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Philadelphia College of Osteopathic Medicine

Department of Psychology

EVALUATION OF A PICTURE EXCHANGE COMMUNICATION SYSTEM
PROGRAM FOR CHILDREN WITH AUTISM

By Jessica Rachel Mark

Submitted in Partial Fulfillment of the Requirements for the Degree of

Doctor of Psychology

March 2019

**PHILADELPHIA COLLEGE OF OSTEOPATHIC MEDICINE
DEPARTMENT OF PSYCHOLOGY**

Dissertation Approval

This is to certify that the thesis presented to us by

_____ on the _____ day of _____,

20____, in partial fulfillment of the requirements for the degree of Doctor of Psychology,

has been examined and is acceptable in both scholarship and literary quality.

Committee Members' Signatures:

_____, Chairperson

_____, Chair, Department of Psychology

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ABSTRACT

The current study examined the effectiveness of the Picture Exchange Communication System (PECS) as a functional communication training (FCT) program implemented by a local community agency specializing in autism diagnosis and treatment in developing communication skills among children with autism spectrum disorder (ASD). Conducted using archival data, this study used a within-subjects repeated measures research design to determine if PECS improved the overall communication skills of enrolled participants at the agency, as measured by the Vineland Adaptive Behavior Scales, Third Edition (Vineland-3) and the Autism Treatment Evaluation Checklist (ATEC). Individual growth on communication goals was measured by comparing goals concerning the use of appropriate communication set before treatment and goals achieved after treatment. A total of 44 children ranging in age from 2 years to 6 years participated in the PECS program, and clinicians and parents completed treatment assessments. The results indicated that the differences between pretreatment and posttreatment measures for the Communication domain on the Vineland-3 and the Speech/Language Communication (I) subtest on the ATEC were significant. There was no significant relationship between the differences in pretreatment and posttreatment scores on the Vineland-3 Communication domain and the ATEC Speech/Language Communication (I) subtest and the length of time between assessments. Individual growth on communication goals was achieved by most participants.

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CHAPTER 1

INTRODUCTION

Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterized by impairments in social and communicative behavior, a restricted range of interest, and excessively repetitive behaviors (American Psychiatric Association [APA], 2013; Faja & Dawson, 2013). The prevalence of the disorder is increasing at an alarming rate in the United States and other countries (Centers for Disease Control and Prevention [CDC], 2016). Research has shown that ASD is associated with genetic and environmental risk factors (APA, 2013; Faja & Dawson, 2013). The impairments of ASD are persistent across multiple settings, and the deficits in communication and interactions result in social impairment and negatively affect the acquisition of speech and language skills. The acquisition of speech and language skills are important in the school setting where the learning process is socially mediated and language based (APA, 2013; Brock & Hart, 2013; Frazier et al., 2014; Hallahan, Kauffman, & Pullen, 2012; Inglese & Elder, 2009; Koning, Magill-Evans, Volden, & Dick, 2013; Pelphrey, Adolpys, & Morris, 2014; Smith & Tyler, 2010). Early intervention alleviates the impairments of ASD, and federal legislation mandates this intervention to improve the quality of life for individuals with ASD (Heath, Ganz, Parker, Burke, & Ninci, 2015; Love et al., 2005). The federal government has encouraged educators to use evidence-based interventions that have been comprehensively evaluated to positively impact individuals with ASD (McCoy, Holloway, Healy, Rispoli, & Neely, 2016; Wang & Spillane, 2009; Wong et al., 2015).

The deficits in social communication and social interaction in individuals with ASD are often pervasive and sustained from early childhood through adulthood, limiting

and impairing daily functioning and having a negative impact on success and the quality of life in multiple settings (APA, 2013). Research indicates that early diagnosis and intervention help to alleviate the impairments of ASD and help individuals with ASD to succeed (Heath et al., 2015; Love et al., 2005). Functional communication training (FCT) is an evidence-based intervention program that has shown effectiveness in increasing appropriate forms of communicative behaviors and decreasing inappropriate forms of communication in individuals with ASD (Franzone, 2009; Lalli, Browder, Mace, & Brown, 1993; Vaughn & Dammann, 2001). This intervention program is a systematic practice that helps individuals with ASD to replace inappropriate behavior or subtle communicative acts with more appropriate and effective communicative behavior or skills (Buckley & Newchok, 2005; Franzone, 2009; Heath et al., 2015). The Picture Exchange Communication System (PECS) is an alternative or augmentative system of communication used to train individuals with ASD and other social communicative disorders to communicate effectively (Frost & Bondy, 2002). The program is based on the principles of Applied Behavior Analysis (ABA) and teaches strategies, reinforcement strategies, error correction strategies, and generalization strategies to help individuals learn how to communicate effectively (Frost & Bondy, 2002). PECS, which has demonstrated effectiveness, is an FCT plan that actively teaches language skills and builds learning environments that help individuals with ASD develop functional communication skills and eliminate challenging behaviors and inappropriate methods of communication (Frost & Bondy, 2002). The implementation of the PECS program for use with individuals with ASD has been increasing worldwide in schools, community agencies, and the home setting. The use of PECS appears to be associated with

improvements in functional communication skills and other positive behavior changes, but more research is necessary to determine the efficacy of this system as the use increases (Pyramid Educational Consultants, 2018).

Statement of the Problem

Federal laws, such as the Individuals with Disabilities Education Act (IDEA) and the Every Student Succeeds Act (ESSA), establish rights for individuals with disorders, and the IDEA guarantees that every individual, including those with disabilities, the right to a free and appropriate public education tailored to individual needs and delivered in the least restrictive environment (Semrud-Clikeman & Ellison, 2009; United States Department of Education, 2018). These laws stress the need for all schools in the United States to guarantee that efforts are made to ensure that students with disabilities are able to communicate in order to help them achieve academic success (Andzik, Cannella-Malone, & Sigafos, 2016). ASD is a disability characterized by significant deficits in communication and interactions with restricted, repetitive patterns of behavior, interests, and activities that result in social impairment and create obstacles to learning and academic success (Hallahan et al., 2012). Individuals with ASD lack a functional system of communication and often engage in challenging behaviors and inappropriate modes of communication in order to obtain attention and communicate their desires. FCT has shown to be an evidence-based effective intervention that increases appropriate communicative behavior and decreases challenging behavior and inappropriate forms of communication in individuals with ASD (Lalli et al., 1993). PECS is an alternative or augmentative system of communication and an FCT plan that improves communication skills in individuals with ASD (Frost & Bondy, 2002). The training manual for PECS

has been updated and translated into 15 languages worldwide, and the program continues to be implemented successfully in educational and home settings with positive results throughout the world (Pyramid Educational Consultants, 2018). In response to federal legislation mandating the ability to communicate in order to succeed and experience a better quality of life and the increased use of PECS, more research concerning the efficacy of FCT programs such as PECS implemented in community mental health settings is necessary.

Purpose of the Study

The purpose of this study was to examine the effectiveness of the PECS as an FCT program used at a local community agency that specializes in autism diagnosis and treatment. This study examined the effectiveness of the PECS program by analyzing pretreatment and posttreatment measures of functional communication skills using the Vineland Adaptive Behavior Scales, Third Edition (Vineland-3) and the Autism Treatment Evaluation Checklist (ATEC) rating scales completed by clinicians at the agency and parents of the participants. Progress for individualized communication goals was also examined. It was hypothesized that the FCT program, specifically PECS, would improve the overall functional communication skills of enrolled participants at the agency. Functional communication skills were defined as bi-directional behavior directed to another person who in turn provides related direct or social rewards. The time frame for data collection was two treatment plans which consisted of approximately 120 days each.

CHAPTER 2

LITERATURE REVIEW

Autism Spectrum Disorder

Etiology and prevalence. ASD is a neurodevelopmental disorder that presents symptoms early in development, usually before the individual enters school, and is characterized by impairments in social and communicative behavior, a restricted range of interests, and excessively repetitive behaviors (APA, 2013; Faja & Dawson, 2013). The prevalence of the disorder in the United States and other countries is growing and occurs in approximately 1 in 59 children, with rates of diagnosis increasing 10% to 17% per year (Centers for Disease Control and Prevention [CDC], 2018). There are likely many causes of ASD, with many different factors influencing the likelihood that a particular child will develop ASD (CDC, 2016). Research has shown that ASD is associated with genetic and environmental risk factors. Heritability estimates for ASD range from 37% to over 90%, and 15% of ASD cases are associated with gene mutations (APA, 2013; Faja & Dawson, 2013). The role of ASD susceptibility with regard to genes and gene mutation is complex, and multiple genes interact to increase susceptibility to ASD. Gene expression and effects of genes are influenced by environmental factors. Environmental risk factors include advanced parental age, low birth weight, fetal exposure to pollution and pesticides, maternal infection, and the use of certain medications during pregnancy (APA, 2013; Faja & Dawson, 2013). This interaction between genetic and environmental risk factors results in the expression of symptoms and impairment in individuals.

Impairment. The symptoms of ASD are persistent across multiple settings, and impairments in social communication and interaction are exemplified by weaknesses in

social-emotional reciprocity, nonverbal communication, and interpersonal relationships (APA, 2013; Brock & Hart, 2013; Frazier et al., 2014; Inglese & Elder, 2009; Koning et al., 2013; Pelphrey et al., 2004). The clinically significant deficits in communication and interactions and the restricted, repetitive patterns of behavior, interests, and activities result in social impairment that creates many obstacles to learning and development (Hallahan et al., 2012). The lack of reciprocal social interaction negatively affects acquisition and use of preverbal communication, speech, and language skills, which are all important in the learning process because most instruction in the school setting is socially mediated and language based (Smith & Tyler, 2010).

ASD is characterized by persistent deficits in social communication and social interaction across multiple contexts, including deficits in social reciprocity and nonverbal communicative behaviors used for social interaction. The deficits in communication and social interaction are often pervasive and sustained from early childhood through adulthood, limiting and impairing daily functioning. Verbal and nonverbal deficits in social communication have varying manifestations, depending on age, intellectual level, language ability, and treatment history. Language deficits may range from a total lack of speech to language delays, poor comprehension of speech, echoed speech, and overly literal language. Even when language skills such as vocabulary and grammar are intact, the use of language for reciprocal social communication is often impaired. Absent, reduced, or atypical use of eye contact, gestures, facial expressions, body orientation, or speech intonation are often present in individuals with ASD, and these individuals have difficulty using language as a tool for social interaction (APA, 2013; Hallahan et al., 2012).

ASD usually presents in early childhood and early school years as delayed language development accompanied by a lack of social interest or unusual social interactions. Babbling and verbalizations may be abnormal in tone, pitch, and rhythm, and pronoun reversals are commonly observed. Difficulties with vocabulary, syntax, and the ability to converse is absent or characterized by irrelevant details or inappropriate shifts in topic (Sheinkopf, Munday, Oller, & Steffens, 2000; Whitbourne & Halgin, 2013; Wick-Nelson & Israel, 2009). The communication deficits in individuals with ASD have a long-lasting, negative impact on success and the quality of life for these individuals.

The combination of skill deficits associated with ASD typically results in pervasive and enduring impairments that affect many aspects of the individual's life from childhood through adulthood (Billstedt, Gillberg, & Gillberg, 2005; DePape & Lindsay, 2016; Eaves & Ho, 2008; Howlin, Goode, Hutton, & Rutter, 2004). Early diagnosis and early intervention for children with ASD is the best way to alleviate the symptoms and change the course of the disorder because primary aged individuals are still building appropriate communication skills, and these communication skills are easier to learn at a younger age. Continued support and intervention help individuals with ASD to succeed and experience a better quality of life. Federal legislation mandates early intervention, which is the most effective means of changing an individual's quality of life (Heath et al., 2015; Love et al., 2005).

Legislation

Federal legislation, including the IDEA, Section 504 of the Rehabilitation Act, the Americans with Disabilities Act (ADA), and the ESSA, establishes the rights of children and adults with disorders such as ASD. These laws ensure that all individuals receive

appropriate education services and fair treatment in public schools, other educational settings, and the workplace.

Individuals with Disabilities Education Act. The IDEA, passed in 1975 and most recently reauthorized in 2004, guarantees every child, including those with disabilities, the right to a free and appropriate public education tailored to individual needs and delivered in the least restrictive environment appropriate to the individual's needs. This Act also guarantees the right of children and their parents or guardians to timely evaluation, access to all meetings and paperwork, and transition planning. Federal funds to states and school districts in support of additional costs for special education are also provided (Semrud-Clikeman & Ellison, 2009; United States Department of Education, 2018). Under IDEA, an evaluation to determine a child's educational needs is done by qualified individuals in order to develop an individualized education program (IEP) for that child. An IEP must comply with the requirements of the IDEA and be formulated to provide educational benefits to the child. A school district's methodology must be designed to accomplish the goals of the IEP and provide educational benefit to the child, or requests for a more appropriate program, reimbursement, compensatory education, or program revision may be granted (Etscheidt, 2003). The IEP is important for a child with ASD to ensure that the child receives an appropriate education and benefits from that education. An IEP for a child with ASD should include goals and objectives specific to each child's unique needs, identify services necessary for the child to achieve the goals, and provide a method for evaluating the child's progress (Autism Society, 2016).

Section 504, Americans with Disabilities Act, and Every Student Succeeds

Act. Section 504 of the Rehabilitation Act of 1973 prohibits discrimination against individuals with disabilities in federally funded programs and activities. All students, including those with ASD, are eligible for special education services under the IDEA and are also eligible under Section 504 (Semrud-Clikeman & Ellison, 2009). The ADA, passed in 1990, protects individuals with physical or mental impairments or disabilities that substantially restrict one or more major life activities, such as learning, from discrimination in schools, the workplace, and other environments. The ESSA, a revision of the No Child Left Behind (NCLB) Act enacted in 2002, was signed into law in 2015 and requires schools to meet standards for educational content and student achievement, provide data on student progress including students with disabilities, and focus on clear goals of fully preparing all students for success in college and careers (Jacob, Decker, & Hartshorne, 2011; United States Department of Education, 2018). Children with ASD experience deficits that inhibit their academic achievement and resulting success in life. These laws serve individuals with ASD in helping them obtain special educational services. The special services help individuals with ASD achieve success in daily living, school, and the workplace (Hallahan et al., 2012; Smith & Tyler, 2010).

Ethical and Legal Considerations

The IDEA, Section 504 of the Rehabilitation Act, the ADA, and the ESSA stress the need for all schools in the United States to guarantee that efforts are made to help all students, including those with disabilities, communicate with others and reach their full potential (Andzik et al., 2016). Parents of children with disabilities such as ASD have challenged the appropriateness of school district programs and interventions in the court

system through litigation. Etscheidt (2003) reviewed 68 hearings and cases concerned with the appropriateness of the IEP for children with ASD published between 1997 and 2002 and found that the goals developed in an IEP must be consistent with the needs identified in the evaluation of the child. Individuals involved in this process must be qualified to make educational placement decisions, and the educational methodology must achieve the goals set forth in the IEP.

Intervention

Early intensive interventions may reduce the symptom expression of ASD and produce more adaptive processes of interaction with the environment (CDC, 2016; Faja & Dawson, 2013). In 2009, the National Longitudinal Transition Study-2, funded by the United States Department of Education, Office of Special Education Programs and conducted by a scientific research institute, reported that approximately 45% of individuals with intellectual disabilities, 39% of individuals with ASD, and 28% of individuals with multiple disabilities were unable to communicate effectively which suggests that many students with disabilities require intervention in order to develop effective communication skills. Early diagnosis and effective interventions have a positive impact on the quality of life for individuals with disabilities such as ASD (Johnson, Reichle, Feeley, & Jones, 2012). The development and daily use of communication skills directly impact the future outcomes and quality of life experienced by the ASD population (Kanne et al., 2011; Klin et al., 2007; Liss et al., 2001; Radley, McHugh, Taber, Battaglia, & Ford, 2017). Effective interventions require high levels of coordination, consistency, and structure, and in order to be more effective, must begin early in the child's life (Hallahan et al., 2012; Smith & Tyler, 2010).

Following the reauthorization of IDEA in 2004 and the adoption of the ESSA of 2015, the United States government has encouraged educators and researchers to implement evidence-based interventions that are derived from scientific research and have met rigorous peer reviews and standards affirming their effectiveness (Wang & Spillane, 2009; Wong et al., 2015). Evidence-based interventions have been comprehensively evaluated using explicit guidelines to rigorously assess the research design, evidence base, and outcomes of the intervention (McCoy et al., 2016). Organizations such as the National Professional Development Center (NPDC) on ASD have adopted initiatives to identify and evaluate evidence-based interventions and use guidelines to qualify an intervention as evidence-based by considering components such as participant selection and assignment, background information, fidelity measures, outcome measures, data analysis, and experimental design (National Autism Center, 2009; Otero, Schatz, Merrill, & Bellini, 2015; Wang & Spillane, 2009; Wong et al., 2015). Interventions designed using ABA principles are identified as effective evidence-based interventions for increasing social and communication skills in children and adolescents with ASD in their natural environment (Turygin & Matson, Hattier, & Belva, 2014; Walton & Ingersoll, 2013; Wong et al., 2015). One intervention designed using ABA found to be effective for treating ASD is FCT (Matson, Hattier, & Belva, 2012; Turygin & Matson, 2014; Walton & Ingersoll, 2013; Wong et al., 2015).

Functional communication training. Individuals with disabilities such as ASD lack a functional system of communication and often engage in challenging behavior in order to obtain attention and communicate their desires. FCT is an effective intervention for increasing appropriate forms of communicative behaviors and decreasing

inappropriate forms of communication, such as challenging behavior, in individuals with disabilities including ASD (Lalli et al., 1993). Challenging behaviors, such as aggression, self-injurious behaviors, stereotypy, including repetitive hand movements or repetitive speech, and noncompliance are common in individuals with ASD (Baghdadli, Pascal, Grisli, & Aussiloux, 2003). If these often severe and chronic challenging behaviors are not addressed, individuals with disabilities such as ASD are at risk for poor academic achievement, adult mental health concerns, and peer rejection (Dunlap et al., 2006). In order to decrease these risks, challenging behaviors can be addressed using consistent implementation of evidence-based practices such as FCT.

FCT procedure. FCT involves assessing the communicative function of an individual's challenging behavior and then teaching the individual how to use a more appropriate form of communication to convey the desired message. The process of FCT involves identifying and analyzing the environmental conditions and factors that evoke and maintain the challenging behavior followed by the implementation of an intervention that teaches an individual a functionally equivalent communicative replacement behavior in order to communicate the desired message (Wacker et al., 2013). The mode of communication that an individual is most proficient in may be the most effective for use in the replacement behavior, but teaching a novel communicative response using a different, unfamiliar mode of communication, such as verbal, pictorial, or gestural, or a new response within the same mode in the replacement behavior may be more effective (Winborn, Waker, Richman, Asmus, & Geier, 2002; Winborn-Kemmerer, Ringdahl, Waker, & Kitsukawa, 2009). After learning the replacement behavior, further intervention strategies help the individual to generalize and maintain the replacement

behavior across other individuals, settings, and times (Calculator, 1988; Falcomata & Wacker, 2013; Tiger Hanley, & Bruzek, 2008).

FCT is a systematic practice to replace inappropriate behavior or subtle communicative acts with more appropriate and effective communicative behavior or skills. A Functional Behavior Analysis (FBA) is typically conducted to determine the function of an interfering behavior and what the individual is trying to communicate, and then FCT is implemented to further identify the inappropriate behavior and teach an appropriate replacement behavior that is easy for the individual to use and serves the same purpose as the interfering behavior. For example, an inappropriate behavior of biting another child in order to get a toy that the child is playing with would be identified and replaced by a more appropriate behavior that would result in the sharing of the toy. A FBA is a process that includes a variety of means of evaluating why an individual is engaging in a particular behavior, such as checklists and observations in typical settings where the behavior occurs, and experimentally manipulating a number of possible conditions while collecting data to measure the frequency of the behavior in each condition. Considerations for a replacement behavior include choosing a mode of communication, such as speech, sign language, or augmentative or alternative communication, that would be most effective for the individual in replacing the challenging communicative behavior (Buckley & Newchok, 2005; Franzone, 2009; Heath et al., 2015).

FCT efficacy. Andzik et al. (2016) analyzed the literature to determine whether practitioner-implemented FCT is an evidence-based practice that results in socially significant increases in appropriate replacement communicative responses and decreased

challenging behaviors, as well as generalization and maintenance of behavior change.

This analysis found that FCT interventions yield generally positive results, and teachers and other school personnel implementing these interventions in the school setting have achieved success with reducing challenging behavior and increasing appropriate communicative functions (Andzik et al., 2016). Implementing FCT in varied and more natural environments has been shown to be effective in promoting generalization of skills (Franzone, 2009). The National Professional Development Center on Autism Spectrum Disorder noted that because FCT is an evidence-based practice and federal law dictates the use of evidence-based practices in the classroom, this training should be a focus in the classroom (Franzone, 2009; Vaughn & Dammann, 2001).

Prior to the development of FCT, behavioral interventions for challenging behavior focused on reactive approaches, such as punishment or withholding reinforcement, which decreased challenging behavior, but did not directly teach replacement behaviors or more socially appropriate behaviors (Carr & Durand, 1985). Carr and Durand (1985) developed FCT, a nonaversive alternative evidence-based practice intervention to address the behavioral concerns for students with communication impairments that went beyond the use of extinction, timeout, response cost, overcorrection, and other aversive procedures (Carr & Durand, 1985; Heath et al., 2015). FCT is based on the assumption that challenging behavior may be a means for an individual to communicate needs when he or she is unable to communicate those needs in a more socially acceptable method, such as through conventional speech. Teaching socially appropriate communicative responses to replace inappropriate communicative responses and challenging behaviors diminishes these behaviors and helps an individual

who exhibits these behaviors to achieve more effective communication of needs (Carr & Durand, 1985; Heath et al., 2015).

FTC has been shown to be effective with early childhood, elementary, and older children and has been used effectively with children and adolescents with ASD. Evidence-based studies conducted in clinical settings, schools, and home environments have found that this training targets skills that help children with ASD effectively decrease the incidence of interfering behaviors and replace these behaviors with more appropriate effective behaviors in order to communicate with others in a variety of situations and settings (Franzone, 2009). Comparing the effectiveness of FCT across age groups and disabilities and with different modes of communication is important in demonstrating the effectiveness of this intervention.

Heath et al. (2015) completed a meta-analytic review of FCT effectiveness across mode of communication, age, and disability with 36 single-case studies evaluating the impact of FCT on challenging behaviors of individuals with disabilities and found that FCT had strong overall effects and was more effective with individuals with ASD than individuals with intellectual disabilities (Heath et al., 2015). Studies were selected from a variety of databases limited to the years 1980 through 2011, and each study had participants with a diagnosed disability other than speech impairment, included a measurement of either challenging behavior or adaptive behavior, such as aggression, self-injury, or on-task behavior, and used FCT as the primary intervention (Heath et al., 2015). The effect size for each study was calculated using a robust improvement rate difference to compare baseline performance to intervention performance, and robust scores were combined to determine the overall effectiveness of FCT (Heath et al., 2015;

Parker, Vannest, & Brown, 2009). Each study was coded using the moderating variables of mode of communication, participant age, and primary disability. Modes of communication included aided augmentative and alternative communication (A-AAC), unaided-augmentative and alternative communication (U-AAC), verbal, or multiple. A-AAC included any type of speech generating device or picture cards to generate the communicative word or phrase. U-AAC included communication that did not require additional tools or devices, such as sign language, gestures, tapping someone on the shoulder, or pointing. Verbal included any verbal response using the vocal cords. Multiple included any participant choice for communicative responses. Twenty-eight percent of the participants were in the primary age group, ages 0 to 5 years old; 40% of the participants were in the elementary age group, ages 6 to 12 years old; 16% of the participants were in the secondary age group, ages 13 to 21 years old; and 16% of the participants were in the adult age group, ages 22 and older. Primary disability was coded as ASD or intellectual disability (Heath et al., 2015).

The meta-analysis enhanced previous work testing the effectiveness of FCT by evaluating moderating variables, including mode of communication used, age of participant, and disability of participant, and found that FCT is an evidence-based practice that is highly effective in decreasing challenging behavior. The use of verbal communication and aided augmentative and alternative communication resulted in stronger effectiveness of FCT than the use of unaided augmentative and alternative communication. FCT was most effective with primary age participants, but this result was not statistically different from effectiveness among secondary age participants. The effectiveness of FCT for primary, elementary, and secondary age participants was

statistically significant when compared to adult participants, but the effects were moderate for all age groups. FCT was significantly more effective for individuals with ASD than for individuals with intellectual disability (Heath et al., 2015).

Protocols. FCT is an effective intervention for decreasing challenging behavior and replacing that behavior with a more appropriate one, and FCT has been shown to be very well suited to making a positive impact on individuals with ASD. The mode of communication used for the FCT should be selected based on the individual's ability to use that mode of communication. Various forms of communication, including verbal, augmentative or alternative, gestural, sign language, pictorial, or a speech-generating device, may be used in FCT. Therapists working with individuals with ASD use a variety of training protocols, strategies, and curricula to teach communication skills to these individuals. Speech imitation protocols, sign language protocols, and picture symbol-based protocols are all training protocols used with the ASD population, but these protocols have limitations (Frost & Bondy, 2002; Heath et al., 2015).

All three of these protocols require eye contact and imitation and involve social consequences, areas in which individuals with ASD often struggle. Speech imitation protocols require eye contact, gross motor imitation, oral and motor imitation, speech imitation, word imitation, and a great deal of time for training. Sign language protocols require fine motor skills and communicative partners who are able to use sign language. Picture symbol protocols teach individuals to act on a picture instead of another individual, which eliminates the social interaction in communication. One example of a picture symbol protocol is the PECS (Frost & Bondy, 2002).

Picture exchange communication system. PECS was developed in 1985 in order to train individuals with ASD and other social communicative disorders to communicate effectively. In PECS, an individual acts on a picture and learns how to approach a communicative partner, giving the picture to that partner in exchange for a desired item, resulting in a communicative act within a social context (Frost & Bondy, 2002). PECS was developed for use with preschool students with ASD and other social communicative disorders who do not exhibit functional or socially acceptable speech. This training protocol is based on the principles of ABA and uses teaching strategies, reinforcement strategies, error correction strategies, and generalization strategies (Charlop-Christy, Carpenter, Le, LeBlanc, & Kellet, 2002; Frost & Bondy, 2002). PECS requires few complex motor movements on the part of the speaker, does not require the listener to be familiar with an additional language, has a relatively low user cost, is portable and suitable for use in many settings, can be taught relatively quickly, incorporates functional communicative responses that promote meaningful interactions between the child and the environment, and requires the child to approach a listener to initiate interaction prior to emitting a referential communicative act (Bondy, 2001). Children with ASD often exhibit social orientation deficits, functional communication skill deficits, and lack sensitivity to social reinforcers (Frost & Bondy, 2002). There are an increasing number of training programs that address teaching these students verbal operants. The design of PECS and the sequence of initial training steps are influenced by Skinner's description of verbal operants and a behavior analytic perspective regarding ASD (Frost & Bondy, 2002). PECS is used for the development of functional

communication and addresses an individual's current repertoire and deficits, as well as the types of consequences that may be effective (Frost & Bondy, 2002).

PECS procedure. PECS implementation consists of six phases. Phase one involves exchanging single pictures for desired activities or items. Phase two involves using single pictures in new places or with different people. Phase three involves discriminating or selecting from two or more pictures. Phase four involves constructing simple sentences such as pairing the "I want" picture with a desired item. Phase five involves learning to use PECS in response to a question such as, "What do you want?". Phase six involves using PECS to comment on the environment with simple sentence starters, such as, "I see," "I hear," and "I feel." When picture repertoires increase, changing to an electronic system such as an iPad that can accommodate more symbols is practical for users of PECS. Using PECS, individuals with limited or no speech can initiate requests and describe observations through the use of pictures which may supplement, support, and promote communication development (Bondy, 2001; Hallahan et al., 2012).

In the use of PECS, individuals learn the basic rules of communication and how to communicate through the use of pictures as the communicative referent. Individuals with ASD have difficulty responding to social reinforcement, which interferes with language development. After learning to communicate with single pictures, individuals using PECS learn how to combine pictures to learn a variety of grammatical structures, semantic relationships, and communicative functions (Charlop-Christy et al., 2002; Frost & Bondy, 2002). The PECS protocol is an FCT plan for actively teaching language skills and building learning environments in which individuals develop functional

communication skills and eliminate challenging behaviors and inappropriate avenues of communication (Frost & Bondy, 2002).

PECS focuses on creating and establishing operations and functional relations with the environment, and children are taught to use mands or verbal operants in which the response is reinforced by consequence. These operants are behaviors defined by their effect on the environment or their functional relation to preceding and consequential events. In the use of mands, there is a direct relationship between the mand, the antecedent, and the postcedent. A mand is a verbal operant in which the response is reinforced by a characteristic consequence. The mand repertoire is important for early language learners and increases the probability that early language learners, including individuals with communication disabilities such as ASD, will obtain access to specific items, activities, and actions delivered or controlled by another individual. For example, an individual using the mand, "I want the ball" would result in the consequence of another individual giving the ball to the first individual, and this would be the postcedent. This postcedent would serve as a strong reinforcer of the behavior of using the mand, "I want the ball." The direct establishment of contact with a listener prior to emitting a verbal operant and receiving a consequence is an important feature of PECS that enhances the success functional communication development, particularly for children with ASD. The reinforcement of verbal behavior is dependent on the mediation of another individual. For example, the verbal operant or mand, "I want some milk" may initiate the consequence of receiving some milk. PECS also incorporates the prompting of delay, which transfers the stimulus control of the communicative behavior to the presence of the desired item. Strong reinforcers, such as providing consequences in

response to mands, are likely to be supported in the natural environment, and the focus on mands in the PECS program contributes to the initiation of verbal behavior. Verbal and pictorial mands are presented simultaneously, and when the child begins to imitate vocalizations, the two responses may be reinforced simultaneously. The PECS procedure may promote generalization by incorporating child selected reinforcers, multiple settings, and interactions with multiple trainers that occur in the natural environment (Bondy, 2012; Charlop-Christy et al., 2001).

PECS efficacy. Research has demonstrated the efficacy of PECS with regard to the emergence of speech, improved social communicative behaviors, and decreased problem behavior (Charlop-Christy et al., 2002). Charlop-Christy et al. (2002) provided the first empirical evidence of the efficacy of PECS and added experimental data to support the use of PECS for FCT for children with ASD with their study examining the effects of PECS training on the emergence of speech in play and academic settings. The efficacy of the PECS program was assessed in terms of training needed for mastery of PECS skills, the development of spoken language in the form of spontaneous and imitative speech, the increase in social communicative behavior, and the decrease in problem behavior. Three boys, ages 3, 5, and 12 years, with ASD who did not speak or rarely spoke were the participants in the study. All three boys mastered PECS within a relatively short time, increased verbal speech, increased social communicative behavior, and decreased problem behaviors (Charlop-Christy et al., 2002).

In 2009, a comprehensive review of research on PECS was done in order to synthesize the scientific evidence supporting the effectiveness of PECS (Sulzer-Azaroff, Hoffman, Horton, Bondy, & Frost, 2009). The review examined 34 published research

articles that included data on PECS. All of the studies examined in the articles followed the PECS protocol, provided data on the outcomes of the studies, and represented a fair, unbiased group of the current literature. The studies investigated various outcomes of PECS use, such as the facilitation of functional communication, language skill generalization to other settings, the effects on disruptive behavior, and the effects when compared to other alternative augmentative communicative systems. The specific effects of PECS use varied across studies, but general outcomes included improved communication between participants and adults across settings, generalized improved communication across new settings, decreased disruptive behavior, and participants using PECS performed equivalently or better than participants using other alternative augmentative communicative systems and teaching methods. The important finding is that the majority of participants in all of the studies experienced improvement in communication skills as a result of the PECS intervention (Sulzer-Azaroff et al., 2009).

The application of the PECS program with individuals with ASD as well as other developmental disabilities has been increasing. Personnel trained to implement PECS are found in dozens of countries, and PECS is implemented in schools, agencies, and home settings worldwide. Investigations of the effectiveness of PECS continue to demonstrate a positive impact on speech production and improved functional communication skills. A growing body of national and international research supports the conclusion that PECS is a promising program for teaching functional communication skills to a variety of nonspeaking individuals, including those who speak a language other than English. There has been a consistent growth in PECS-related research in recent years. An increase in professional workshops, conferences, professional articles, and an expanding body of

scientific research concerning the implementation of PECS and the resulting efficacy is evidence of PEC'S global application (Bondy, 2001, 2012; Sulzer-Azaroff et al., 2009). Since the prevalence of ASD is increasing, there is an increased need for FCT programs and interventions such as PECS to help individuals with ASD overcome the communicative deficits and impairments associated with this disorder in order to enjoy a more successful and better quality of life, and the continual evaluation of these programs is necessary in order to promote the efficacy of these programs.

CHAPTER 3

METHODOLOGY

Overview

The purpose of this study was to examine the effectiveness of the PECS as a FCT program used at a local community agency that specializes in autism diagnosis and treatment. Through a within-subjects repeated measures research design, this study examined the effectiveness of the PECS program by analyzing pretreatment and posttreatment measures of functional communication skills using rating scales and growth on communication goals provided by the agency and the parents of the participants. The Vineland-3 and the ATEC were used as rating measures. Individual growth on communication goals was measured by comparing goals concerning the use of appropriate communication set before treatment and goals achieved after treatment. It was hypothesized that the PECS program would improve the overall functional communication skills of enrolled participants at the agency.

Participants

Participants were children ranging in age from 2 to 6 years enrolled in the PECS program that is implemented at the local community agency specializing in autism diagnosis and treatment in developing communication skills among children with ASD. The need for PECS was determined through collaboration between the speech therapist and other special service providers at the agency. Before beginning the PECS program, verbal ability, communication skills, and development were considered, as was parent input concerning the implementation of PECS. Only individuals receiving the PECS

program and with pretreatment and posttreatment assessment data were included in this study.

During the 2017-2018 treatment year, a total of 44 children, 38 males and 6 females, participated in the PECS program and completed treatment assessments. The participants did not all start the program on phase one of PECS. Sixty percent of the participants started the program using gestures. Five percent started the program using phase one of PECS. Nineteen percent started the program using phase two of PECS. Seven percent started the program using phase three of PECS. Two percent started the program using phase four of PECS. The starting phase of PECS was unknown for 7% of the participants. The mean age of the participants was 4.27 years. The demographics of the sample included 2.2% Asian, 42.2% Hispanic, 48.9% not Hispanic, and 6.7% unknown. Within the PECS program, participants used various communication modes, including a Choice Board, an iPad, the PECS, and the PECS with Tech Speak, with 82.2% using the PECS. All of the data were de-identified for the purposes of this study.

Materials and Measures

The current study used the Vineland Adaptive Behavior Scales, Third Edition (Vineland-3) and the Autism Treatment Evaluation Checklist (ATEC) to measure improvement in communication skills. The Vineland-3, an instrument for supporting the diagnosis of intellectual and developmental disabilities, is designed to meet any adaptive behavior assessment need and yields valuable information for developing educational and treatment plans. This assessment tool addresses special needs populations, such as individuals with intellectual and developmental disabilities, autism spectrum disorder, and attention deficit hyperactivity disorder (Sparrow, Cicchetti, & Saulnier, 2016). The

Vineland-3 measures personal and social skills needed for everyday living and can be administered to individuals ages 3 through adult. Administration time for the Vineland-3 is minimal and offers three convenient rating forms including interview form, parent/caregiver form, and teacher form. The forms are organized to address the three broad domains of adaptive functioning including Communication, Daily Living Skills, and Socialization, and all three forms of measurement were used in the current study. In addition, the current study used optional forms addressing Motor Skills and Maladaptive Behavior domains (Sparrow et al., 2016). The Vineland-3 is standardized in the normal population of children and adolescents, and the reliability and construct validity of the assessment tool as a measure of adaptive functioning in the intellectually disabled population of children and adolescents has been demonstrated (de Bildt, Kraijer, Sytema, & Minderaa, 2005).

The ATEC, a one-page form designed to be completed and scored by parents, teachers, or caretakers, consists of four subtests including Speech/Language Communication (I), Sociability (II), Sensory/Cognitive Awareness (III), and Health/Physical/Behavior (IV) (Edelson, 2016). The baseline scores on the ATEC are compared to posttreatment scores, yielding a measure of treatment effectiveness following intervention. The ATEC provides several subscale scores in addition to a total score. Lower scores on the ATEC indicate fewer problems (Edelson, 2016). Studies have shown the ATEC to be a sensitive and valid measure of change as a result of treatment, and the internal consistency reliability has been demonstrated through split-half reliability tests on over 1,300 completed ATEC evaluations (Rimland & Edelson, 2018).

Individual growth on communication goals was measured by comparing goals concerning the use of appropriate communication set before treatment and goals achieved after treatment. For example, a goal for number of expressions out of opportunities to communicate appropriately was set at the start of the treatment plan and then compared to the number of expressions out of opportunities that were achieved at the end of the treatment plan. Individual progress in changes of phases of PECS, including communicating with gestures through communicating using verbals, and changes in level of prompting required were examined.

Procedure

Participants in the current study were enrolled in the PECS program implemented at a local community agency specializing in autism diagnosis and treatment in developing communication skills among children with ASD. Forty-four children, ages 2 to 6 years, were enrolled in the PECS program during the two treatment plan time periods of approximately 120 days each. The PECS program implemented at the agency is a standard program offered at the center, and therefore informed consent was not obtained. The treatment plan was not randomized or manipulated, and all data were redacted for the purpose of this program evaluation. The current study used the Vineland-3 and the ATEC to measure improvement in communication skills. Individual growth on communication goals was measured by comparing goals concerning the use of appropriate communication set before treatment and goals achieved after treatment. Progress toward individualized communication goals of participants was monitored and recorded by the agency. Parent satisfaction was collected by the agency using an annual survey, but could not be reviewed for this study because the surveys were anonymous

and did not identify the specific program that each client participated in. The integrity of the program was evaluated using internal control, with trained staff members observing the implementation of the program monthly using a checklist to ensure that goals were achieved and appropriate opportunities using the PECS program were provided. The integrity data could not be reviewed because the data was not accessible for this study.

CHAPTER 4

RESULTS

In order to examine the effectiveness of the PECS program implemented with the participants at the agency, the Vineland-3 and the ATEC were used to measure participant improvement in communication skills. The hypothesis that the PECS program would improve the overall functional communication skills of enrolled participants at the agency was tested. Multiple dependent paired samples *t*-tests were conducted on the pretreatment and posttreatment scores of the domains of the Vineland-3 and the subtests of the ATEC. The assumptions of the dependent paired samples *t*-tests were reviewed and met.

The measured domains of the Vineland-3 included Communication, Daily Living Skills, Socialization, Motor Skills, and Maladaptive Behavior. The difference between pretreatment and posttreatment measures for the Communication domain of the Vineland-3 was significant, $t(42) = -2.089$, $p = .043$, and represented a small to medium effect size, $d = .319$. On average, participants given the posttreatment measure of the Vineland-3 Communication domain scored better ($M = 60.23$, $SD = 12.886$) than when they were given the pretreatment measure of the Vineland-3 Communication domain ($M = 54.98$, $SD = 18.521$). The results indicated that the differences between pretreatment and posttreatment measures were not significant for the Vineland-3 Daily Living Skills, Socialization, Motor Skills, and Maladaptive Behavior domains. The results of the Vineland-3 are shown in Table 1.

Table 1

Paired Samples t-test Vineland-3

Domain	Pretreatment Mean (SD)	Posttreatment Mean (SD)	<i>t</i>	<i>p</i>	Effect Size
Communication	54.98 (18.521)	60.23 (12.886)	-2.089	.043*	.319
Daily Living Skills	63.63 (14.498)	62.63 (12.817)	.414	.681	.063
Socialization	56.19 (12.614)	59.44 (12.835)	-1.635	.110	.249
Motor Skills	72.83 (12.876)	73.13 (14.515)	-.072	.943	.013
Maladaptive Behavior	60.33 (10.987)	61.33 (10.082)	-.526	.602	.081

* $p < .05$.

The measured subtests of the ATEC included Speech/Language Communication (I), Sociability (II), Sensory/Cognitive Awareness (III), and Health/Physical/Behavior (IV). The difference between pretreatment and posttreatment measures for the ATEC Speech/Language Communication (I) subtest was significant, $t(34) = 2.347$, $p = .025$, and represented a small to medium effect size, $d = .397$. On average, participants given the posttreatment measure of the ATEC Speech/Language Communication (I) subtest scored better ($M = 19.51$, $SD = 5.953$) than when they were given the pretreatment measure of the ATEC Speech/Language Communication (I) subtest ($M = 21.51$, $SD = 3.697$). The results indicated that the differences between pretreatment and posttreatment measures were not significant for the ATEC Sociability (II), Sensory/Cognitive Awareness (III), Health/Physical/Behavior (IV) subtests, and the difference between pretreatment and

posttreatment measures of the ATEC total score was not significant. The results of the ATEC are shown in Table 2.

Table 2

Paired Samples t-test ATEC

Subtest	Pretreatment Mean (SD)	Posttreatment Mean (SD)	<i>t</i>	<i>p</i>	Effect Size
Speech/Language Communication (I)	21.51 (3.697)	19.51 (5.953)	2.347	.025*	.397
Sociability (II)	15.71 (6.013)	15.26 (7.407)	.386	.702	.066
Sensory/Cognitive Awareness (III)	18.32 (5.602)	17.62 (8.232)	.570	.573	.010
Health/Physical/ Behavior (IV)	25.09 (14.366)	25.12 (9.270)	-.011	.991	.002
Total Score	79.15 (13.769)	77.62 (21.431)	.477	.636	.082

**p* < .05.

Additional analyses were conducted to investigate if more time in the program correlated with improved performance in communication skills. Correlations were conducted to analyze the relationship between the differences in pretreatment and posttreatment scores and the number of days between the administration of pretreatment and posttreatment measures. The results indicated that the Vineland-3 Communication domain differences in pretreatment and posttreatment scores were not significantly correlated with the number of days between the administration of the Vineland-3

pretreatment and posttreatment measures, $r = .004$, $p = .979$. The results also indicated that the ATEC Speech/Language Communication (I) subtest differences in pretreatment and posttreatment scores were not significantly correlated with the number of days between the administration of the ATEC pretreatment and posttreatment measures, $r = -.064$, $p = .717$.

The results of individual goal analysis indicated that 90% of the participants improved their communication goals. These participants met their communication goals with a progression to a higher phase of PECS. Five percent of the participants who improved on their communication goals had a reduction in level of support. Sixty-six percent of the participants who improved on their communication goals progressed from communicating with gestures to communicating with various phases of PECS, including using verbals. Twenty-nine percent of the participants who improved on their communication goals progressed from communicating with various phases of PECS to communicating with verbals. Ten percent of the participants did not meet their communication goals.

CHAPTER 5

DISCUSSION

The purpose of this study was to examine the effectiveness of the PECS as an FCT program used at a local community agency that specializes in autism diagnosis and treatment. To examine the effectiveness of the PECS program, pretreatment and posttreatment measures of functional communication skills were obtained for participants enrolled in the PECS program at the agency. The measures of functional communication skills used were the Vineland-3 and the ATEC. Multiple dependent paired samples *t*-tests on the pretreatment and posttreatment scores of the domains of the Vineland-3 and the subtests of the ATEC were conducted. The difference between the pretreatment and posttreatment scores for the Communication domain on the Vineland-3 and the Speech/Language Communication (I) subtest on the ATEC were found to be significant indicating improvement following intervention. A more sensitive measure of progress in communication skills was obtained through progress monitoring and recording of individual communication goals. Results of individual communication goal analysis indicated that most participants improved in their individual communication goals during their participation in the PECS program. Many participants met their communication goals and progressed to a higher phase of PECS, including an increase in the percentage of participants utilizing verbalizations. The hypothesis stating that the PECS program implemented at the agency would improve the overall functional communicational skills of enrolled participants at the agency was supported.

These results are consistent with research concerning the effectiveness of FCT programs and specifically the PECS program. FCT programs have yielded positive

results in reducing challenging behavior resulting from a lack of communication skills and replacing this behavior with appropriate communicative responses (Andzik et al., 2016). Positive results using FCT program interventions have been found across age groups and disabilities and with different modes of communication (Heath et al., 2015). PECS as an FCT program has demonstrated efficacy and yielded positive results, improving social communicative behaviors and decreasing problem behaviors (Charlop-Christy et al., 2002). The small to medium effect sizes found in the current study are also consistent with previous research concerning the effectiveness of PECS. A meta-analysis investigating empirical evidence of the effectiveness of the PECS program used with individuals with ASD yielded a small to moderate effect size pertaining to communication skills (Flippin, Reszka, & Watson, 2010). Scientific evidence supporting the effectiveness of PECS is growing, and general positive outcomes include improved communication between participants and adults across settings, generalized improved communication across new settings, and decreased disruptive behavior (Sulzer-Azaroff et al., 2009).

Two correlations were conducted to analyze the relationship between the differences in pretreatment and posttreatment scores and the number of days between the administration of pretreatment and posttreatment measures. Results indicated that there was no significant relationship between the differences in pretreatment and posttreatment scores on the Vineland-3 Communication domain and the ATEC Speech/Language Communication (I) subtest and the length of time between administrations of the assessments indicating that more time is not associated with improved performance. This lack of significance may have been due to individual participants starting the program at

different phases of PECS. The participants in the study did not all start the program on phase one of PECS. Sixty-six percent of the participants started the program using gestures. In addition, standardized global assessments, such as the Vineland-3 and the ATEC, may not be as sensitive to change as progress in individual goals.

Limitations

A limitation of the current study is that the study involved only one agency with a small population who participated in this study. The sample at the agency consisted of only six females and 38 males. Another limitation was the lack of information concerning other interventions and treatments for improvement in communication skills that may have been implemented outside of the agency and the PECS program. Participants may have experienced improvement in communication skills due to other interventions or individual factors. Information concerning participant prior experience with PECS was not available. Data was only collected every other day, and identification of phase changes in the PECS program was not consistent. The current study also lacked review of and access to parent satisfaction and integrity data. Review of parent satisfaction surveys was planned, but the agency collects the surveys anonymously, and the forms did not identify specific program participation. As such, the forms could not be reviewed for this study. Integrity data was not accessible.

Implications

This study adds to a growing body of national and international research concerning the effectiveness of the PECS program and serves as a guide for further program evaluations, particularly in community agencies. The results of the current study support the hypothesis with regard to improvement in communication skills and

add to the available research on the effectiveness of PECS used with children with ASD. The current study guides future program evaluations of the PECS program implemented at the agency and future program evaluations and modifications of PECS programs implemented at other agencies and in other settings. Program evaluations and modifications are necessary with the growing use of PECS. The application of the PECS program is growing and is currently used worldwide in various settings with positive results in increasing functional communication skills (Bondy, 2001, 2012; Sulzer-Azaroff et al., 2009). The continuing increase in the prevalence of ASD and the communicative impairments of the disorder increase the necessity of FCT programs such as the PECS program being implemented in various settings, including community mental health agencies.

Future Directions

More studies evaluating the PECS program implemented at community agencies and in other settings are necessary. The effectiveness of the PECS program among larger populations of participants in community mental health settings should be evaluated. Other factors of the PECS program implementation should be studied across settings, such as the training of the individuals implementing the program, standard procedures in the program implementation, and parent satisfaction and program acceptability. Future studies should also investigate the generalization and maintenance of treatment gains after the implementation of the PECS program. More studies would provide additional evidence for the use of the PECS program and the effectiveness of the program. Studies concerning the efficacy of the PECS program and additional PECS program evaluations

are necessary to improve the use of the program implemented in order to improve the communicative skills of individuals with ASD.

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