, parents can effectively improve and facilitate their child's language and communication skills using naturalistic reinforces and model the correct way of using interventions (Howlin & Rutter, 1989).

Five studies were found that involved parent training and implementation of PECS with their children with ASD (Carson et al., 2012; Chaabane et al., 2009; Greenberg et al., 2012; Park et al., 2011; Stiebel, 1999). In Carson et al. (2012), the investigators provided PECS training to parents of children with autism to measure changes in speech sound responses from children with autism by examining them with a pre- and post-intervention. This study was conducted with three boys with autism who were between 2 and 3 years old and with their parents. The therapists conducted a pre-intervention assessment before the training sessions for children with autism to provide a baseline for the children's speech skills. The parents finished five types of assessments: (a) the Preschool-Language Scale- Fourth Edition (PLS-4) (Zimmerman, Steiner & Pond, 2002) to measure receptive and expressive language, (b) the Vineland Adaptive Behavioral Scale- Second Edition (VABS-2) (Sparrow, Cicchetti & Balla, 2005) to measure the children's level of overall adaptive functioning, (c) the Psychoeducational Profile-Third Edition (PEP-3) (Schopler, Reichler, Bashford, Lansing, & Marcus, 1990) to measure the imitation skills, (d) the Early Echoic Skills Assessment (EESA) (Esch, 2008) to measure the correctly repeating words, and (e) the Communication and Symbolic Behavioral Scale- Developmental Profile (CSBS DP) (Wetherby & Prizant, 2002) to measure symbolic representation skills. After the assessments, the mothers of children with ASD received the PECS training in a clinical setting first, and then they conducted the training sessions in to their homes. Parents received the PECS training with investigators providing modeling and verbal feedback. The length of each session in the clinic was 30-40 minutes. The investigators then provided training in home settings to ensure the generalization of PECS skills. During the home visits, the therapists observed

the mothers when they implemented PECS with their children, provided feedback, and answered parents' questions regarding PECS implementations (Carson et al., 2012). The results indicated that children with autism did not produce vocal sounds during baseline. However, during post-intervention, the use of vocal sounds had been increased to make requests. Investigators found that children with stronger imitation skills are more likely to develop speech after using PECS. However, this study did not provide results for parents' implementation of PECS (Carson, et al., 2012).

Another study conducted by Park et al. (2011) did however, examine the effects of PECS on parents. In this study, the investigators trained mothers of children with autism to examine their effects on independent communication. This study was conducted with three children between 2-3 years-old with autism and their mothers. Each mother received training in PECS at their homes without their children with ASD. A combination of training strategies was used to provide effective training to the mothers. The mothers were then given written guidelines that included an explanation for each step of the PECS phases. Then, the mothers watched video clips that consisted of a modeling of the PECS phases, and researchers answered the mothers' questions. Immediately, the mothers practiced with the experimenter implementing PECS until they reached the criterion of 90% accuracy across three trials sequentially. The mothers then implemented all PECS sessions with their children in their homes. A changing-criteria design was implemented with the children. The results demonstrated that children were able to use PECS independently, and they generalized their communication skills with other communication partners. Only two children in this study demonstrated vocalization skills at the end of the study. Parents achieved near to 100% of the criteria. However, this

study did not provide visual analysis results of the percentages on parents' implementation of PECS with their children (Park et al., 2011).

Another study was conducted by Stiebel (1999) to examine if the AAC problem-solving intervention for a family's life style would increase the use of PECS and develop the spontaneous use of picture cards during the daily routine. In this study, parents were trained through discussion and feedback to teach their children to spontaneously use PECS cards. Parents received training in Phase I and II. Two of these phases were divided into six steps to achieve problem solving for daily routines. Researchers used a multiple-baseline design across participants for this study. The training section involved multiple steps that included each parent: (a) selecting one home routine when his/her child did not use the picture cards, (b) identifying possible reasons why the child did not use the cards, (c) providing possible solutions that would increase the number of opportunities to use the cards, (d) discussing the strengths and weaknesses of these solutions, (e) selecting the preferable solution, and (f) describing how and when the solutions were to be used. Then, trainers asked parents some questions before the follow-up sessions (e.g., "What are your family's goals for the routine?" "Do the solutions work with your goals?"). Results indicated that the children with autism were able to use the picture cards during their daily routine, and that the parents could increase opportunities to spontaneously communicate (Stiebel, 1999).

One study examined the effects of PECS on children with autism when parents implemented generalization sessions (Greenberg et al., 2012). This study focused more on assessing generalization skills of using PECS. In this study, investigators utilized PECS in different settings from Phases I to IV using a multiple baseline design across

participants. Four parents had the opportunity to implement PECS with their children during the generalization sessions at their homes. The therapists were the primary implementers of PECS for the children in the behavioral treatment center. The therapists then implemented PECS in the home. Then parents implemented PECS with their children for two sessions in their homes with each session involving 10 trials. Also, generalization sessions were conducted in different settings; in a store and in their homes. The results showed that the children achieved successful generalization skills using PECS in different settings with different people (therapists and parents). However, there were no results that indicated the parents' implementation of PECS during intervention sessions and their effects for their children with autism (Greenberg et al., 2012).

Another study provided training to parents using a multiple-baseline design across symbol categories (i.e., colors, shapes, and functions) (Chaabane et al., 2009). Two children with autism and their mothers participated in this study. The investigators utilized the BST package that included a combination of training methods (e.g., written instructions, verbal explanation, modeling, practice, and feedback) for parents to ensure effective training. The parents implemented all sessions during baseline, PECS training, follow-up, and generalization using improvisation training. However, the training procedures and results were not clearly described. The results indicated that parents were able to train their children with about 90% accuracy of implementation. In addition, a clear functional relation between children with autism and their parents was found in this study when parents implemented PECS. The children with autism showed an improvement of mands across symbol categories, and they achieved generalization skills for untrained preferred items (Chaabane et al., 2009).

The findings of the previous studies (Carson et al., 2012; Chaabane et al., 2009; Greenberg et al., 2012; Park et al., 2011; Stiebel, 1999) provide promising implications for parents who work with their children with autism. There is a functional relationship between parent-implemented PECS training and improvisation of communication and generalization skills in their children with autism.

Overall, the findings of the studies conducted with practitioners and parents training provided promising implications and improvisation of communication and generalization skills in their children with autism. The results of these studies demonstrated that practitioners and parents are able to master the criteria of PECS implementation and implement PECS effectively. Although the results indicated positive outcomes of parents' implementation of PECS, few studies were conducted with parents training (Carson et al., 2012; Chaabane et al., 2009; Greenberg et al., 2012; Park et al., 2011; Stiebel, 1999). On the other hand, only one study provided visual analysis for parent implementation and their children use of PECS (Stiebel, 1999). More research is warranted in this area about fidelity of parent implementation of PECS and progress of students with autism in communication skills.

The BST training package had been used to provide effective training to parents that included written instructions, modeling, watching videos, verbal feedback, and practice (Chaabane et al., 2009; Park et al., 2011). Feedback is an essential part of training programs. Providing the feedback to the implementer can be direct or indirect. The direct feedback strategies involve verbal feedback, such as answering questions for the implementer either before, during, or after sessions. For many of PECS studies, researchers provided feedback directly by discussing with practitioners or parents

verbally during practice sessions. Indirect feedback is another way to provide an effective feedback through audio by using Bug-in-ear (BIE) to provide immediate feedback. This would reduce errors that could occur during sessions and disruptions during intervention sessions.

Training Using Bug-in-Ear

BIE is a technology that has been used for more than 60 years to develop professional acquisition skills (Ottley & Hanline, 2014). BIE is a communication device that is small, wireless, and easy to use. The device can be helpful in providing one-way or two-way communication between the coach and trainee during training (Ottley & Hanline, 2014).

Several studies have been conducted to examine the effects of training teachers involving immediate observation, training, and corrective feedback coaching using BIE technology for implementers in order to decrease errors during implementation of the interventions: Learn Units "interconnected verbal interaction between students and teachers" (Goodman et al., 2008); communication strategies (Ottley & Hanline, 2014); three terms contingency (antecedent, behavior, and consequence) (Scheeler & Lee, 2002; Scheeler, McAfee, Ruhl, & Lee, 2006); and peer coaching by teachers using BIE to teach other teachers (Scheeler, Congdon, Stansbery, 2010). Another two studies used BIE to deliver online training. Scheeler, McKinnon, and Stout (2012) conducted a study using BIE plus a webcam to deliver immediate coaching and feedback to four pre-service special education teachers from remote locations. Rock et al. (2009) conducted online BIE research-based teaching practice training. The results of the studies suggest that BIE

is an effective method for coaching teachers and providing immediate feedback. BIE helped researchers and trainees complete coaching and reduce errors during training.

To date, no studies that have been conducted focusing on training the parents of children with autism in PECS intervention while using BIE. BIE can provide consistent and immediate feedback, thus reducing any errors that could happen when parents implement interventions with their children with autism.

Alsayedhassan, Banda, & Griffin-Shirley (under review) conducted a study that focused on the effect of parents being trained in the use of PECS to help their children with ASD develop communication skills while providing them with immediate feedback using BIE technology. This study examined whether training using BIE technology to provide immediate feedback would lead to successful implementation of PECS and a high percentage of accuracy. Parents received training to be the primary implementer using PECS with their children with ASD from Phase I to Phase III.

Two parents, a mother and father with their children with ASD participated in this study. The ages of the children with ASD were between 3-8 years old. The parents and their children did not have a history of using PECS prior to the study. Several training strategies were utilized during the training including written instruction for PECS phases, modeling, practice, and feedback. After conducting baseline sessions with each parent, they received training individually by the investigator in a therapy room for Phase I until reaching the determined criterion. Then, they implemented Phase I of PECS with their children until their children mastered the criterion. Next, the parents moved on and received training for Phase II of PECS. After reaching the criterion, they implemented Phase II with their children and so on with Phase III. When the parents implemented

PECS with their children, the investigator provided parents with immediate feedback through BIE while observing through a one-way mirror.

The results indicated that parents can be taught to implement PECS with their children with autism with high integrity. Both children with ASD mastered the criterion and used PECS independently to receive their desired items. Also, the results demonstrated a relationship between parents and their children with ASD that developed the communication skills during Phase I. Parents found the intervention was highly socially valid and appropriate to be used in different settings such as home, school, and public places such as restaurants and playgrounds.

Although the results of this study were positive, some limitations were found that need to be addressed in future research. First, when using PECS intervention, highly preferred items should be provided to increase the rate for children with ASD to independently exchange pictures and receive their preferred items. However, in this study, parents were not helpful enough with deciding their children's preferred items. Then, when conducting direct and indirect preference assessments, only two highly preferred items were found for each child. Future studies need to address this limitation by providing the indirect preference assessment to each child's teacher so that they may provide enough information about the preferred items. Second, the generalization sessions were only conducted at the participant's home, and parents found that PECS is helpful intervention to be used in different settings. Future studies need to include generalization sessions in different settings. Furthermore, more studies are needed to investigate the effect of PECS training with parents and its impact on their children when

immediate feedback is provided using BIE. The current dissertation is an expansion of the pilot study.

Purpose

The purpose of this study was to investigate the effects of parents' training and the use of PECS to help their children with ASD develop communication skills while the investigators provided them with immediate feedback using BIE technology. The present proposal is a systematic replication of the Park et al. (2011) study in which the same training procedure for parents and their implementation of PECS, except with the addition of BIE feedback. In addition, this proposal replicated the procedure of the Scheeler et al. (2006) study in which immediate and corrective feedback was provided using BIE technology. Furthermore, this study expanded Alsayedhassan et al. (under review) study including additional parents, phases, and generalization sessions.

Summary

Based on the literature review, the current study proposes to examine the following research questions: (1) Do parents acquire mastery of PECS stages after training? (2) Does the use of BIE for training parents reduce errors during PECS implementation with their children with autism? (3) Do children with autism acquire communication skills by using PECS with their parents? (4) Do participants maintain the acquired skills over time? and (5) What is the perception of parents regarding PECS as measured by the *Treatment Acceptability Rating Form-Revised* (TARF-R) (Reimers, Wacker, Cooper, & DeRaad, 1992)?

CHAPTER III

METHODOLOGY

This study intended to investigate the effects of parents' training and use of PECS to help their children with ASD develop communication skills while the investigators provided parents with immediate feedback using BIE technology. Specifically, this study was intended to answer the following questions: (1) Do parents acquire mastery of PECS stages after training? (2) Does the use of BIE for training parents reduce errors during PECS implementation with their children with autism? (3) Do children with autism acquire communication skills by using PECS with their parents? (4) Do participants maintain the acquired skills over time?, and (5) What is the perception of parents regarding PECS as measured by the *Treatment Acceptability Rating Form-Revised* (TARF-R) (Reimers, Wacker, Cooper, & DeRaad, 1992)? This chapter describes the participants, setting, trainers, materials, variables, experimental design, procedures, inter-observer agreement, treatment integrity, social validity, and data analysis techniques.

Participants

Selection Criterion

Two parents and their children with ASD (two boys) were recruited for the study. The following inclusion criteria were considered:

1. The participating parents had a child diagnosed with ASD;
2. The parents were the caregiver for their child;
3. The parents had no previous history of using PECS with their child;
4. The child with ASD was non-verbal or uses very limited expressive language;

5. The child with ASD did not use PECS to communicate or had no history of using PECS;
6. The child's age was between 3 and 12 years; and
7. The child had not been diagnosed with a hearing or visual problem due to the challenges that he or she may face during the study in to follow directions or view PECS pictures.

Recruitment Procedures

After obtaining approval for the study from a Southwestern University Institutional Review Board (IRB), an invitation to participate was sent to parents of children with ASD who were on the mailing lists of local schools, autism centers, and agencies that serve children with ASD. Interested parents contacted the investigator through email or phone. The investigator scheduled an orientation meeting at a convenient time for the parents to explain the procedure, timeline, benefits of the study, and to answer parent questions regarding the study. The consent procedure was also explained to interested parents. At the end of the meeting, parents were asked to sign the consent form if they were interested. They had the choice to sign the consent form during the meeting or to mail it later to the address provided. The parents were given a copy of the signed form.

Participating parents provided demographic information about their child with ASD including the child's age, diagnosis, assessment scores, and previous interventions used. They also provided services and interventions that are related to communication skills, recent Individualized Education program (IEP) goals related to communication

skills, and the history of previous communication interventions/methods used (e.g., sign language, AAC).

Participants' Characteristics (Children and Parents)

Ray. Ray was three years old with a diagnosis of autism. Ray was living with his parents and his older brother. Ray was verbally limited and could only clearly say some numbers (3, 8, 10). However, his other speech was non-comprehensible. Also, he had poor eye contact with people. Ray's Child Behavior Checklist for Ages 1.5-5 (CBCL) (Achenbach, & Rescorla, 2001) was in the clinical range above the 90th percentile that the externalizing problems scale score was in normal range. The Vineland Adaptive Behavior Scales-second edition (VABS-2) (Sparrow, Cicchetti, & Balla, 2005) demonstrated that Ray's domain standard score was an average range of 85 to 115 and subdomain v-scale scores with an average range of 13 to 17. The domain and subdomain in the moderate to low range indicated difficulties in functional skills including communication, daily living skills, socialization, and adaptive behavior composite. In addition, the Stanford-Binet Intelligence Scales- fifth edition (SB-V) (Roid, 2003) was administered to evaluate intellectual and cognitive functioning. The results demonstrated that the standard score for Ray's full-scale IQ was 64 indicating an extremely low range causing him difficulty overall, 75 in nonverbal IQ, which is below average, and 56 in verbal IQ indicating an extremely low range and demonstrating significant difficulty in understanding spoken language. Furthermore, Ray's mother reported that he was taught sign language to communicate and did not have any experience using PECS.

Ray's mother. Ray's mother was a 35-year-old with two children. She had a bachelor's degree in education and worked full-time as a teacher at the time of the study.

Jack. Jack was eight years old at the time the study began. Jack was living with his father. Jack was diagnosed with autism by a pediatrician at the age of three years. He was enrolled in a special education program located in an elementary school building where he received speech therapy, occupational therapy, and behavior intervention to reduce his aggressive behavior. Jack was assessed using the *Gilliam Autism Rating Scale-Second Edition* (GARS-2; Gilliam, 2006) to evaluate his functional and language skills. The results showed standard scores of 47, 64, 61, and 72 on communication, daily living skills, socialization skills, and motor skills respectively, with a composite score of 58. At the beginning of the study, Jack had limited verbal expressions (a few words) and was otherwise noncommunicative. Also, Jack exhibited aggressive behaviors including hitting, kicking, spitting, scratching, and throwing items toward others.

Further information provided by Jack's father prior to participation in this study showed that Jack had limited expressive language. Jack primarily communicated his needs and wants through idiosyncratic means such as physically moving to a desired item or pulling an adult towards the items. In addition, Jack had a difficult time generalizing working with different therapists. Jack received sign language training, but he does use it frequently.

Jack's father. Jack's father was a 31-year-old with one child. At the time of the study, he was in the first year of graduate school and worked part-time.

Settings

The study took place in a therapy room at in a university setting, and at the participants' homes. The training sessions were conducted in a therapy room at the university that was equipped with a one-way mirror to allow the investigator to provide

immediate feedback to parents. There was a table and chairs to allow the parent and the child to sit facing each other. The duration of a training session was 10-15 minutes, and the researcher conducted three sessions per day, three to four times a week. All sessions were videotaped so that an independent observer was able to review the recorded sessions and collect interobserver agreement and procedural integrity data. The generalization probes were conducted at the participants' home. Generalization across settings occurred at each participant's home.

Trainers

The primary trainer was a graduate student at a university in the Southwestern portion of the United States. Additionally, one graduate student received a brief training. Parents received formal training in PECS by the trainers, and when parents mastered the criteria for each phase of PECS, they brought their children into the therapy room and implemented PECS with them.

Materials

The materials included a communication book for PECS with a three-ring binder and several strips of Velcro, several 2-by-2" laminated photographs that matched the items used in the study, data collection sheets, a timer, a pen/marker for marking correct or incorrect responses, and a camera to record videos. Also, the investigator used a Tronfy Mini4 Bug-in-Ear® to provide immediate feedback to the parents when they implemented PECS with their children. In addition, a collection of preferred snacks and toys were provided that were identified through a preference assessment.

Dependent Variables

The dependent variables in this study were the PECS acquisition and their use for requesting desired items.

Parents

The primary dependent variable was the percent of correct implementation of PECS Phases I, II, and III. When a parent implemented a PECS step in each phase accurately as defined, that item was scored as correct. The incorrect implementation of PECS was defined as when parents missed a step of PECS phases or when they did not follow the same sequence of the steps in each phase. Additionally, when parents implemented PECS with their children, the percent of correct implementations of steps of the PECS phases were tracked coupled with a frequency measure of feedback information provided by the investigator using BIE. The mastery criterion was 100% for each phase within two consecutive sessions. The calculation of the percentage for each session was calculated using the number of correct responses divided by the total number of exchanges during the sessions multiplied by 100.

Children

The percentage of correct exchanges of pictures using PECS to request the preferred items and the percentage of mastered criteria were measured. Two types of responses were calculated for each participant: independent and prompted. The independent responses were collected when the child picked up the picture from the communication book and exchanged the picture with the communication partner to receive the desired item within 5 seconds after presentation of the item without a prompt. However, the prompted responses were recorded when the child did not make a request

by picking up the picture from the communication book and handing it to the communication partner until the delivery of the physical prompt. The mastery criterion was 80% for each phase with unassisted or unprompted PECS exchanges for a minimum of two consecutive sessions. The calculation of the percentage for each session was made using the number of correct responses divided by the total number of exchanges during the sessions multiplied by 100.

When the parents implemented PECS with their children, two data sheets were used to collect their data: (1) the PECS Implementer Skills Assessment data sheet to assess their PECS implementation with their children, and (2) data sheets to indicate a score for the percentage of independent communication by the children (see Appendix C). All of the sessions were recorded, and then the investigator and a graduate student collected all the data. For Phase III, besides the two data sheets, an error-correction data sheet was collected for the parents' implementation (see Appendix C). Additionally, the same data sheet for the parents' implementation was used to collect information on the frequency of the parents' correct implementation of the PECS intervention. The frequency of prompts for parents from the investigator was calculated during the implementation.

Independent Variable

The independent variable was the PECS training Phases I through IIIB. The PECS phases were taught to the parents, and then parents implemented PECS with their children. Each phase was taught separately to parents until they mastered the criterion within 100%. Then, parents implemented the learned phase with their children until their children mastered the criterion within 80%. Therefore, parents received training to the

next phase and so on. The goal of Phase I was to teach the child how to communicate by picking up a picture card of the desired item and exchanging the picture with the communication partner (parent). Phase II teaches the participants distance and persistence. Each child was required to travel to the communication book and pick up the picture of the desired item, and then travel to the trainer to exchange the picture for the corresponding item. In this phase, the distance increased gradually between the child and communication book, and the child needed to move to the communication partner to make the exchange. Phase III is aimed at teaching the child to discriminate between pictures and choose a specific picture for a specific need or desire. Next, the child was taught to discriminate between multiple pictures and match each of them with the desired items. Phase III includes Phases IIIA and IIIB. The goal of Phase IIIA is to assist the child to discriminate between two unrelated pictures of a highly preferred item and a non-preferred item. Phase IIIB aims to teach the child to discriminate between more than two pictures of highly preferred items.

Experimental Design

This study used two single-subject designs: a multiple-baseline design across participants for parents, and a changing-criterion design for the children with autism. A multiple-baseline design across participants was implemented for parents training to evaluate the impact of the intervention (Harvey, May, & Kennedy, 2004). Multiple-baseline design is a single transition from baseline to treatment, wherein the transition is conducted at different points of times across participants. In this design, the experimenters do not need to withdraw the treatment to evaluate effects because they implement the intervention with more than one subject. The baseline sessions began

concurrently across parents until demonstrating stable data. Then, the investigator moved to an intervention phase, in which a single transition between parents was conducted. In this design, the treatment was introduced systematically for one parent, and the baseline data collection continued in the others (Cooper et al., 2007). The baseline condition remained in effect with other subjects or groups (Cooper et al., 2007). This was followed by the implementation of the training package for PECS Phases I-IIIB. After parents mastered the criteria for each phase, they implemented PECS with their children until their children had mastered the criteria, and then the parents moved on to receive training for the next Phases of PECS. The sessions were implemented across four phases: baseline, PECS Phase I, PECS Phase II, PECS Phase III.

A changing-criterion design (Cooper et al., 2007) was implemented for children to evaluate the effects of parent-implemented PECS training to their children with autism. The reason for selecting this design was to teach requesting skills using PECS independently in a stepwise manner. The changing-criteria design is an experimental design used to determine the effects of an independent variable when it is applied in a graduated manner to a single target behavior (Cooper et al., 2007). The changing-criteria design allows the investigator to gradually change the criteria during the intervention sessions across phases to produce an increase in the rate of communication using PECS independently to meet the criteria (Janosky, Leininger, Hoerger, Libkuman, 2009). In this design, the criterion changes during the intervention phases, and reinforcements are presented when the criteria levels are met or surpassed (Janosky et al., 2009). The procedure of changing-criteria design began with an initial baseline phase to collect data on a child with autism, and then the investigator moved to the treatment phase (Richards,

Taylor, & Ramasamy, 2014). In this study, parents were responsible for implementing all the sessions during baseline and the PECS Phases from Phase I through Phase IIIB. The treatment phase was divided into sub-phases where each phase required a specific criteria change, and the participant must have met the criteria of each phase to move to the next more complex phase of PECS (Richards et al., 2014).

Overview of the Procedure

The study comprised five phases: (1) preferences assessment, (2) baseline, (3) intervention, (4) generalization, and (5) follow up.

Stimulus Preference Assessment

A preference assessment was conducted to determine the edible items and toys that are preferred in each child's daily environment to be used for reinforcing. The purpose of stimulus preference assessment is to identify stimuli (edible item and toys) that are highly preferred and systematically served as a potential reinforcement to increase the desired skill of independent communication (Hagopian, Long, & Rush, 2004). The process for the stimulus preference assessment involved two steps, indirect measure and direct measure. The indirect measure was based on information gathered from the parent of children with autism through an interview and checklist. After obtaining a potential reinforcer list, the investigator then conducted direct observation by examining the preferred items of each individually in terms of specific stimuli.

Indirect preference assessment. The investigator interviewed parents about their children's preferred items. This helped determine what edible items or toys and activities were more likely to be reinforcing for each participant. Then, the parents were given a checklist (see Appendix A) to indicate what items (e.g., food items and/or activities) were

most preferred. Parents were asked to rank the items from most to least preferred by their children in a stimuli checklist for each category. All the items for preference assessment were provided by the investigator based on information from the parents.

Direct preference assessment. After the informal assessment with the parents, the investigator conducted a direct assessment with each child to verify the preferred items that were identified by parents. A multiple-stimulus without replacement preference assessment (MSWO) (DeLeon & Iwata, 1996) was implemented by presenting seven to nine preferred items representing a combination of food, toys, and activities. The investigator presented items initially to see if the child picked up or approached the items. If the child did not reach for any of the items, the investigator waited for 5-10 seconds, and then the items were removed. When the child reached for an item, the investigator provided the child with a small piece of an edible item or 30 seconds of play with a selected toy. After selecting an item, the investigator removed the selected item in order to not present it for next trial. The investigator rotated the location of the remaining items before beginning the next trial. The process was repeated until all items were presented. At the end of the assessment, the first three selected items were confirmed as the highly-preferred items, and these were used during the intervention sessions. The investigator conducted trials for the selection of leisure items and food assessments separately because food tends to motivate children more than toys and other activities (Bojak & Carr, 1999; DeLeon & Iwata, 1996). A total of six sessions were conducted involving three sessions with food items and three sessions with toys and activities. Two sessions were conducted per day: one food session and one toys and activities session. A total of 30-42 trials were conducted during all the preference

assessment sessions. In addition, brief preference assessments sessions were conducted before each training session when the children lost their interest in the items used.

The investigator ranked the selected items on a data sheet (see Appendix B). Then, the investigator calculated the percentage for each item by dividing the number of times each item was selected by the number of items presented. The percentage was summarized for each item across all sessions, and then the investigator ranked each preferred item from high to low, indicating the most preferred items to the least preferred items. The preferred items for Ray were train, dinosaur, bubbles, cookies, ice cream, books, and gummies. The preferred items for Jack were iPad, Hershey's kisses, M&Ms, books, banana, and grapes.

Table 1 shows a hierarchy of preference for items and the percentage of selection across participants. For Ray, the items were ranked in the following order: train (100%), dinosaur (90%), bubbles (90%), cookies (80%), ice cream (80%), book (70%), and gummies (50%). For Jack, iPad was identified as the most preferred item with 100%, followed by Hershey's kisses (90%), M&Ms (90%), books (70%), banana (70%), and grapes (70%).

Table 1

MSWO Preference Assessment Results for Each Child Participant

	Ray		Jack	
Rank	Item	% of selection	Item	% of selection
1	Train	100%	iPad	100%
2	Dinosaur	90%	Hershey's Kisses	90%
3	Bubbles	90%	M&Ms	90%
4	Cookies	80%	Books	70%
5	Ice cream	80%	Banana	70%
6	Book	70%	Grapes	70%
7	Gummies	50%	-	-

Baseline

The baseline sessions were conducted in two steps. The investigator implemented baseline sessions with the parents, and then the parents implemented baseline sessions with their children with autism before the beginning of training sessions.

Parents. Baseline sessions were conducted with the parents to determine their performance level in PECS implementation. In these sessions, parents acted the part of the communication partner and physical prompter, and the investigator played the child's place. However, in baseline sessions, no prompts or feedback were provided. A preferred item was held by the parent and the corresponding picture was placed on the table. The parent was sitting in front of the investigator and waited for 10 seconds for a response. If the investigator did not use PECS, did not respond, or reached for the item without using PECS, the parent was told to allow the investigator to access to the preferred item to interact with for 30 seconds. Each session consisted of 10 trials, and each session lasted about 10-12 minutes. Parents did not receive feedback or prompts during baseline sessions. The baseline sessions were conducted with each parent separately because the investigators used a multiple-baseline design across parents in this study. Three sessions were conducted per day, three times a week for one to two weeks. After reaching a stable data, the investigators moved to the intervention phase of the study. After conducting baseline sessions with each participant, the training was implemented with one participant while the baseline sessions continued with other participants (Cooper et al., 2007).

Children. Initially, the parents were trained in how to conduct baseline sessions with his or her child with ASD. The parent conducted baseline sessions with his or her

child in a therapy room or classroom with using BIE to receive instruction. In these, the parent placed one picture on the cover of the communication book and presented a preferred item in front of the child corresponding to the picture. Parents waited for their child to respond for 10 second. If there was no response, or if the child just reached for the item without using the picture from the communication book, the parents allowed the child to access the preferred item for 30 seconds without any verbal prompt, or if it was food, until it had been consumed. If the child picked up the picture and gave it to his/her parent to get the preferred item, the child and allowed access to the item for 30 seconds. Each session lasted 10-12 minutes. Ten trials were conducted during each session, and two to three sessions were conducted per day. Baseline sessions were conducted three times a day for one to two weeks. A minimum of three baseline sessions were conducted prior to the intervention. After reaching stable baseline data, the parents moved on to the intervention phase after receiving training. During the baseline sessions, the investigator observed each parent and the child through a one-way mirror.

Intervention

Parent training. The parents' training was individually implemented by the experimenter prior to each phase of PECS training. A behavioral skills training (BST) was used during parents' training including: written and verbal instructions for each phase and an explanation in detail of how to conduct each step including each phase, modeling, rehearsal, and feedback. Parents were given the written instructions of the PECS process before the training. Data was collected when the parents practiced the intervention procedures with the investigator. The investigator trained the parents to implement PECS Phase I. When the parents mastered the criterion of Phase I, they

implemented Phase I with their child with ASD in a therapy room until their child reached the determined criterion. Then, the investigator trained parents to implement Phase II of PECS intervention until achieving the criterion. Next, parents implemented Phase II of PECS with their child with autism until their child reached the criterion, and so on with Phase III. Parents' training included the following: (a) receiving written and verbal instructions in the PECS protocol (see Appendix E), (b) watching the process modeled by the investigator and a graduate student, (d) practicing PECS phases with the trainers, and (f) having their questions answered. For example, the parents mostly asked about the procedure of implementing PECS. Modeling, practice, and feedback were repeated until the parents had achieved 100% mastery of all steps. Each phase was implemented separately until the parents mastered 100% of the criteria.

During the intervention session, the investigator and a graduate student modeled each phase for one session to help parents understand the use of each phase. The investigator acted as the communication partner and physical promoter, and the graduate student took the role of the child. Then, the parent acted as the communication partner and physical prompter, and a graduate student took the role of the child. Specifically, the parent was trained to initiate each trial by presenting the preferred item and the picture corresponding to the item. The parent provided the preferred item to the graduate student and allowed access to the item. The parents provided physical prompts as needed.

For Phase I, the parent handed the preferred item and waited for 10 seconds for the graduate student (in the child's role) to respond. If the graduate student as the child independently picked up a picture from the cover sheet in the communication book and handed the picture card to the parent (communication partner), the parent praised the

child and immediately provided the item. However, if the graduate student as the child did not independently pick up the picture, the parent physically prompted the child using full physical prompting to pick up the picture and hand it to the communication partner. The parent allowed the graduate student access to the preferred item for 30 seconds. If the preferred item was food, the parent waited for the graduate student to consume the food. Each session included 10 trials and each session lasted 10-12 minutes. The parents were asked to practice the procedure to provide the correct consequence until they had reached 100% accuracy across two consecutive sessions. After each session, the investigator provided feedback to the parents as needed (e.g., wait for the child to initiate, entice the child with both items). For additional feedback see (Appendix C). When parents had mastered the criteria for Phase I, they implemented Phase I with their child until their child had mastered the criteria. Then, parents received training for the Phase II until reaching the criteria to implement the phase with their child in a therapy room or classroom.

The Phase II sessions were identical to the Phase I training sessions. However, the parents were taught to increase the distance that the child would move to pick up the picture and then move to the communication partner to make the exchange in order to receive the preferred item (see Appendix D).

In Phase IIIA, the parents were trained to practice picture discrimination and the error correction procedure was implemented. In this Phase, parents implemented the error correction procedure when the child (graduate student) did not pick up the correct picture card. The parent presented a highly preferred item and a non-preferred item and two corresponding pictures to the items. When the child picked up the correct picture of the

preferred item, the parent immediately provided verbal praise (e.g. "Good Job! You chose the ball!"), gave the child the preferred item, and allowed access to the item for 30 seconds. However, when the child picked the picture of the non-preferred item, the parent gave the child the non-preferred item. When the child showed a negative response (e.g., rejected the item, threw it away, or returned it to their parent), the parent implemented the four-step error correction of modeling, prompting, switching, and repeating. First, the parent modeled the correct response to the child. The parent then touched the correct picture, placed the picture next to the preferred item, presented it to the child, and named it. Second, the parent provided physical prompting by touching the child's hand, guiding the child to pick up the correct picture, and hand the picture to the parent. Third, the parent paused for 2 to 3 seconds by asking the child to do an activity that was not related to the process such as asking the child to touch his/her head to visually distract the child from the book when the parent replaced the picture so that the child did not simply repeat the process by imitation. However, the child was not allowed to access to the item. Fourth, the parent needed to rotate the two pictures on the coversheet in the communication book and began the next trial. When the parents had mastered the criterion by implementing this phase within 100% mastery, they brought their child with ASD to implement this phase with them in a therapy room (see Appendix D).

In Phase IIIB, the same procedure as in Phase IIIA was conducted. However, in this Phase, each parent was trained to present two preferred items to the child (graduate student) and provided two pictures corresponding to the items. Also in this Phase, the parent provided the error correction procedure when the child did not pick up the correct picture. When the child picked up a picture from the communication book and handed it

to the parent, the parent said "Ok, take it" and waited for the child to reach for the item. If the child took the correct item (the one corresponding to the picture), the parent verbally praised the child, named the item, and immediately gave the child the item. However, if the child handed the wrong picture to the parent, the parent said "Ok! Take it," and waited for the child to reach for the item. When the child reached or touched an incorrect item, the parent implemented the error-correction procedure. The parent blocked the child from accessing the item and implemented the same error-correction procedure as used in Phase IIIA. Also in this phase, a distance was maintained between the child and his/her parents. Then, parents brought their children into a therapy room or classroom to implement Phase IIIB with them.

Implementing PECS with children with ASD. The parents implemented all the PECS Phases I to IIIB with their children. After stable baseline of child's data was established, the parents conducted the intervention sessions with their children in the therapy room with the one-way mirror or in a classroom. The investigator watched the sessions through a one-way mirror in a therapy room and provided feedback through BIE. During training sessions, the parent acted as the communication partner and physical prompter who provided reinforcement when the child gave the parent the picture card corresponding to the reinforcement item in the parent's hand. The children were required to master the criteria within at least 80% or above for all phases to move on to the next phase.

BIE. Bug-in-ear (BIE) is a communication device that is small, wireless, and easy to use. The device can be helpful in providing one- or two-way communication between the coach and trainee during training (Ottley & Hanline, 2014). Throughout the parents'

implementation of PECS with their children, parents were given the BIE. The investigator explained to the parents that they would receive prompts or feedback on their interactions with their children while wearing the BIE. During the intervention sessions, the investigator observed the parents and their child through one way mirror and provided immediate verbal feedback to the parents on implementing each phase of PECS through BIE. Short phrases were used by the investigator to provide feedback. Examples included, "let the child cross the room to reach you," "wait for the child to initiate."

The feedback through BIE was delivered immediately by the investigator within 3 seconds after the target behavior occurred. This criterion was established by looking at the child's response with picture exchange and parent's implementation of PECS. This criterion of latency was established in a previous study between a student response and teacher consequence (Scheeler & Lee, 2002). No feedback was provided when parents implemented PECS correctly. From the point that parents did not need feedback when they implemented PECS accurately, the BIE was gradually faded. Parents wore BIE for two consecutive sessions, and when they did not need any feedback from the investigator, they kept it in view. After that, BIE was removed from the parents. All sessions were videotaped for the purpose of data collection. The investigator collected data following each session by counting the number of feedback messages provided.

When the parents were training their children within 90% or more accuracy during the first three sessions of Phase IIIB, the BIE was gradually faded. The amount of feedback was reduced at the fourth session of Phase IIIB into half the number of prompts. Then, the number of prompts was faded into 1 prompt per session if it was needed.

Generalization. Generalization probe sessions were conducted to evaluate whether the children with ASD could generalize the independent communication in different settings outside of the therapy room. Generalization sessions were conducted in each of the participant's homes to give the child the opportunity to request objects or activities from his or her own environment using PECS Phase IIIB. Parents were asked to identify activities in which their children like to participate. The investigator observed the parents and their children in the activity. Each session consisted of 10 trials, and the procedure was identical to Phase IIIB. Two visits to each participant's home were made, and each visit took 20-30 minutes to determine if the child was able to independently use PECS Phase III. These sessions were conducted over a one-week period. However, the parents did not use the BIE to receive feedback from the investigator. Instead, they independently implemented PECS with their children.

Follow up. Maintenance probes were conducted to evaluate if the child maintained the independent exchanges using PECS. Two follow-up sessions were conducted in each participant's home one month after the generalization sessions. Follow-up sessions were conducted in the same manner as the baseline session. The investigator placed the PECS items on a table and asked the parent to use them with their child according to the PECS protocol.

Interobserver Agreement

Interobserver agreement (IOA) is a procedure that enhances the accuracy of the data collected in which two or more independent observers observe and measure the same events or variables (Kennedy, 2005). The investigator and a graduate student (independent observer) coded IOA data for at least 30% of all the sessions for parent

implemented PECS phases with their children by reviewing video tapes. Before the data collection, the investigator discussed and explained to the graduate student the operational definitions of the dependent variables to be scored during training sessions. The graduate student reviewed the data sheets, practiced the recording, and observed the training procedures. When the graduate student achieved 90% of agreement with the investigator, she coded the data independently by reviewing the video tapes. During the scoring, the two observers independently observed and measured the same event; observers began and ended the observation period at the same time (Cooper et al., 2007). The IOA was assessed by comparing the number of total independent PECS exchanges to the number of independent PECS exchanges that were performed correctly. A point-to-point IOA procedure was used to calculate the percentage of IOA data. This entailed dividing the number of agreements by the sum of agreements + disagreements to find the percentage at the end of each session.

The interobserver agreement for each participant of the study is summarized in Tables 2 and 3. The tables show the number of training sessions and trials for each trained phase and the number of trials during which interobserver agreement was assessed with their corresponding percentage values for each participant. The last rows indicate the mean agreement in percentage points for each phase. Overall, the mean IOA for Ray's responses was 98.4% for all PECS Phases, and for Jack's responses, it was 99% for all Phases.

Table 2

Total Number of Sessions, Total Number of Trials, and Number of Trials with Interrater Agreement Data Collected for Ray

Phases	BL	I	II	IIIA	IIIB
Number of training sessions	3	6	5	3	6
Number of trials	30	60	50	30	60
Number of sessions with IOA data collected (%)	1 (10 trails)	3 (30 trials)	3 (30 trials)	1 (10 trials)	3 (30 trials)
Agreement Average (%)	100%	98%	100%	95%	99%

Table 3

Total Number of Sessions, Total Number of Trials, and Number of Trials with Interrater Agreement Data Collected for Jack

Phases	BL	I	II	IIIA	IIIB
Number of training sessions	3	6	4	3	5
Number of trials	30	60	40	30	50
Number of sessions with IOA data collected (%)	1 (10 trials)	3 (30 trials)	2 (20 trials)	1 (10 trials)	3 (30 trials)
Agreement Average (%)	100%	97%	100%	100%	98%

Treatment Integrity

Treatment integrity refers to the degree of accuracy and the consistency of the implemented interventions planned (Cooper et al., 2007; Peterson, Homer, & Wonderlich, 1982). Treatment integrity was collected when parents implemented the PECS intervention sessions with their children. Treatment integrity in this study was evaluated by an independent second observer who was familiar with data collection and

intervention procedure. The independent observer practiced data collection with the investigator by watching the recorded videos to see if the parents implemented the procedures in baseline and the intervention phases correctly. When the independent observer reached 100% agreement with the investigator on the implementation of the intervention procedure checklist for Phase I-IIIB (Appendix C), the training was terminated, and the independent observer started data collection. The trained observer completed a checklist of training procedures using the PECS Implementer Skills Assessment sheets by Frost and Bondy (2002) for each phase.

The treatment integrity was collected twice for parents in which during their implementation of PECS with the investigator and during their implementation of PECS with their children with ASD. A minimum of 30% of the total sessions, including baseline and intervention was observed and evaluated by the second observer randomly distributed across sessions. First, the fidelity for Ray's mother during parents training was 100 % during the baseline sessions, Phase I, and Phase II, and was 95% during Phase III. The overall average for all Phases was 98%. Jack's father had an integrity with a 100% for baseline and all phases I-III. Second, a procedural integrity was collected for parents when they implemented PECS with their children. Ray's mother achieved 100% for baseline, 98% for Phase I, 100% for Phase II, 94% for Phase IIIA, and 100% for Phase IIIB, generalization, and follow up. The overall average of all Phases was 98.4%. Jack's father achieved 100% for baseline, 95% for Phase I, 100% for Phase II, 100% for Phase IIIA and IIIB, 100% for generalization and follow-up sessions. The overall average was 99% across all Phases.

Social Validity

A social validity of the *Treatment Acceptability Rating Form-Revised* (TARF-R) (Reimers, Wacker, Cooper, & DeRaad, 1992) was distributed to the parents to assess the extent to which they found the sessions acceptable to the goals, procedures, and outcomes of the intervention (See Appendix F). This questionnaire consisted of 12 item rating questions, and parents responded using a 6-point Likert rating scale ranging from "not at all …" to "very … ." The scale took approximately10-15 minutes to complete. The questions included: (a) the parents' understanding and the clarity of the treatment package, (b) the parents' conception of the treatment and its effects on their child, (c) the benefits of this treatment, (d) the disadvantages of the treatment package, and (e) the treatment effects on the family routine. The data obtained from the parents was converted to a percentage of satisfaction.

Data Analysis

Data was graphed and analyzed using the visual analysis method (Cooper et al., 2007). Four important components were measured during the visual analysis: level, trend, variability, and immediacy of changes (Cooper et al., 2007). The level is considered as the absolute value of the outcome measures around a set of data (Cooper et al., 2007). The level was measured before and after providing the intervention to determine the significant changes of the targeted behaviors (Cooper et al., 2007; Kratochwill et al., 2013). Two important aspects were examined during the analyzing of level: stability and changes. The level stability refers to the variability or the changes of data points in a phase or between phases. The trend is defined as the direction of the data for both of the outcome measures within conditions (Cooper et al., 2007). The direction is described as

increase, decrease, or zero trend (Cooper et al., 2007). The variability refers to the degree of overall scatter (Cooper et al., 2007; Kratochwill et al., 2013). The variability of data describes how different the data points are from each other. The variability is described as stable, variance, and extreme variance (Cooper et al., 2007). The immediacy of changes describes the immediate or delayed effect of intervention following the onset or withdrawal of the intervention (Horner et al., 2005). Visual analysis of the data is used to determine the functional relationship between an independent variable and dependent variables (Kratochwill et al., 2013).

CHAPTER IV

RESULTS

This study examined the effects of parents' training and the use of PECS to help their children with ASD develop communication skills while the investigator provided them with immediate feedback using BIE technology. The results for all participants were graphed and presented to answer the research questions: (1) Do parents acquire mastery of PECS stages after training? (2) Does the use of Bug-in-Ear for training parents reduce errors during PECS implementation with their children with autism? (3) Do children with autism acquire communication skills by using PECS with their parents? (4) Do participants maintain the acquired skills over time? and (5) What is the perception of parents regarding PECS as measured by the *Treatment Acceptability Rating Form-Revised* (TARF-R) (Reimers, Wacker, Cooper, & DeRaad, 1992)?

Results for Parents and their Children with Autism

This study examined if the parents would acquire mastery of PECS phases after receiving training from the investigator. Figure 1 indicates the parent's mastery of correct implementations of PECS.

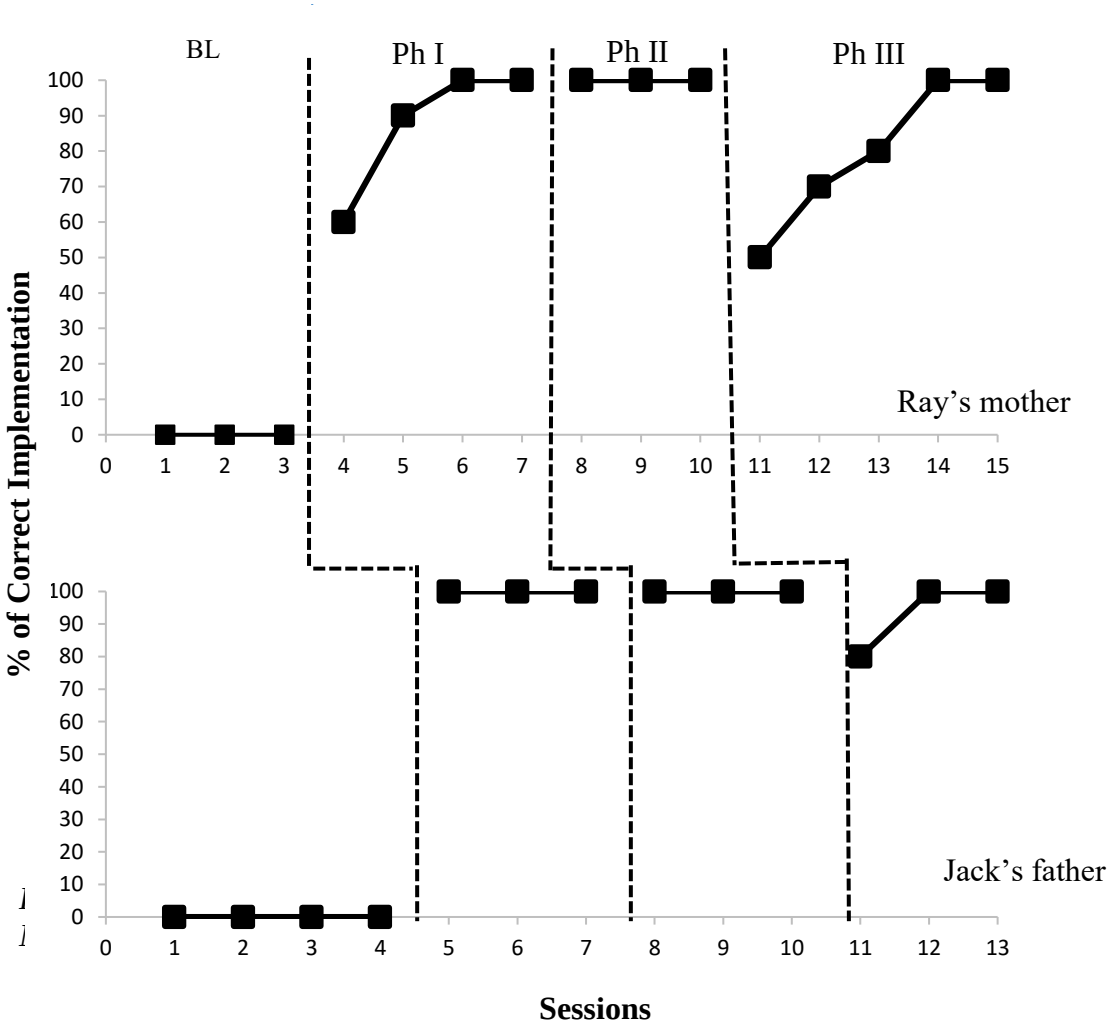

Figure 1. Percentage of accurate implementing PECS of parents.
Note. BL = Baseline, Ph = Phase

Ray's Mother

The top panel of Figure 1 shows data for Ray's mother. During her parent's training, she participated in a total of 15 training sessions (150 trials) including baseline, Phase I, II, and III. During the baseline sessions, the mother did not request any items using PECS icons indicating stable data with 0%. However, when the training began, the mother's correct implementation of PECS had a moderate to high level and a gradually increasing trend from 60%-100% at the end of Phase I with an average of 88%. Overall,

Phase I comprised 4 training sessions (40 trials), and the mother reached the criteria in the fourth training sessions. Phase II included three training sessions (30 trials) in which the mother reached 100% during all the training sessions with stable data path. Phase III included five training sessions (50 trials). There was an increasing trend from 50%-100%, and the mother mastered the criterion after five training sessions with a moderate to high level with a mean mastery score of 80%.

Jack's Father

The bottom panel of Figure 1 indicates data for Jack's father. During his parent's training, he participated in a total of 13 sessions (130 trials) including baseline, PECS Phase I, II, and III. In the baseline sessions (in 4 sessions and 40 trials), the father did not request or implement PECS correctly and had a stable data with 0%. In Phase I, he participated in three training sessions and achieved the criterion of 100% with a stable data path. In Phase I, he mastered the steps in three sessions (30 trials). As well as in Phase II, he met the mastery criterion with 100% accuracy in all the training sessions (30 trials). In Phase III, he met the criteria in the second session with an increasing trend and high level from 80%-100% with an average of 93%.

Also, this study sought to examine if the children with autism could acquire the use of PECS with their parents and make requests. The acquisition skill was measured by the rate of independent correct uses of PECS (percentage correct responses) and number of sessions/trials to criterion. Figure 2 shows a visual presentation of the results for Ray and Figure 3 for Jack.

Ray

Ray participated in a total of 28 training sessions with his mother (280 trials) that consisted of baseline, PECS Phase I, II, IIIA, IIIB, generalization, and follow up. During the baseline sessions, Ray showed an average of 0% picture exchanges and showed stable data points that included three baseline sessions (30 trials). Ray did not request any of the preferred items using PECS. However, he made his requests by reaching for the preferred items from his mother without using the PECS icons. When the training sessions began, Ray's correct responses using PECS increased from 60% to 90% by the end of Phase I with an increasing trend with some variability. He reached the criterion in six training sessions (60 trials) with a mean score of 78%. Phase II comprised 5 sessions (50 trials) to achieve the criterion. In this phase, Ray showed a variable and high level data and achieved 100% of correct responses using PECS icons. This phase was divided into two steps by increasing the distance gradually. At the end of this phase, Ray could travel to PECS for a 6-foot distance with an average of 92% accurately. Phase IIIA comprised three training sessions (30 trials) to achieve the criterion with an overall average of 93%. Ray had a high level with an increasing trend from 80% to 100% with low variability to discriminate between two picture cards (one preferred and one non-preferred). When he requested the non-preferred item, he rejected it and returned the item to his mother or threw it away. Then, Ray mastered the criterion when his mother implemented the error correction procedure. During Phase IIIB, Ray was required to discriminate among an array of pictures of preferred items and gradually increased the number of preferred item and pictures that corresponded to the presented items. For this Phase, the data showed that Ray had a stable pattern with a high level and achieved 100% of correct responses.

The number of pictures was gradually increased to 5 picture cards, and Ray acquired the skills with 100% correct exchanges. In Phase IIIB, Ray participated in a total of six training sessions (60 trials) with a mean accuracy score of 98%.

Three generalization sessions (30 trials) were conducted at Ray's home where his mother implemented PECS Phase IIIB without receiving any feedback from the investigator. Ray's generalization data across settings indicated an increasing trend with a range of 90%-100% (average =93%). After one month had elapsed, two follow-up sessions were conducted at Ray's home with procedures identical to the generalization sessions. Ray demonstrated a high level of correct responses with using PECS. The data showed that Ray's correct response was in a range of 90%-100% (average = 95%), showing an increasing trend.

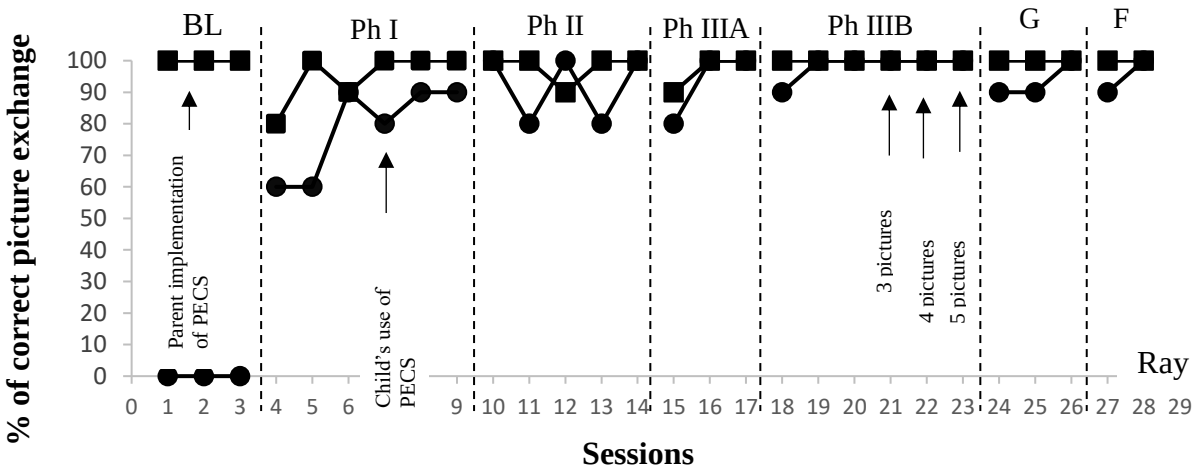

Figure 2. Percentage of independent Picture Exchange during baseline, PECS Phases, and follow up for Ray.
Note. BL= Baseline, Ph = Phase, G = Generalization, F= Follow-up

Jack

Figure 3 shows the percent of independent picture exchanges by Jack during baseline, PECS Phase I, II, IIIA, IIIB, generalization, and follow-up sessions. Jack

participated in a total of 25 sessions (250 trials). During the baseline sessions, Jack did not perform any requesting skill correctly, even though he was reaching for the items. In addition, Jack acted aggressively towards his father when removing preferred items after trials. During baseline, Jack had a stable baseline with an average of 0% picture exchanges that included three baseline sessions (30 trials). Phase I comprised six training sessions (60 trials). During this phase, Jack's independent requesting responses increased from 50% to 100% by the end of the sixth session. A high level of performance was maintained through the sixth session. At the end of this phase, Jack's average percentage of correct responding was 83%. Jack mastered Phase II in four sessions (40 trials) with an average accuracy of 92%. The data for Phase II indicated an increasing trend with a high level of correct responses. Jack mastered Phase IIIA in three sessions (30 trials) with an average of 100% correct responses. Jack did not show any discrimination issues during this phase, and he had a stable data of 100% accuracy for all sessions. Phase IIIB also was mastered with a high level, indicating 100% accuracy during all sessions. Jack participated in five training sessions (50 trials) during this phase with a gradual increase in the number of picture cards up to four pictures.

Jack's father conducted two generalization sessions (20 trials) at their home where the father implemented PECS Phase IIIB without receiving any feedback from the investigator. Jack's data for the generalization sessions across settings demonstrated a stable data trend with a high accuracy level that averaged 100%. After one month had elapsed, two follow-up sessions were conducted at Jack's home where the procedure was identical to the generalization sessions. Jack demonstrated a high level of correct

responses using PECS. The data showed that Jack's correct average response was 100%, showing a stable trend.

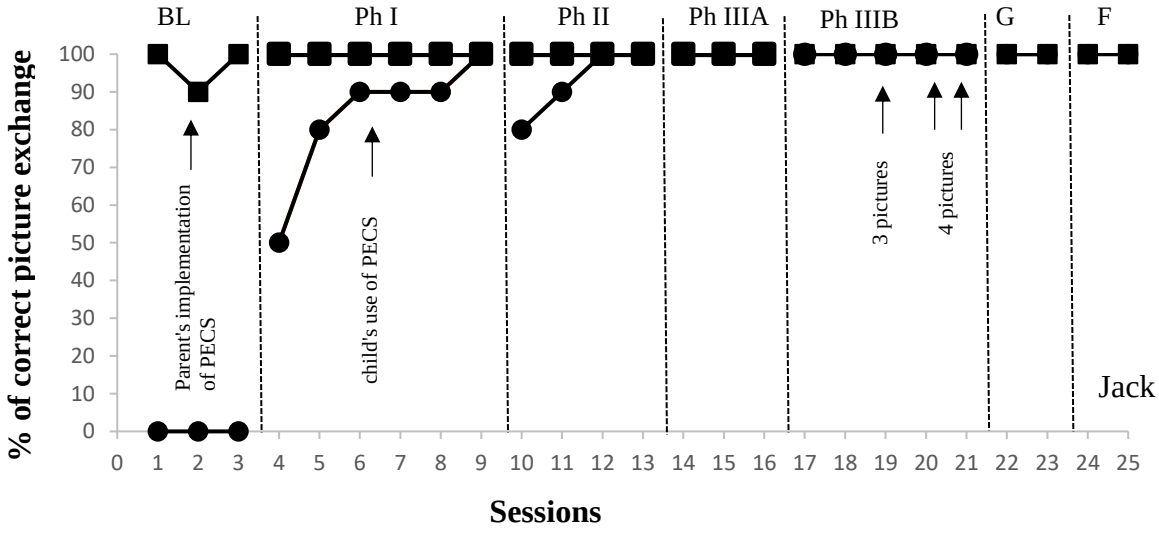

Figure 3. Percentage of independent Picture Exchange during baseline, PECS Phases, and follow up for Jack.

Note. BL= Baseline, Ph = Phase, G = Generalization, F= Follow-up

BIE and Feedback Provided to Parents

The primary measure of the parents' accuracy of PECS training was the percentage of correct implementation of PECS to their children with autism during the training sessions, which was calculated to evaluate how accurately the parents taught their children each phase of PECS. During the children's training, the investigator provided feedback to the parents through BIE when the parents implemented some steps of the PECS phases incorrectly or if they missed a step. Therefore, an additional measure was tracked, which was the frequency number of feedback messages provided to parents during their implementation. Thus, Figure 2 and 3 and Table 4 demonstrated the

percentage of steps that each parent implemented correctly. Additionally, Table 4 shows the number of feedback messages provided for each phase, the number of sessions of each phase, and the number of steps required for each phase. The results indicated that parents implemented PECS with high integrity across phases. The parents received a few number of feedback messages per sessions.

Table 4

Percentage of Procedural Integrity of Mother-implemented PECS Training and Number of Feedback Messages Received

PECS Phases	Ray's mother			Jack's father		
	% of correct steps	# of feedback messages	# of sessions	% of correct steps	# of feedback messages	# of sessions
Baseline	100%	0	3	97%	0	3
Phase I (12 steps for each session)	95%	10	6	100%	11	6
Phase II (14 steps for each session)	98%	3	5	100%	1	4
Phase IIIA (13 steps for each session)	97%	1	3	100%	0	3
Phase IIIB (13 steps for each session)	100%	BIE faded	6	100%	BIE faded	5

Overall, the findings revealed that all parents and their children with autism acquired all the training phases of PECS. Parents demonstrated a high percentage of mastery while implementing PECS during their training sessions with the investigator and the graduate student. Parents could master the criterion in a short period of three weeks. In addition, parents implemented PECS with their children effectively with high

procedural integrity. Moreover, the children with autism could master the criterion in spite of individual differences in their rate of acquisition. Ray required more training sessions during Phases I and II and had the most unstable and variable data trend. However, Jack needed more training sessions in Phase I. Both children displayed a high level of discrimination skills. All participants started training with no history of PECS. However, at the end of training, they achieved the criterion and learned to exchange PECS icons for preferred items, travel to PECS, and discriminate between the pictures of preferred items from an array of pictures in a communication book. In addition, the data demonstrated generalization skills for both children across settings, and both children could maintain the acquired PECS skills weeks after training.

Social Validity

Both parents responded to the social validity questionnaire. With regards to the question concerning the parents' understanding of the treatment package for both parents and their children, both parents indicated a *very good understanding* of the treatment (M = 5). Similarly, they both found that the treatment regarding their concerns about the children with autism was *very acceptable* (M = 5). When parents were asked if PECS would be costly if they carried out the treatment, one of them indicated that it was *not costly at all*, and the other parent indicated that it would be *a little costly* (M = 4.7). Parents also were asked about the advantage of treatment, and they both found it to be *very advantageous* (M = 5). In addition, parents indicated that their children were *very likely* to make permanent improvements in communication skills (M = 5). Ray's mother believed that Ray would *need some time to* use PECS each day. However, Jack's father thought that Jack would need *natural* time to carry out this strategy each day (M = 4).

Ray's mother considered Ray's communication problem to be *serious*, and Jack's father considered Jack's communication problem to be *a little serious* compared to other children with communication problems (M = 4.7). When parents were asked about their perception of the effectiveness of the treatment, they both found it *very effective* (M = 5). Also, they both liked the procedure of the treatment *very much* (M = 5). Parents also were asked about their children's experience during the treatment. Ray's mother stated that Ray was *natural*, and Jack's father indicated that Jack showed *some discomfort* (M = 4). Finally, when parents were asked how well they perceived the applicability of the treatment for other settings, both parents answered *very well* (M = 5).

Based on the parents' reflections on the social validity, the parents seemed to be satisfied with the treatment package and their children's outcome. The two parents thought it was easy to implement, cost effective, and that their children were likely to improve their communication skills in the future. Most importantly, they thought the treatment fit into the family's routine and was applicable to other environments.

Summary

The data revealed that both parents could acquire the PECS stages and implemented the procedure with high integrity. In addition, when parents implemented PECS with their children with ASD, both children independently exchanged pictures across three PECS phases. Finally, both children generalized and maintained the skills in a home setting. Parents received feedback through BIE. During initial sessions, parents required many prompts but required fewer or no prompts at the end of the study.

CHAPTER V

DISCUSSION

This study was designed to answer the following questions: (1) Do parents acquire mastery of PECS stages after training? (2) Does the use of Bug-in-Ear for training parents reduce errors during PECS implementation with their children with autism? (3) Do children with autism acquire communication skills by using PECS with their parents? (4) Do participants maintain the acquired skills over time? and (5) What is the perception of parents regarding PECS as measured by the *Treatment Acceptability Rating Form-Revised* (TARF-R) (Reimers, Wacker, Cooper, & DeRaad, 1992)? This chapter discusses the major results of the study in relation to each research question, describes implications for practice, and presents limitations of the study and recommendations for future research.

To this end, two parents, a mother and a father, were trained to teach their child PECS Phases I through IIIB and were then asked to implement PECS with their children with ASD to request a preferred item or activity. Results showed that both parents could successfully learn the training procedures of each phase of PECS and teach their child in using PECS to communicate with high integrity. Although there were some variabilities in the length of time required for each child to master the criterion, both children with autism acquired independent picture exchanges when parents implemented the PECS procedure. In addition, both children could generalize their communication skills by using PECS at their home as well as the therapy room. Also, they maintained the acquired skills for at least one month after the training.

Do Parents Acquire Mastery of PECS Stages After Training?

This question was intended to examine the parent's acquisition of PECS, which was measured as the percentage of correct implementations of PECS with their children with autism. In addition, the accuracy was measured during parent training prior to the implementation of PECS with their children, as the parents were required to master the criterion before implementing PECS with their children. The findings suggest that, even though parents did not correctly implement PECS during baseline sessions, both parents were able to acquire PECS procedures mastery and implement them with high procedural integrity (100%). Furthermore, the parents learned the training procedures in a short period of time, within one 40-to-60 minute session per phase.

Moreover, both parents taught their children PECS with high levels of integrity across phases. These results indicate that when parents receive appropriate training and feedback, they can train their children to use PECS to independently request desired items or activities. This confirms the assertion of Bondy and Frost (1994; Bondy et al., 1998) and findings from previous studies that parents could learn and implement PECS effectively with high procedural integrity (Carson et al., 2012; Chaabane et al., 2009; Greenberg et al., 2012; Park et al., 2011; Stiebel, 1999).

Several possible reasons may have contributed to the positive outcomes in this study. First, PECS is a systematic intervention that includes clear and specific procedural guidelines. Once a person understands the procedure and follows the steps to implement PECS, it is possible to achieve high procedural integrity. Second, the training procedure included a BST package to teach the parents how to implement PECS. This package consisted of different components that included written guidelines, verbal explanations,

video clips, modeling, practice, and immediate feedback. Third, both parents in this study had a high level of education. Although the parents' academic majors were not directly related to implementing behavioral interventions, their educational level may have had a positive impact on their understanding of the PECS procedure. Fourth, both parents voluntarily participated in the study, which indicated that the parents were motivated to learn communication intervention skills to help their children with autism.

Does the Use of Bug-In-Ear for Training Parents Reduce Errors During PECS Implementation with Their Children with Autism?

This study supports previous research findings that immediate feedback through BIE is effective in preparing pre-service teachers to implement interventions with their students (Goodman et al., 2008; Rock et al., 2009; Scheeler et al., 2006; Scheeler & Lee, 2002). However, the current study was different from the previous studies by providing training and immediate and specific feedback to parents of children with autism to implement PECS. Both parents implemented PECS effectively with high procedural integrity, which helped their children with autism to learn PECS effectively. Furthermore, the feedback was delivered covertly, with no interruption to the training, and allowed the parents to immediately practice the correct implementation of PECS.

During Phase I of PECS, parents needed several feedback messages when they implemented PECS with their children because of the problem behaviors that were displayed by their children with autism. In addition to the feedback, using BIE can assist parents in controlling sessions when their children engage in problem behaviors because the investigator can develop problem solving fast enough to keep the session going without interruption. For example, Ray easily lost his interest in the presented items, was

very distracted by any available items in the room (e.g., book, stand for the camera), or sometimes he ran from the therapy room. Also, Jack showed aggressive behavior such as throwing items and hitting when preferred items were removed. Then, the investigator asked the father to allow Jack to engage in his preferred items for one minute instead of 30 seconds. Thus, parents needed more feedback for these situations to keep the sessions going on without interruption. An example of immediate feedback parents received when implementing PECS with their children would be the investigator saying, "immediately provide the item," when the parents delayed providing reinforcers, or "show the child the picture of the item and label it," when they did not implement the training procedure correctly. Parents realized their errors as soon as they received feedback and rarely made the same error twice in a session.

However, although Phase III included several steps and the error correction procedure, parents did not need feedback when they could implement this phase without any assistance, except that Ray's mother needed one feedback message. Since the parents implemented PECS Phase I, II, and IIIA with high integrity and did not need feedback during Phase IIIA, the BIE was faded for Phase IIIB, and parents implemented this phase correctly with a high percentage of accuracy, which, in turn, led to high quality and more effective teaching. Therefore, using BIE in the therapy room with parents provided immediate, specific feedback during training that did not disrupt the children or the training sessions. In addition, the shorter feedback latency improved the acquisition and performance.

Do Children with Autism Acquire Communication Skills by Using PECS with Their Parents?

The data suggested that, even though both parents and their children with autism did not have a history of using PECS and demonstrated 0% of exchanging pictures correctly at baseline, they were able to acquire PECS behaviors through Phase IIIB. The parents' implementation of PECS training had a positive influence on their children in terms of the percentage of independent picture exchanges as well as the number of steps that they independently completed. This confirms the assertion of Bondy and Frost (1994; Bondy et al., 1998) and findings from previous studies that parents have a positive effect on their children with autism (Park et. el., 2011). Furthermore, the current study extends existing research on PECS by teaching parents as the primary PECS trainers and using BIE when they implemented PECS with their children to ensure accuracy (Goodman et al., 2008; Rock et al., 2009; Scheeler & Lee, 2002; Scheeler et al., 2006). In addition to the parents' training, other factors could facilitate the children's acquisition of PECS. Individuals with autism are visual learners (Quill, 1995), and PECS provides the visual stimuli including colored photographs of preferred items that match corresponding objects. Moreover, the use of highly preferred items including edible items and toys identified through preference assessments allowed identification of items that highly motived the individuals with autism to request preferred items through exchange of pictures. PECS included multiple teaching strategies including discrete-trials training to teach manding, errorless learning by providing full physical prompts, tact skill training by labeling the selected items, all of which may have facilitated learning (Cafiero, 1998). During the children's training, Ray showed tacting skills by verbally labeling the selected items while exchanging pictures with his mother. At the beginning of PECS training,

Jack used non-understandable speech such as mumbling when labeling and asking for something indistinctly and quietly, making it difficult for others to hear. Then, starting with Phase II training, Jack developed an understandable speech. In addition, Jack's aggressive behavior was decreased during the sessions. However, data were not collected to track these behaviors.

In addition, the children with autism were able to generalize and use the acquired skills of PECS in a different setting, which was their home setting. The children demonstrated a high percentage of correct PECS exchanges with their parents at their homes. Also, parents implemented PECS correctly with their children at their home with no immediate BIE feedback. Both children scored an average of 90% correct or higher on generalization across settings probes. This could be attributed to some factors inherent in the PECS program as well as the research process. First, PECS teaching involves mass trials, which provides opportunities for teaching sufficient multiple examples (Cooper et al., 2007). This involves teaching the participants to respond correctly to multiple examples of antecedent stimulus conditions during the training sessions, and then move to generalization sessions with untaught examples. Second, the parents' training to implement and provide opportunities for using PECS at home and community settings might have maximized the communication with using PECS with reinforcement in these settings. The natural settings are different from the training settings; thus, facilitating generalization of PECS behaviors. Third, in this study, the children were taught to request their needs and desires, and the requesting behaviors produced reinforcement for them. During the training sessions, the toys and edible items were highly desirable to the participants. However, the reinforcing items were controlled in one environment that may

have provided the motivation to perform the skills at home at any given opportunity. There are things in the environment that they love.

Do Participants Maintain the Acquired Skills Over Time?

Maintenance sessions were conducted at each family home to determine whether training for each phase contributed to the acquisition of the terminal behavior and to investigate how the child could use the acquired skill in Phase IIIB in order to terminate the training sessions. Maintenance probe data were collected one month after generalization probes using Phase IIIB. The follow-up data for Ray and Jack indicated that the learned PECS behaviors endured. Both participants were successful (80% or better independent, correct responding on probes). Ray selected the incorrect picture inadvertently in a trial of the first maintenance session, resulting in a mean percentage of 95%. The mean percentage of independent picture exchanges during maintenance probes was 100% for Jack, in that he selected the correct picture in each trial. In addition, both parents implemented PECS with high integrity. These results replicated the previous studies conducted with parents' training to implement PECS with their children with autism, in that both parents and their children with autism achieved positive outcomes during generalization and maintenance probes (Carson et al., 2012; Chaabane et al., 2009; Greenberg et al., 2012; Park et al., 2011; Stiebel, 1999).

Several factors may have contributed to achieving a high rate of criteria during the follow-up sessions. First, the motivating operations (e.g., hunger, thirst) (Cooper et al., 2007) could have influenced the children to communicate needs through PECS to receive the food item. Second, the children's cognitive ability may have influenced their skill acquisition by independently exchanging pictures with a desired item (Park et al.,

2011). Attention skills from the children could be related to the acquisition of PECS skills, especially in Phase III because they needed to look at the pictures and select the correct one in order to receive their preferred item. Ray demonstrated poor eye contact with humans; however, he had good eye contact with items. Thus, he did not take a long time to master Phase III, evidenced by the fact that his mother only implemented the error correction procedure twice. Jack demonstrated good eye contact to both people and items. Therefore, Jack was careful when selecting pictures during Phase III, and his father did not need to implement the error correction. As Ganz and Simpson (2004) mentioned, children who have higher cognitive ability may master PECS skills more rapidly than those with lower cognitive ability.

What is the Perception of Parents Regarding PECS as Measured by the Treatment Acceptability Rating Form-Revised (TARF-R)?

The social validity data suggested that both parents were satisfied with the goals, treatment package, and outcomes of PECS. The parents demonstrated that PECS was easy to implement, cost effective, and likely to have positive outcomes for their children. Most importantly, they thought the treatment fit into the family's routine, and it was applicable to other environments. Specifically, parents believed the importance on teaching both children with ASD and their parents the PECS intervention. Moreover, both parents were willing to continue using PECS and recommended that other mothers teach their child PECS. These findings in the social validity replicated the finding of the parents' perception in the Park et al. (2011) study.

Implication for Practice

This study involved training two parents and their children with autism in teaching the children with autism to teach requesting communication skills using PECS. In addition, parents received immediate feedback through BIE when they implemented PECS with their children. The findings of this study have implications for practice for parents who work with their children with autism who have deficits in communication skills. With systematic training, parents could easily acquire the PECS procedure and were able to implement PECS effectively to their children with autism. In addition, the children with autism could learn to request desired items through PECS with their parents. This study also demonstrated that PECS can be successfully implemented at the participants' homes. Parents and their children maintained using PECS at their homes after the training sessions. Ray's mother reported that they moved PECS into Ray's school setting, and that Ray could use it with his teachers and therapists. This study demonstrated an increase in communication skills between parents and their children with autism through PECS and could have reduced problem behaviors in children.

An important component of this study was the parental involvement in PECS training and their implementation of PECS with their children. Parents are fundamental to the social and communication development of their children. When parents had the opportunity to receive training, they could support their children in developing socially appropriate communication in the natural environment and had the chance to communicate effectively with their family members to generalize communication (Hill et al., 2014; Park et al., 2011). Children may also have opportunities to use PECS through

their daily routines to develop more effective and functional communication (Greenberg et al., 2012; Stiebel, 1999). In this regard, parents knew how to communicate with their children with autism, understand their children's needs and wants, and reinforce the skills at home. This has implications for practice.

Moreover, the Scheeler et al. study (2006) suggested that using immediate feedback using BIE or other means is more effective than delayed feedback in supervision. This study provided immediate and specific feedback through BIE during the parents' implementation of PECS with their children with autism, and they corrected their errors immediately. This indicates that professionals could use BIE technology to provide immediate and specific feedback to implement intervention sessions.

Limitation and Future Recommendations

Although the findings of this study demonstrated positive outcomes, some limitations were found that need to be addressed in future research. First, the parents received training only in Phase I, II, III; all the six phases of PECS were not included due to the restricted time frame for the study. Therefore, future research needs to extend the parents' training, including all six phases of PECS, in order to develop more effective results and help individuals with autism to use more functional communication.

Second, the current study conducted generalization sessions across settings, but the investigator did not conduct generalization sessions across people such as including siblings, grandparents, and any other family members. Generalization across people who are around the child could support the use of PECS at home and community settings and

remove the gap between the child with autism and family members. Thus, future research needs to expand generalization skills to facilitating generalization use of PECS.

Third, the parents who participated in this study were highly educated and all volunteered for the study. Also, this study was only conducted with two families. Therefore, the results in this study may not be generalized to parents with less education or to more families in general. Fourth, this study involves only two parents which provided limitation in demonstrating the functional relationship across participants with using multiple baseline design. Multiple baseline design requires at least three or more participants. Future research need to conduct this study with larger number of participants to generalize the findings.

Conclusion

The aim of this study was to examine the effects of using a BST package during parents' training in PECS implementation with their children with autism. Parents implemented PECS to help their children develop communication skills. During parents' implementation of PECS, an immediate feedback from the investigator was delivered through BIE technology to reduce errors. The results indicated that both parents implemented PECS process accurately and their children mastered the criterion of PECS Phases. Using BIE in the therapy room with parents provided immediate, specific feedback during training that did not disrupt the children or the training sessions. BIE reduced errors during parents' implementation of PECS with their children. However, this study provided training in PECS Phase I, II, and III with exclusion of Phase IV, V, and VI. Thus, future research needs to include all PECS Phases.

Overall, several children with autism who encounter communication impairment had used PECS to establish functional communication skills. PECS was considered to be adequate treatment and had significant impact on communication skills. In this study, individuals with communication challenges were able to develop generalization by using PECS in their actual environment which reduced their challenges. Parents found that PECS is an affective intervention and facilitates the communication between parents and their children with autism.

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APPENDIX A

PREFERENCE ASSESSMENT FORM (INDIRECT)

Child's Name: _____ Date: _____

Item	Trial									
	1	2	3	4	5	6	7	8	9	10
M&Ms										
Potato chips										
Worms										
Magnetic rods										
Dice (Game)										
Poker chips										
Rings										
Candy pop										
Coca Cola										
Marbles										
Flying disc										
Cookies										
Reeses peanut pieces										
Kool-Aid										
Fire truck										
Train										
Police car										
Activity ball										
Spiky ball										
Play Doh										
Cell phone										

APPENDIX B

FORMAL REINFORCEMENT ASSESSMENT (DIRECT)

This assessment is used to determine which items a child likes more than others and which items are the most powerful reinforces.

Child Identifier: Date:

Item	**Rejects** Score 0	**No reaction** Score 0	**Reaches for within arm distance** Score 1	**Protests when taken away** Score 2	**Shows signs of pleasure** Score 1	**Takes again** Score 1

Reinforcer Hierarchy	
1.	6.
2.	7.
3.	8.
4.	9.
5.	10.

Non–Preferred Items	
1.	4.
2.	5.
3.	6.

APPENDIX C

PECS – PROTOCOLS FOR PARENTS

Phase I: PECS Implementer Skills Assessment (for Parents)

This assessment is used for parents when they implement PECS with children with ASD to determine if follow the step when they implement PECS. Within the table, record Pass or Redo next to each step observed to indicate to what extent the step was implemented/addressed during your observation.

Communication Partner: Prompter:
Data initial: Session #:
Date:

Phase I You as Communicative Partner:	Pass	Redo	Comments
• Arranges training environment effectively – pictures available one at a time, trainers positioned appropriately, control of reinforces			
• No prompting			
• Entices appropriately			
• Uses open hand prompt effectively- appropriate timing			
• Reinforces within 1⁄2 second and provides social praise			
• No insistence on speech			
• Returns picture (while student consumes/plays with R+)			
Notes:			

Phase I You as Physical Prompter:	Pass	Redo	Comments
• Waits for student to initiate (reach for REINFORCER) for 5 s			
• Physically guides to pick up, reach, release			
• Fades prompts effectively			
• Interrupts/prevents student's interfering behaviors			
• No social interaction with student			
Notes			

PECS – Phase II

Within the table, record Pass or Redo next to each step observed to indicate to what extent the step was implemented/addressed during your observation.

Communication Partner: Prompter:

Data initial: Session #:

Date: Primary/Reliability

Phase II You as Communicative Partner:	Pass	Redo	Comments
• Arranges training environment appropriately –pictures available one at a time, trainers positioned appropriately, control of reinforces			
• Entices appropriately			
• Gradually increases distance between student and communicative partner			
• Teaches student to cross room to reach communicative partner			
• Gradually increases distance between student and communication book			
• Teaches student to cross room to reach communication book			
• Reinforces appropriately— new behavior within 1⁄2 second			
• Does not insist on speech			
Notes:			

Phase II You as Physical Prompter:	Pass	Redo	Comments
• Waits for initiation			
• Prompts removal of picture from book if necessary			
• Physically guides student to trainer if necessary			
• Physically guides student to communication book if necessary			
• Does not interact socially with the student			
• Uses backstepping if necessary			
Notes			

PECS – Phase IIIA. Simultaneous Discrimination of Pictures

Phase 3A. Discrimination Between a Highly Preferred Icon and a Distracter Icon
Within the table, record Pass or Redo next to each step observed to indicate to what extent the step was implemented/addressed during your observation.

Communication Partner: Prompter:

Data initial: Session #:

Date: Primary/Reliability

Communication partner	Pass	Redo	Comments
1. Provide two pictures of two items (one preferred and one non-preferred) so that the learner must move to and pick up the correct (preferred) picture/symbol from the two pictures.			
2. Entice the learner with both items by interacting with them.			
3. The learner has the picture/symbol in hand and moves some distance to give it to the communication partner.			
4. Provide social reinforcement as soon as the learner touches the correct picture.			
5. Immediately hand the item to the learner and name it as the exchange is made.			
6. A variety of distracter items and target pictures are provided in the communication book as the learner is able to discriminate between two or more pictures to increase the number of discriminations he/she must make.			
7. Provide no verbal prompts to the learner during the exchange.			
8. Pictures are moved around on the book (e.g., diagonal, vertical, horizontal).			

PECS – Phase IIIB. Simultaneous Discrimination of Pictures

Teaching Simultaneous Discrimination of Picture Discrimination Correction Procedure

Within the table, record Pass or Redo next to each step observed to indicate to what extent the step was implemented/addressed during your observation.

Communication Partner: Prompter:

Data initial: Session #:

Date: Primary/Reliability

Communication partner	Pass	Redo	Comments
1. As the learner is able to discriminate between two or more pictures, add pictures to increase the number of discriminations he/she must make.			
2. Offer ample opportunities for the learner to make requests.			
3. Present two preferred items to the learner with two pictures as the learner becomes more successful at discriminating.			
4. When the learner makes exchange, respond, "Okay, take it." If the learner reaches for the other item, block access and apply a correction sequence so that the learner must pick up the correct picture.			

PECS – Phase III: Error Correction Procedure

Within the table, record Pass or Redo next to each step observed to indicate to what extent the step was implemented/addressed during your observation.

Communication Partner: Data initial: Session #:

Date: Primary/Reliability

Communication partner	Pass	Redo	Comment
1. When the learner gives the wrong picture, pick up the correct picture, show it to the learner, and verbally label the picture.			
2. When the learner looks at the picture, prompt the learner to give the correct picture by holding out hand near the picture, and physically prompting if necessary.			
3. When the learner does not gives the correct picture, verbally acknowledge the correct response (e.g., "Yes, the ___."), but do NOT give the learner the object. Follow with a non-related directive (e.g., "Touch your head.").			
4. When the learner follows directive, entice him/her by interacting with the desired object (e.g., tasting food item, playing with toy).			
5. When the learner touches the correct picture, provide verbal praise.			
6. When the learner gives the correct picture, hands the desired object to the learner.			

APPENDIX D

PECS – PROTOCOLS FOR CHILDREN

PECS – Phase I (for Children)

These data collection sheets are used to ensure that children with ASD follow the steps when using PECS.

Communication Partner: Data Initial: Sessions #:

Prompter: Child Name: Date:

PECS – Phase I

Trials	Staff	Pick Up	Reach	Release	Hand?	Picture	Activity

Hand Cue:	**Y** = Communicative partner had hand open	**N** = Communicative partner had hand closed
Pick Up/Reach/Release	**IN** = Independent response	**P** = Prompted response

PECS – Phase II (for Children)

Data initial: Participant initial: Session #:

Date: Therapist: Prompter:

Trials	Travel to CP	Distance to CP	Travel to Book	Distance to Book	Picture	Note
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Travel to Trainer/Book:	**IN** = independent	**P** = prompted

PECS – Phase IIIA (for Children)

Communication Partner: Child name:

Date: Session #: data initial:

Trial	Discrimination Level	Negative Reaction	Picture	NOTE
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

H= Preferred D=Distractor (non-preferred)

PECS Phase IIIB (for Children)

Trial	Discrimination Level	Corresponding Check	Item selected	NOTE
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

H= Preferred D=Distractor (non-preferred)
C=Took same item requested IC= took incorrect item

APPENDIX E

PARENTS WRITTEN INSTRUCTION

The picture exchange communication system (PECS) is a pictorial communication strategy that is created for children with communication difficulties. This approach teaches children with autism to exchange the symbols (pictures) instead of pointing to the symbols to ask for their wants and needs.

Parents are the most important people in the lives of children with ASD and are fundamental to the social and communication development of their children. By training parents to implement PECS, children may obtain more consistent benefits from PECS without extra costs, and parents may significantly improve the targeted communicative responses of their children in natural contexts

PECS Procedures

There are six phases in PECS training protocol. Although every phase involves picture exchange as the central action, each phase targets different communication skills. Each phase is built on the skills developed from the previous phase(s) with added new skills. In this study we are going to teach parents the first three phases of PECS.

Phase I-"How" to Communicate. In this phase, the terminal objective is, that upon seeing a "highly preferred" item, the child will pick up a picture of the item, reach toward the communicative partner, and release the picture into the trainer's hand (Frost & Bondy, 2002, pp. 67). One trainer entices the child with an object that is highly desired. As the child reaches for the desired object, the second trainer, the facilitator, physically assists the child in picking up a picture for the desired object. The first trainer immediately gives the child a reward along with an appropriate comment, such as "good job" when he/she

receives the picture. Through multiple practices, the procedure teaches the child to initiate a communication act and experiencing the reciprocity aspect of communication. The Phase I procedure is fueled by explicit reinforcement chosen from highly preferred items of the child. Functionally, Phase I allows the child to gain the ability to request, which is a fundamental skill of expressive language.

Phase II - Distance and persistence. In this stage, the exchange continues with attempts to increase the child's independence. Thus, the terminal objective is that the child goes to his communication book where his picture is stored, pulls the picture off, goes to the trainer, gets the trainer's attention, and releases the picture into the trainer's hand (Frost & Bondy, 2002, p. 93). The child now is encouraged to use greater spontaneity and persistence, and to generalize the skill he acquired. The facilitator is still available for assistance as needed. Thus, the child learns to remove the picture from a display board for the exchange and must engage in more physical movement than in Phrase I in order to accomplish the exchange. However, the child is still encountering only one symbol on a board at any one time. Phase II continues to teach initiation communication, but it also teaches the child that he/she has to establish joint attention through physical efforts to complete the communication act.

Phase III - Picture discrimination. The terminal objective for this phase is that the child requests desired items by going to a communication book, selecting the appropriate pictures from an array, and going to a communication partner and giving him/her the picture (Frost & Bondy, 2002, p.123). In this stage, the child is asked to discriminate between two items on a board, choosing which item he wants, or which activities he wants to try. The child begins by answering forms of the question "What do you want?"

but these are faded quickly so the child will make choices spontaneously as well as in response to a question. As the child becomes more comfortable making discriminations, a third item may be added, and so on. This phase teaches the child one-to-one coordination between the picture symbols and the objects. It lays the foundation of naming or labeling objects, and continues teaches the child to request from one item to multiple items.

APPENDIX F

SOCIAL VALIDITY FORM

Name of Rater: _____ Date: _____

Please complete the items listed below. The items should be completed by placing a check mark on the line that best describes how you feel about the PECS activity your child has just had.

1. How clear was your understanding of the PECs treatment?

_____	_____	_____	_____	_____
Not at all clear	A little unclear	Neutral	Clear	Very clear

2. How acceptable did you find the treatment regarding your concerns about your child?

_____	_____	_____	_____	_____
Not at all acceptable	A little acceptable	Neutral	Acceptable	Very acceptable

3. How costly will it be for you to carry out this treatment?

_____	_____	_____	_____	_____
Not at all costly	A little costly	Neutral	Costly	Very costly

4. To what extent do you think there might be disadvantages in the treatment?

_____	_____	_____	_____	_____
Very disadvantageous	A little disadvantageous	Neutral	Advantageous	Very advantageous

5. How likely is this treatment to make permanent improvements in your child's communication skills?

_____	_____	_____	_____	_____
Not at all likely	A little likely	Neutral	Likely	Very likely

6. How much time will be needed each day to carry out this treatment?

_____	_____	_____	_____	_____
Very little time will be needed	A little time will be needed	Neutral	Some time will be needed	Much time will be needed

7. Compared to other children with communication problems, how serious were your child's problems?

Not at all serious	A little serious	Neutral	Serious	Very serious

8. How effective was this treatment for your child?

Not at all effective	Not very effective	Neutral	Somewhat effective	Very effective

9. How much do you like the procedures used in this treatment?

Do not like them at all	Do not like them much	Neutral	Like them somewhat	Like them very much

10. How much discomfort did your child experience during the course of this treatment?

Much discomfort	Some discomfort	Neutral	Not much discomfort	Not discomfort

11. How well do you think PECS would work in other settings such as ordering food in a restaurant?

Not at all well	Not Very well	Neutral	Well	Very well