Chapter 1

A Review of the Efficacy of Using Picture Exchange to Improve Spoken and Non-spoken Communicative Behaviors:

Introduction and Literature Review

Picture Exchange Systems

Several studies are available demonstrating efficacious use of picture exchange systems to increase non-spoken and spoken communicative behaviors (Lund & Troha, 2008; Preston & Carter, 2009; Bondy & Frost, 1994; Carr & Felce, 2007). These studies used picture exchange communication systems as an intervention technique for individuals with significant language impairments. Accordingly, the research participants had co-morbid diagnoses routinely associated with language impairments, such as autism spectrum disorders (ASD), severe language delays, developmental delay, and cognitive impairment.

Sulzer-Azaroff, Hoffman, Horton, Bondy, and Frost (2009) reviewed 34 published articles discussing the data related to the use of picture exchange systems to promote communication behaviors. Participants among the studies included children and adults with a range of disabilities including autism spectrum disorders, Down syndrome, developmental delays, cerebral palsy, and intellectual disability, among others. The results of the review indicated picture exchange systems were efficacious for individuals with limited communication ability. The authors also found spoken language or speech to have been increased in some of the participants.

Similarly, Preston and Carter (2009) published a literature review on the use of picture exchange communication systems. They evaluated studies published between

1994 and 2002, which included 27 randomized controlled trials, group designs, and single-subject experiments. A total of 394 participants were included among the studies and were between the ages of 20 months and 40 years. These participants included individuals with various disorders, although most had been diagnosed with autism. Only one of the total participants did not achieve the ability to use picture exchange to spontaneously request. The authors concluded that picture exchange systems yielded "preliminary evidence" for children and adults with autism spectrum disorders and other developmental disabilities (p. 1483).

In sum, the use of picture exchange is a researched and supported practice for improving communicative behaviors in individuals with language impairments. As such, individuals with language impairments may benefit from picture exchange treatments. Picture exchange should be considered as an evidence-based treatment method for the remedy of language impairments.

Picture Exchange Communication System (PECS)

The most commonly used picture exchange system in the published research is that proposed by Bondy and Frost (1994), called the *Picture Exchange Communication System* (PECS). This program, as well as adaptations to this program, supports its use to improve both non-verbal and verbal or spoken communication skills in individuals with significant language impairment. The PECS treatment protocol, as described by its authors, is listed in Table 1.

Although the PECS treatment protocol was designed for use with non-speaking individuals with autism spectrum disorders, the authors do not describe the merits of the intervention specific to children or adults with such specific disabilities. Rather, they

Table 1.

Phases of PECS as proposed by Bondy and Frost (2002)

Phase	Description
I	One picture symbol for a highly desirable item is used. Two trainers teach the child to place the picture symbol in one of the trainer's hands (communicative partner) in exchange for the item. The communicative partner states the name of the item while giving it to the child.
II	Multiple trainers, settings, and items are used while increasing the distance between the child and the communication partner. The picture symbol is placed in a communication book with the specific location of the symbol within the book varying for each trial. The child is taught to get a symbol from the book and travel to the communication partner to place the symbol in his/her hand.
III	Two picture symbols are placed in the communication book. One symbol is for a highly desirable item and one item is undesirable. Periodic testing is done to ensure the desirable item is still desired and, therefore, that the child is requesting the appropriate item.
IV	Sentence building is introduced. The child hands a picture symbol for "I want" and a picture symbol for a desired item to the communicative partner in exchange for the item. The communicative partner models "I want" [pause] "[item]." The communicative partner then gives the 2 symbols and the item to the child.
V	The communicative partner prompts the child with "What do you want?" Gestural cues are provided toward the "I want" symbol. Progressive time delays are used to fade the use of the gestural cue so the child answers the question with no cues provided.
VI	Comments are taught using "What do you see?" "What do you want?" and "What do you have?" The child answers the questions with the exchange of a sentence strip of picture symbols.

encourage the use of their system with any and all individuals for whom the intervention may be appropriate. Given the association of significant language impairments in the autism population, it is not surprising that PECS, PECS modifications, or other picture exchange systems are prevalent in the literature for individuals with this spectrum of diagnostic label. That said, other children and adults, beyond those with autism spectrum disorders diagnostic labels can and do present with significant language impairments. PECS, PECS modifications, and other picture exchange systems have been used with individuals with varied diagnostic labels associated with language impairments, and the results support the methodology for individuals with language impairments.

The application of PECS, PECS modifications, or other picture exchange systems are appropriate interventions for children who present with delayed or atypical communication behaviors. Intervention methods are designed to address specific "behaviors." Some behaviors are more associated with specific diagnostic labels; thus, it is understandable that lines may be drawn between treatment approaches and labels. That said, professionals who are entrusted to teach children with language impairments should be cognizant of the behaviors that they choose to target therapeutically and link those behaviors with the best available evidence to distinguish or modify the behavior. Diagnoses of any kind, including language impairments, are not an exact science and may be affected by a child's age, gender, culture, and medical or educational experiences to name but a few variables. As such, professionals such as speech-language pathologists are trained to assess and evaluate communicative behaviors using both formal and informal techniques, and then design a treatment plan based on the behaviors observed.

Picture Exchange and Non-Spoken Requesting

Several studies have supported the opinion that picture exchange systems are an effective means of promoting non-spoken communication requesting behaviors, as well as other forms of non-spoken communicative functions (e.g., describing). For example, Flippin, Reszka, and Watson (2010) published a meta-analysis reviewing the impact of the PECS treatment protocol on communication and spoken language (speech) with children with autism spectrum disorders based on available literature between 1994 and 2009 which included single-subject and group studies. Regarding overall efficacy of the PECS treatment protocol, these authors concluded it to be "promising, although not yet established, evidence-based practice for promoting communication in children with autism" (p. 189).

Lund and Troha (2008) used a multiple baseline across participants in a single-subject design and modified the PECS protocol for use with tactile symbols. Included were three participants between 12 and 17 years old who were blind and had severe language delays, cognitive impairments, and/or autism. This study included three phases of the PECS system: exchange of a tactile system to request an item or activity, increased distance between the participant and the communication partner to whom exchanges/requests were made, and discrimination between two tactile symbols. The PECS protocols were modified for this study to include tactile symbols, a modified least-to-most prompting hierarchy, one communication partner, the use of verbal cues to assist the participants with the communication partner's location, and training by one team in one context. One participant progressed through all three phases of the study and all participants increased their communication skills from baseline.

A group randomized controlled trial by Howlin, Gordon, Pasco, Wade, and Charman (2007) was conducted to determine the effectiveness of training and consulting teachers in the use of the PECS protocol. The participants included children ages 4 to 11 years with autism, no sensory impairments, and little to no functional language. Teachers, staff, and parents of these children attended a two day workshop in the instruction of PECS and the schools were consulted once per month for the next five months for a total of six consultation visits. The participants were filmed during snack time and data was recorded for frequency of initiations, frequency of picture symbol use, and frequency of speech during baseline and the conclusion of two treatment phases. The rates of initiations and symbol use in the classroom showed improvement at the conclusion of treatment. Unfortunately, these effects were not maintained.

Bock, Stoner, Beck, Hanley, and Prochnow (2005) compared PECS to voice output communication aids (VOCAs) regarding the rate of acquisition of requesting skills and generalization to the classroom setting. Their study included six participants, all of whom were boys, age four years, with developmental delay who did not speak or use an alternative communication system. All participants in this study acquired the ability to spontaneously initiate requests and maintained the use during generalization. That is, the PECS treatment protocol was found to be efficacious for teaching the participants a functional means of communication.

Taken together, the above studies support the use of picture exchange as a treatment methodology to improve non-spoken communication requesting in individuals with language impairments. Table 2 summarizes these studies.

Table 2.

Picture Exchange for Non-Spoken Communication Behaviors

Study	Participants	Pictorial Intervention	Results on Expressive Language
Flippin et al. (2010)*	Ages up to 18 with diagnosis of autism spectrum disorders	PECS	"PECS treatment had a significant impact on communication outcome" and is a "fairly effective" strategy for these individuals (p. 186)
Lund & Troha (2008)	3 participants ages 12 to 17 years who were blind and had severe language delay, cognitive impairments, and autism	Modification of PECS to include tactile symbols	1 participant advanced through all 3 phases; All participants increased communicative behaviors
Howlin et al. (2007)	84 participants between 4 and 11 years of age with autism	PECS	Rate of initiation and symbol use increased
Bock et al. (2005)	6 participants age 4 years with developmental delay	PECS	All participants began using at least a single picture symbol to make requests; 5 participants did so with increased distance; 2 participants made requests with discrimination between 1 desired and 1 neutral picture symbol

Note. *Meta-analysis

Picture Exchange Systems and Expressive Language

Several studies have shown that the use of picture exchange systems, such as PECS, promote speech or spoken expressive language in some children with language impairments (Tinacani et al., 2006; Ganz et al., 2009; Charlop-Christy et al., 2002). For example, a multiple baseline design study by Ganz, Parker, and Benson (2009) studied the use of PECS for requesting, intelligible word use, and maladaptive behaviors. The participants were three children between the ages of three and eight years, who had been diagnosed with autism, had spoken language delays, and infrequently used spontaneous spoken language. All of these participants progressed through the first phase of PECS. Rapid acquisition of picture exchanges for requests, generalization, and maintenance was demonstrated. The authors also found that two of the three participants began speaking during the study.

Similarly, Charlop-Christy, Carpenter, Le, LeBlanc, and Kellet (2002) also used a multiple baseline design to study the acquisition of communicative behaviors using the PECS protocol. The treatment protocol included training during two 15-minute sessions each week. Training occurred during play and academics with three boys with autism who had been receiving treatment targeting speech but remained ineffective communicators. On average, using PECS to make requests was acquired after 170 minutes of training and reached 80-percent success through all phases of the PECS protocol, which extends beyond requesting to describing. Joint attention, initiations, requests, and spontaneous speech increased for each of the participants as well, while problem behaviors decreased for all participants.

Tincani, Crozier, and Alazetta (2006) also studied the effects of the PECS treatment protocol on spoken and non-spoken requesting in two school-age children, ages 10 and 12 years, with autism who did not communicate using spoken language or speech in the academic setting. Both participants demonstrated an increase in requesting when using picture symbols, as is taught in the PECS protocol, and also demonstrated generalization. One of the participants exhibited a decrease in vocal approximations during the first three phases of training, but showed an increase over baseline during Phase IV and generalization probes. Upon examination of the results of increased vocal approximations during Phase IV, Tincani and colleagues used an ABAB design to study the effects of a reinforcement delay with a third participant. After being taught Phase IV of PECS, the first phase of the second study did not include a reinforcement delay; the second phase implemented one. During the second phase, the participant demonstrated a substantial increase in the percentage of vocal approximations (3-percent to 83.3%). Based on the results of this study, the authors suggest that in order to increase speech production, prompting and reinforcement with augmentative and alternative communication (AAC) devices may be essential

In summary, multiple studies have demonstrated picture exchange, such as the PECS protocol, to be a promising way to improve spoken language in individuals with language impairments. These studies are listed in Table 3. The studies summarized are not intended to be an exhaustive list, but instead denote the findings that picture exchange has proved beneficial for multiple participants in multiple studies for promoting expressive language development.

Table 3.

Picture Exchange and Expressive Language

Study	Participants	Pictorial Intervention	Results on Expressive Language
Tincani et al. (2006)	3 participants between ages 9 and 12 years with autism	PECS	The 2 participants in the first study substantially increased the average percentage of mands (requests) with the use of picture symbols; the participant in the second study increased vocal approximations with the addition of a reinforcement delay
Ganz et al. (2009)	3 participants ages 3 to 8 years with autism	PECS	Use of picture exchange acquired rapidly with positive results from generalization and maintenance
Charlop-Christy et al. (2002)	3 participants with autism, ages 3 to 12 years	PECS	All participants acquired picture exchange use to at least 80% criterion and increased social-communicative behaviors

Picture Exchange and Intellectual Disability

Many studies have specifically demonstrated effective use of picture exchange to promote non-spoken and expressive language or speech in individuals with language impairments. A number of these studies describe the participants as having an intellectual disability. Several of these studies are summarized in this section.

Stoner, Beck, Bock, Hickey, Kosuwan, and Thompson (2006) studied the effectiveness of the PECS protocol with five adults with developmental disabilities and mental retardation (intellectual disability) between 22 and 31 years old who were non-speaking. This single-subject design incorporated a modification of an ABAB design. The intellectual quotients of the participants ranged from 20 to 49; two of the five participants had been diagnosed with Down syndrome. This study included four phases during which the participants were taught to discriminate between picture symbols up to a maximum of 12 and to request using a sentence strip of "I want _____" for food, toys, and activities. The results of this study conclude that PECS through Phase IV was acquired rapidly and proved efficacious for three of the five participants, including the two with Down syndrome. The two individuals with Down syndrome also generalized the use of the PECS to spontaneously make requests at restaurants and used picture symbols to denote sizes of the food items requested. One of the individuals with Down syndrome was also observed to have increased vocal approximations of the symbols toward the end of the study.

Schwartz, Garfinkle, and Bauer (1998) also examined the acquisition of communication behaviors using the PECS protocol. The first part of the study included 31 participants with severe disabilities ranging in age from three to six years; the

individuals had diagnoses of autism, Down syndrome, and other developmental disabilities and had very limited functional communication. The authors used five phases to train PECS: exchange, distance and persistence, discrimination, sentence building, and PECS with peers (p. 146). Results demonstrate that all participants acquired the use of requesting with pictures; within an average of 14 months, participants used the provided pictures functionally with peers and adults. The second portion of the study involved 18 participants with various disabilities including autism and Down syndrome among others, during snack time when the participants were encouraged to use picture exchange during free-choice when picture symbols were available to them. Data was coded for gestures, vocalizations, manual signs, picture exchanges, verbalizations, requests, comments, protests, responses, and communication forms with no communicative intent. Results demonstrated that the participants acquired the use of requesting with picture exchange and used pictures for multiple communication functions in multiple settings. Overall, there was also an increase in spoken language or speech for 44-percent of the participants.

Sulzer-Azaroff, Hoffman, Horton, Bondy, and Frost (2009) reviewed 34 published articles discussing the data related to the use of the PECS treatment protocol and similar picture exchange systems to promote communication behaviors. Participants among the studies included children and adults with a range of disabilities including autism spectrum disorders, Down syndrome, developmental delays, cerebral palsy, and intellectual disability, among others. The results of the review indicate PECS and adaptations of PECS are efficacious for individuals with limited communication ability. The authors also found spoken language or speech to have increased in some of the

participants, notably those that began using the PECS protocol in early childhood and made it through at least Phase IV of the system. Phase IV moves beyond the communicative function of requesting to the communicative function of describing.

Preston and Carter (2009) also published a literature review on the use of PECS as described by Frost and Bondy in 1994 and 2002 including 27 randomized controlled trials, group designs, and single-subject experiments. A total of 394 participants were included among the studies and were between the ages of 20 months and 40 years. These participants included individuals with various disorders, although most had been diagnosed with autism. Only one of the total participants did not achieve at least Phase I, the exchange of one picture symbol to request, in the PECS hierarchy. Multiple studies reviewed reported increases in speech production, although the authors conclude that the effect of PECS on speech "remains unclear" (p. 1481). They do note that their review yields only "preliminary evidence" for children and adults with ASD and other developmental disabilities (p. 1483).

In a case study by Kern, Gallagher, Starosta, Hickman, and George (2006) to determine the behavioral effects of using the PECS protocol with a 10 year old male with Down syndrome, the authors reported a decrease in aggression and an increase in engagement with the use of pictures to communicate. Although quantitative data were not recorded for spontaneous communication, the authors reported qualitative increases in the use of a communication book and spontaneous communication for desired activities and needs.

As stated previously, this is not an exhaustive list of studies that researched the effects of a picture exchange system used to promote expressive language for individuals

with intellectual disability. However, the studies summarized indicate efficacious use of picture exchange for the participants involved and demonstrate a need for further research. Select studies are summarized in Table 4.

Picture Exchange and Speech

Research involving the use of PECS and other pictorial exchange systems report mixed results involving a correlated increase in spoken language (speech) (Lancioni et al., 2007, Yoder & Stone, 2006; Preston & Carter, 2009; Bondy & Frost, 1994; Schwartz et al., 1998; Tincani, 2004; Kravits et al., 2002, Carr & Felce, 2007; Charlop-Christy et al., 2002; Tincani et al., 2006; Ganz et al., 2009). Although there does not seem to be conclusive evidence that these systems increase the frequency of speech, multiple studies do report positive effects related to the use of picture exchange for speech, especially during Phase IV of the PECS protocol.

Lancioni, O'Reilly, Cuvo, Singh, Sigafoos, and Didden (2007) reviewed 17 studies, published between 1992 and 2006, which used the PECS protocol or a pictorial system as an intervention approach for requesting and included participants with developmental disabilities. Of the total 173 participants, 170 demonstrated at least some success with the systems. They also found that several of the studies reviewed reported increases in spoken language or speech. The authors noted that these studies did not demonstrate causal relationships between the communication system and spoken language/speech, only correlations.

A randomized group experiment conducted by Yoder and Stone (2006) compared *Responsive Education and Prelinguistic Milieu Teaching* (RPMT) with PECS in 36 preschoolers who had diagnoses of autistic spectrum disorders. The participants were

Table 4.

Pictorial Exchange and Intellectual Disability

Study	Participants	Pictorial Intervention	Results
Stoner et al. (2006)	5 participants between 22 and 31 years of age with developmental disabilities and intellectual disability who had diagnoses of Down syndrome or unspecified etiologies	PECS	Rapidly began using picture exchange to request with non-spoken sentences and was efficacious for 3 participants, including those with Down syndrome for whom generalization was also noted
Schwartz et al. (1998)	31 participants, ages 3 to 6, who had been diagnosed with autism spectrum disorders, Down syndrome, Angelman syndrome, or other developmental disabilities	PECS	All participants acquired non-spoken requesting behaviors and used it functionally
Sulzer-Azaroff et al. (2009)*	386 participants ages 18 months through adults with varying diagnoses including autism, intellectual disability, Down syndrome, autism spectrum disorders, attention deficit hyperactivity disorder,	PECS and adaptations of PECS	Picture exchange may be used to teach individuals to initiate requests for reinforcement

Study	Participants	Pictorial Intervention	Results
	cerebral palsy, and developmental delays		
Preston & Carter (2009)*	456 participants ages 20 months to 40 years with diagnoses of autism, autism spectrum disorder, or pervasive developmental disorder	PECS	All participants except 1 began at least exchanging 1 picture symbol for a desired item
Kern et al. (2006)	1 participant age 10 years with Down syndrome	PECS	Increase in engagement, decrease in aggression, and an increase in spontaneous communication

Note: *Systematic review

between 18 and 60 months of age and were either non-speaking (nonverbal) or had limited speaking abilities. Intervention consisted of three 20-minute individual treatment sessions each week for six months. Results of this study indicated that, immediately following treatment, participants favored picture exchange as evidenced by an increase in the frequency of spoken acts and the number of different spoken words used. Gains were also found between the onset of the study and six months post treatment. Particularly for those individuals who initially demonstrated higher levels of object exploration, picture exchange was found to have maintained treatment effects.

Bondy & Frost (1994) also documented that 39 out of 66 children who had used the PECS protocol for over one year used only speech to communicate. Of their total group of participants who had used picture exchange for more than one month, they found that 76-percent used spoken language/speech alone or in combination with the picture symbol system. These results were based on a group of children who began picture exchange by at least five years of age and had an educational diagnosis of autism. As noted by the authors regarding their experience, they have not experienced a correlation between the use of picture exchange and speech outcomes with children older than seven years or with adults.

Schwartz, Garfinkle, and Bauer (1998) studied 31 preschool children ages three to six years with severe disabilities, including Down syndrome, and found the PECS protocol to be efficacious for young children with severe communication difficulties. A second part to this study demonstrated the ability for generalization when taught to use the PECS protocol. The participants in the second part who were initially "talkers" (i.e., spoke five or more words during an initial observation) showed an increase in vocabulary

and spontaneous speech. Overall, there was an increase in spoken language/speech for 44-percent of their participants after being taught the PECS protocol. As noted by the authors, "augmentative communication systems can be used alone or in conjunction with spoken language" (p. 144).

In an alternating treatments quasi-experimental study by Tincani (2004), PECS was compared to sign language training for requesting with children ages five and six years who had been diagnosed with autism and intellectual disability. Both participants were taught both systems of communication. Results indicate that requests increased for one participant with the PECS training; reinforcement delay included, vocalizations increased for the same participant.

Kravits, Kamps, Kemmerer, and Potucek (2002) used a single-subject study to evaluate the effects of the PECS protocol on spontaneous communication and social interaction as well as to determine how practical the communication system was for the participant's mother, teacher, and peers in the home and during center and journal times at school. Their study included one participant, a six year old female with autism, language delay, and intellectual disability who used one to two word utterances with prompting. Results of the study revealed that the frequency of spontaneous language increased, intelligible verbalizations increased at home and during journal time at school, and social interactions were lengthened during journal time at school.

Carr and Felce (2007) conducted a quasi-experimental study, which included twenty-four children in the intervention group who were between ages three and seven years and had a diagnosis of autism. The intervention group received 15 total hours of training to Phase III of PECS during which two picture symbols were available, one of a

desired item and one of an item undesired by the individual, to evaluate the effects of the initial phases of the communication system. Results showed that five of the 24 children in the experimental group substantially increased the amount of spoken language used and none of the children reduced the amount of spoken words. In contrast, only one participant in the control group increased the amount of spoken words used and the change was minimal. Interestingly, four of the children in the control group actually decreased the number of spoken words used.

Several of the aforementioned studies also reported an increase in spoken language/speech with the use of the PECS protocol. In the study by Charlop-Christy et al. (2002), all three participants demonstrated large increases in the percentage of spontaneous expressive language/speech. Similarly, Tincani et al. (2006) reported a substantial increase in vocal approximations with training of Phase IV of PECS in which sentence building was introduced using a picture symbol for "I want" with a second symbol for a desired item. Ganz and colleagues (2009) also found that two of their three participants began speaking. In their research review, Sulzer-Azaroff et al. (2009) found that, with the use of picture exchange, in this instance PECS, spoken language/speech increased for some participants, particularly those that began the treatment in early childhood and made it through at least the phase in which the use of two picture symbols are used for sentence construction to make a request. As described previously, this is the phase in which sentence building is reinforced using two picture symbols, one for "I want" and another for a desired item. In a separate literature review, Preston and Carter (2009) noted that AAC "may have the potential to enhance speech development" (1481).

Although a cause and effect relationship has not been established for the use of pictorial exchange systems and spoken language, the above studies (also summarized in Table 5) present a need for further research regarding intervention that assists spoken language development for functional communication.

Characteristics of and Communication Intervention with Down syndrome

Children with Down syndrome are typically social individuals with delays in expressive language. Young children with Down syndrome may have good nonverbal social interaction but this will not match typically developing peers in regard to non-spoken requests (Mundy, Sigman, Kasari, and Yirmiya, 1988; Mundy, 1995; Roberts 2007). The overall amount of expressive communication demonstrated by children with Down syndrome is also typically less than that of their developmentally matched peers without disabilities (McCathren, 2000).

The study by Mundy et al. (1988) demonstrated a correlation between non-spoken requesting and expressive language. The authors found non-spoken requesting to be a "potentially useful target for early intervention" (Mundy et al., 1995, p. 247). Roberts, Price, and Malkin (2007) noted the majority of individuals with Down syndrome have intellectual disability and demonstrate a deficit in syntax. The authors reported that visual supports help these individuals to give more detail when retelling narratives and argue that AAC methods should be part of facilitating and enhancing the speech and language development of individuals with Down syndrome. As noted by Roberts (2007), research on interventions that effectively improve the communication skills of those with Down syndrome is lacking. This suggests that interventionists should consider the available treatment evidence for populations with similar profiles, such as individuals with

Table 5.

Picture Exchange and Spoken Language Research

Study	Participants	Pictorial Intervention	Spoken Language Results
Lancioni et. al (2007)*	Participants who used picture exchange: 173 participants ages 3 to 40 with various disabilities including intellectual disability	PECS or pictorial system for requesting	Correlations between the intervention and increases in spoken language reported in several studies reviewed
Yoder & Stone (2006)	36 participants ages 18 to 60 months with autism spectrum disorders	PECS	PECS demonstrated maintained effectiveness
Preston & Carter (2009)*	456 participants ages 20 months to 40 years with diagnoses of autism, autism spectrum disorder, or pervasive developmental disorder	PECS	Several studies reviewed reported increases in spoken language production
Bondy & Frost (1994)	85+ participants	PECS	76% of participants using PECS for over 1 year used spoken language alone or in combination with PECS
Schwartz et al. (1998)	31 participants ages 3 to 6 who had been diagnosed with autism spectrum disorders, Down syndrome, Angelman syndrome, or other developmental disabilities	PECS	Increase in spoken language for 44% of participants

Study	Participants	Pictorial Intervention	Spoken Language Results
Tincani (2004)	2 participants ages 5 and 6 with autism and intellectual disability	PECS	Increase in vocalizations with reinforcement delay for 1 participant
Kravits et al. (2002)	1 participant age 6 years with autism, language delay, and intellectual disability	PECS	Increase in intelligible vocalizations in 2 of 3 settings
Carr & Felce (2007)	24 participants ages 3 to 7 years with autism	PECS	5 of the participants increased the amount of spoken language used
Charlop-Christy et al. (2002)	3 participants with autism, ages 3 to 12 years	PECS	All 3 participants increased spontaneous spoken language
Tincani et al. (2006)	2 participants ages 10 and 12 years with autism	PECS	Substantial increase in vocal approximations with Phase IV of PECS
Ganz et al. (2009)	3 participants ages 3 to 8 years with autism	PECS	2 of 3 participants began using spoken language
Sulzer-Azaroff et al. (2009)*	386 participants ages 18 months through adults with varying diagnoses including autism, intellectual disability, Down syndrome, autism spectrum disorders, attention deficit hyperactivity disorder, cerebral palsy, developmental delays	PECS	Several articles reviewed reported an increase in spoken language, especially with early PECS training and through Phase IV

Note: *Systematic review

intellectual disability without Down syndrome. As such, a study by Kroeger and Nelson (2006) analyzed the results of withholding reinforcement using direct instruction, natural environment, and incidental teaching on spoken requests. The participant was a nine year old male who had been diagnosed with Down syndrome and autism. Results indicated that the methods used can be effective for increasing prompted, responsive, and spontaneous verbalizations.

Purpose

Currently, there are no set guidelines for speech-language pathologists for communication intervention strategies that are likely to be effective for a child with Down syndrome who has limited expressive language or speech. In developing the methods for the current study, the authors considered the expressive language deficits characteristic of children with Down syndrome as described previously, positive research suggesting targets for requesting in communication intervention, research suggesting the use of visual aids with children with Down syndrome, the favorable research supporting the efficacy of the PECS protocol for children with intellectual disability to promote expressive language, and the positive correlative effects of picture exchange systems on spoken language.

In the most current PECS manual, Frost and Bondy (2002) encourage testing "adaptations of PECS," and the present investigation reflects a considerable variation of the PECS protocol. Because the instructional procedures used in the current study substantially differed from standard PECS teaching procedures, we refer to the present study as a "picture exchange system" (pp. 114, 136). The present study used a single-

subject design and a picture exchange system inspired by the protocol for the PECS system as described by Frost and Bondy (2002).

The purpose of the current study was to answer the question of whether or not a picture symbol system would result in an increased amount of spoken requests for a young child with Down syndrome and language impairment. Given the previous literature in this area, it was hypothesized that increases in requesting would occur for the research participant with the methodology used in the current study. The methodology used here, which is described in the Method section, is an adaptation of the PECS protocol. It was anticipated that measurable increases in spoken requesting behaviors would be observed and documented during the course of the intervention described in this study.

Chapter 2

Method

This study was conducted with the Radford University Institutional Review Board approval. A description of the study participant, assessment procedures, research design, procedures, and setting and materials, and an explanation of the treatment protocol follow. Although case study research typically involves a detailed description of these elements, for the purposes of this thesis, some of these elements are purposefully left non-descript. This study was conducted in the greater Roanoke area of Virginia, which is where Radford University is situated. Given that the participant had a diagnosis of Down syndrome and that this genetic disability is relatively uncommon, the author of this thesis took those steps necessary to ensure the privacy of the participant and the participant's family in any published report. For this reason, although the pronoun *his* can be used to denote both sexes, the expression *his/her* is used to provide the utmost privacy for the participant.

Participant

One child with Down syndrome, who also had a language impairment and intellectual disability, participated in this study. The child had been given these diagnoses prior to the research study by various professionals, including educators, psychologists, and medical doctors. The evaluations conducted as part of this study confirmed the language impairment and delayed communication behaviors. As mentioned above, specific demographic information about the participant in the present study has been purposefully omitted to protect the privacy of the child and family. A pseudonym is used in this paper to protect the identity of the child participant. Additionally, the author chose

an androgynous name for the child and to provide age ranges rather than the precise chronological age of the child as not to provide the gender. The participant is referred to as Jadyn. His/her history follows.

According to written report by the child's parent, Jadyn was first diagnosed with Down syndrome via amniocentesis prior to birth. Jadyn began receiving speech-language services as a young child with a speech-language pathologist at a private practice and was then transferred to public school services. Per intake forms, Jadyn's parent reported Jadyn to have said a first word at approximately 18 months. Written school records provided by Jadyn's parent identify him/her as having intellectual disability. According to public school records, a *Wechsler Primary and Preschool Scale of Intelligence-Third Edition* (Wechsler, 1967/2002) was administered to Jadyn. This test has a mean of 100 and standard deviation of 15. Accordingly, Jadyn's scores: a score of 51 in the Verbal subtest, a score of 45 in Performance, and a score of 42 in the full scale place Jadyn's performance below two standard deviations from the mean. These scores are commensurate with those classified as falling in the intellectual disability range, according to the assessment tool.

In terms of language competence, Jadyn was assessed using the *Rossetti Infant-Toddler Language Scale* (Rossetti, 2005) as a toddler and again in the formal school-age years by his/her local public school system. Although this assessment is not norm-referenced and Jadyn's performance cannot be compared to a population based sample, the manual presents benchmarks of language achievement ascertained from other sources. According to these reports, Jadyn's most current expressive language skills were equivalent to those of a 15 to 18 month old child and receptive language skills were

equivalent to a 21 to 24 month old child. These estimates are actually quite similar to those obtained from the first administration of the Rossetti. Results between the two time points discussed above indicated minimal growth in receptive language skills from toddlerhood to the formal school-age years and no growth in expressive language skills during this time.

Assessment Procedures

Jadyn's participation in the current study was a part of speech-language treatment. Jadyn was a child who was in the earlier years of formal education at the onset of treatment. Jadyn was seen for speech-language treatment a priori and concurrent with the current study. A graduate student in the field of speech-language pathology conducted the treatment protocol under the direct supervision of a licensed speech-language pathologist. The graduate student is referred to in the remainder of this paper as the "educator."

Prior to the onset of instruction/treatment/intervention, Jadyn's parent completed the *MacArthur-Bates Communicative Development Inventory: Words and Sentences* (Fenson et al., 1993). Although analysis is not applicable because Jadyn was out of the age range for the inventory (toddlerhood, i.e., Jadyn was beyond the ceiling chronological age), the inventory was completed to gain an account of Jadyn's communication ability. The results are summarized in Table 6. Per parent report on the inventory, it was noted that Jadyn did not produce pronouns, question words, prepositions or locations, helping verbs, or connecting words.

During informal evaluation conducted for the current study, Jadyn occasionally repeated words immediately following a model (e.g., "Jadyn say hello." "Hello"), vocalized rote expressions (e.g., "the end") in appropriate contexts, completed rote

Table 6

Results of the MacArthur-Bates Communicative Development Inventory: Words and Sentences

Part	Category	Number Understood	Number Possible
I: (Words	Sounds	9	12
Children Use)	Animals (real or toy)	20	43
	Vehicles (real or toy)	6	14
	Toys	13	18
	Food and Drink	31	68
	Clothing	12	28
	Body parts	18	27
	Small household items	11	50
	Furniture and rooms	6	33
	Outside things	6	31
	Places to go	2	22
	People	8	29
	Games and routines	10	25
	Action words	14	103
	Descriptive words	12	63
	Words about times	1	12
	Pronouns	0	25
	Question words	0	7
	Prepositions and locations	0	26
	Quantifiers and articles	1	17
	Helping verbs	0	21
	Connecting words	0	6
	How children use words	3	5
	Word endings-Part 1	1	4
II: Sentences &	Word Forms: Nouns	1	5

Part	Category	Number Understood	Number Possible
Grammar	Word Forms: Verbs	0	20
	Word endings-Part 2: Nouns	0	14
	Word endings-Part 2: Verbs	0	31
	Complexity	0	37

Subsection	Jadyn's Inventory	Age of Child Scoring at Similar Levels*
Vocabulary production	180	21 months
Use of irregular nouns and verbs	1	18-21 months
Use of over-regularized words	0	
Length of the 3 longest sentences	2.2	19 months
Sentence complexity	0	up to 19 months

Note. Adapted from the *MacArthur-Bates Communicative Development Inventory: Words and Sentences*, 1993. Jadyn falls beyond the age range specified for this inventory; therefore, his/her results may not be compared to the norms. This information is provided for the reader to understand how a child in the age range specified would score on the inventory.

phrases (e.g., ready, set, _____), and identified characters (e.g., Elmo) and objects (e.g., basketball) outside of question prompts. Moreover, Jadyn used a few manual signs when prompted (e.g., please, more).

At the onset of the current study, Jadyn was not observed to spontaneously gain a communicative partner's attention, praise, or recognition with conventional communication

means such as words, manual signs, or conventional gestures. Instead, Jadyn used unconventional methods to gain assistance (e.g., using a partner's hand to gain access to an elevator). Jadyn protested with vocalizations (i.e., "no, no, no") and by physically removing him/herself (e.g., walking away from the activity at hand). Although Jadyn used facial expressions for emotion and interest (i.e., smiles), Jadyn was not observed to use facial expressions to communicate. In sum, Jadyn's communication was characterized by limitations in using joint attention, gaze shifting, pointing, showing, requesting, and social interaction. Deficits in these early communicative behaviors elucidated the failure to demonstrate communication growth since toddlerhood.

In sum, formal and informal evaluation of Jadyn's communication functioning at the onset of the current study suggest that his/her communication could be described as compromised in all language modalities—spoken, gestural, and manual signing. This suggests that Jadyn was not responsive to the years of speech-language pathology services reported by his/her parents in the preschool years.

Parent report and available treatment information suggested that treatment up until the start of this study utilized naturalistic teaching methods. It was clear that this approach was not effective for the participant; thus, a behavioral approach seemed a

reasonable alternative to continuing with an approach that had not demonstrated measurable progress.

A speech-language therapy plan was developed based on the results from the assessments and parent report discussed above. A plan rooted in behavioral approaches that targeted an early developing communicative function, requesting, was deemed a communicative objective for the treatment period. Requesting was targeted because it is one of the earlier communicative acts displayed by young children. For example, Bondy and Frost (1994) recommended teaching requests first because the reinforcement used is specific and concrete (p.2).

Given that spoken language is the preferred method of communication for humans, use of spoken language (speech) for requesting was a goal of Jadyn's treatment. Spoken productions allows for communication in all settings, whereas other forms of expressive language (e.g., manual signing) are limited to communication partners who understand that modality or language system. Moreover, Jadyn had demonstrated a preference for, and capacity to, produce spoken language above and beyond that of conventional gesture or manual signing.

Research Design

To evaluate the effectiveness of using picture exchange to improve spoken requesting in the child participant, the current study used an A-B-C single-subject design. Single-subject research may be used to confirm clinical practices which are effective (Odom et al., 2003) and nearly all of the published picture exchange studies, to date, have employed single-subject designs (Lancioni et al., 2007; Preston & Carter, 2009, Sulzer-Azaroff et al., 2009).

There are many variations of single-subject designs. As discussed by Perdices and Tate (2009), single-subject research, including case descriptions, pre and post designs, A-B designs, and multi-phase and multiple baseline designs, is beneficial for clinicians treating patients on a day-to-day basis. Perdices and Tate (2009) explain that visual analysis of the data is the traditional way that social scientists conclude a measurable difference between phase A (baseline) and phase B (treatment) in single-subject research. This inspection permits inferences to be drawn about causal associations between the independent and dependent variable (Gillis & Butler, 2007, p. 535). As such, whereas group designs might provide the statistical power to analyze group differences between means, single-subject designs examine the change in a behavior over a time period (Gillis & Butler, 2007).

Although the traditional method of analysis in single-subject designs involves visual analysis of the measured behaviors, there exist ways to complement this discovery with statistical methods (Perdices & Tate, 2009). The statistical analyses do not include the use of ANOVA, MANOVA, correlation, or regression as seen in group designs; rather they may include randomization tests, split-middle trend lines, and C-statistics, among others (Perdices & Tate, 2009).

Procedures

Parental consent for the present study was obtained a priori to the intervention. Approximately two 50-minute training sessions took place each week over a 6-week period. One week was missed due to educator illness and inclement weather. Therefore, the treatment protocol—which included a baseline, intervention, and generalization phases, occurred over ten 50-minute sessions.

This study contained three phases: baseline, intervention, and generalization. A mastery criterion was set at 90% accuracy on a minimum of 3 consecutive trial sets of 10 during the three phases of the study. The dependent measure in this study, the number of requests made using three intelligible words or word approximations, is displayed in Table 7. Data were plotted graphically to determine if the data show a causal relationship between the intervention (i.e., a picture exchange program) and improvement in number of words spoken per trial, and trends were examined using visual inspection to determine results.

Specific details about the phases of the current study are described below.

*Baseline***.** Jadyn sat in a child-sized chair at a child-sized table and the educator sat on the opposing side of the table. The 3-ring communication binder containing picture symbols for 12 snack items was available on the table within reach for Jadyn. A standard sized table positioned behind the educator supported 12 bins with matching picture symbols corresponding with the 12 snack symbols in the communication binder with the picture symbols facing Jadyn.

The educator said, "Jadyn, this is what we have for snack" as she gestured to the bins (i.e., held out her hand over the bins). Using this method, Jadyn was given 10 opportunities to request a snack from the bins. No cues were provided. The communication binder given to Jadyn included the picture symbols for "I/Jadyn" and "want" in place on the sentence strip. Jadyn was expected to choose a picture symbol for snack from the corresponding "snack" page of the communication book, place it at the end of the sentence strip, and spontaneously say "I want _____." A spoken request of three intelligible words or word approximations (e.g., "I wa cooie") was considered a

Table 7

Independent and Dependent Variables

Independent variable	Dependent variable
Picture symbol exchange system	Number of requests made using 3 intelligible words or word approximations (See Table 5 for acceptable responses.)

correct response for which Jadyn was given the requested item. Baseline was established after a consistent percentage of correct responses were given over three trials of 10 opportunities. If Jadyn did not initially provide a correct response, but repaired his/her production to provide a correct response, he/she was given credit for a correct response. Responses which were considered correct and those considered incorrect are displayed in Table 8.

*Intervention***.** The intervention phase of the current study began with a field of two snack items. By parent report, one available item was known to be of interest to the participant and the other was a foil. The participant, Jadyn, and the educator sat at the child-sized table as in the baseline phase with only the snack bins corresponding to the participant's choices available. The participant was provided the communication book containing the sentence strip with "I/Jadyn" and "want" in place. The snack divider was placed directly above the scaffolding sentence page and contained only the picture symbols for the two choices.

The participant was prompted with, "Jadyn, this is what we have for snack." The combination of three intelligible words or word approximations of "I/Jadyn" + "want" + an available item was considered a correct response, and the participant was reinforced by gaining the snack item requested. If Jadyn did not request an item for snack with the natural cue (i.e., time delay for a response after snack time was made available), the educator continued from least to most invasive prompting. The hierarchy included an expectant delay, a gestural cue (i.e., pointing to the sentence strip), a spoken cue (i.e., "I" or "I want"), a spoken cue combined with a gestural cue (i.e., "Say it" then pointing to each word on the sentence strip while modeling "I want _____."), and a physical prompt

Table 8

Acceptable Spoken Language Behaviors

Correct		Incorrect	
Description	Example	Description	Example
• Three intelligible words or word approximations, including a subject, verb, and direct object, used regardless of the icons presented (e.g., placing a raisin picture symbol on sentence strip and saying, "I want cookie") – Acceptable verbs included those which indicate a request (e.g., *want*, *need*)	• "I want cookie." • "I wa cooie;" • "I wan jui" • "want juice. I want juice."	• One or two intelligible word(s) • Not using words or word approximations	• "cookie" • "want cookie" or "cooie" • "wa cooie"
• Restart or Repairs	• "I want… I want cookie"		

Correct		Incorrect	
Description	Example	Description	Example
		• Communicating by reaching for or grabbing items	

(i.e., hand-over-hand). The physical prompt ensured that the child was successful with each trial.

When cues were used, the trial was not considered a correct response, but reinforcement was provided by giving the snack item to the participant. After each trial, the picture symbols on the communication binder divider were randomly rearranged to avoid promoting selection of a specific picture symbol. If the participant requested the snack item used as a foil, he/she received that snack item. If the participant attempted to reach for the item, the educator blocked access by removing the item from reach or redirecting the participant to the scaffolding sentence strip/communication book. If the participant placed a picture symbol on the sentence strip that did not match the item spoken, the symbol was ignored and the participant was given the spoken item requested. It should be noted that mid-intervention phase, the educator began placing the available snack items within close proximity and in sight of the participant to increase his interest in the activity.

In subsequent phases of intervention, the field of snack items was increased to three, six, and a maximum of 12 choices. The current study moved to the generalization phase upon the participant obtaining 90% accuracy across three consecutive sets of 10 trials.

*Generalization***.** To probe for generalization, the same setting and materials as those described in the intervention phase were used with a novel adult partner who was unfamiliar with the treatment protocol. The novel partner used the same prompt, "Jadyn, here is what we have for snack." As in the intervention phase of the present study and outlined in Table 8, the combination of three intelligible words or word approximations

of "I/Jadyn want _____" was considered a correct response, and the request was fulfilled. An incorrect response was marked accordingly, and the probe continued to the next trial with no cues or reinforcements provided. Generalization was considered achieved if the participant achieved 90% accuracy across three consecutive sets of 10 trials.

The phases of the current study described above are listed in Table 9.

Table 9

Phases of the Present Study

Phase		Description
Baseline		The educator controlled access to twelve snack items. Jadyn was provided the item requested when he/she spoke, "I/Jadyn want _____."
Intervention	I	Two picture symbols for snack items were used. One was known to be desired and one known to be undesirable was used as a foil. The participant was taught to place the picture symbol for the desired snack item on the sentence strip with "I/Jadyn" + "want" and to then speak "I/Jadyn want _____." A hierarchy of prompts were used from least to most invasive: expectant delay, gestural cue (i.e., pointing to the sentence strip), spoken cue (i.e., "I" or "I want"), spoken cue combined with a gestural cue (i.e., "Say it" then pointing to each word on the sentence strip while modeling "I want _____."), and physical prompt (i.e., hand-over-hand).
	II	Three picture symbols for snack items were used. Two were known to be desired and one known to be undesirable was used as a foil. The participant placed the picture symbol for a desired snack item on the sentence strip with "I/Jadyn" + "want" and spoke the request "I/Jadyn want _____." The same hierarchy as in Phase I was used when necessary.
	III	Progression to a maximum of 12 picture symbols for snack items was used. The snack items offered were desired snack items. The participant placed the picture symbol for a desired snack item on the

Phase	Description
	sentence strip with “I/Jadyn” + “want” and spoke the request “I/Jadyn want _____.” The same hierarchy as in Phases I and II was used when necessary.
Generalization	A novel communication partner controlled access to a maximum of twelve snack items. Jadyn placed the picture symbol for a desired snack item on the sentence strip and spoke, “I/Jadyn want _____.”

Setting and Materials

The treatment for the current study occurred in a classroom / treatment room / therapy room that was approximately 8 x 9.5 feet. A non-descript explanation is provided to protect the privacy of the research participant and his/her family. The intervention setting was equipped with video-tape equipment that recorded the instructional interactions.

Jadyn sat in a child-sized chair on one side of a child-sized table with his/her back to the mirror. A standard sized table positioned behind the educator held the items used for requesting. Plastic bins of approximately 4 x 7 x 5 inches were filled with various snack items known to be of particular interest to Jadyn or particularly disliked by him/her as reported by the parent. Each snack bin contained a picture of approximately 2 x 2 inches that symbolized the category of item contained in the bin (e.g., a generic picture of chips was placed on the snack bin containing chips) with the word written above the picture. The picture symbol was taped to the end of the bin facing Jadyn.

Jadyn was given a 3-ring binder of approximately 7 x 5 x 1 inches which contained plastic folder dividers. One folder divider was labeled “snacks,” one “people,” one “toys,” and one “colors.” Each of the categorical dividers contained colored 2 x 2 inch pictorial symbols from Speaking Dynamically Pro with Boardmaker or the internet with the typed word accompanying the symbol. A fifth sheet placed in the binder was used for a scaffolding sentence strip which contained a solid, horizontal strip of hook-and-loop fastener for Jadyn to attach the symbols. When the binder was opened vertically, the divider with the scaffolding sentence strip was closest to Jadyn with the dividers for various categories of items directly above so they could be viewed

simultaneously opposing the scaffolding strip. The scaffolding strip contained the typed text "I/Jadyn" + "want" with space to the right for a picture symbol of an item. A 1-inch square picture of Jadyn accompanied the text "I/Jadyn" and a Boardmaker symbol for *want* accompanied "want." The symbols were laminated and attached to the plastic dividers using the hook-and-loop fastener. All text used was in Calibri 14 point font and placed above the picture symbol. The present study concentrated on the folder divider specifying "snacks." The snack symbols provided in Jadyn's binder matched those on the corresponding bins for each snack choice provided during that phase of the study. A second communication binder that matched the one used in the current study was sent home with Jadyn, and Jadyn's school also used a similar book.

Explanation of the Treatment Protocol

The instructional procedures used here were inspired by, but differed considerably from those detailed by Frost and Bondy (2002) referred to as the *Picture Exchange Communication System* (PECS). Lund and Troha (2008) successfully modified the protocol proposed by these authors with use of tactile symbols to use with participants who were blind and had autism. The modifications proved efficacious through the first three phases of the picture exchange protocol proposed by Frost and Bondy (2002).

In the current study, the outcome measure pertained to the child's use of spontaneous spoken language and was not limited to picture sharing. In the Frost and Bondy (2002) protocol, spoken language is not required. In fact, Bondy and Frost (2002) caution against requiring participants to use spoken language as they exchange picture symbols and say that, "we do not teach PECS as a way to learn to speak" (p. 176). Although spoken communication is not a specified outcome in the PECS program, if a

child has the ability to produce spoken language (speech), evidencing intentional communication using spoken language is preferred over non-speech communicative forms, such as handing pictures to communicative partners. As such, given that Jadyn was able to speak, he/she was expected to display communicative intent via picture sharing paired with spoken language.

Also notably discrepant from the standard PECS protocol, the current intervention was provided by only one educator, in one context, at a maximum of a bi-weekly basis. While it is preferred that a child be given opportunities to communicate throughout the entire day to simulate communication by typically developing children, as recommended by Bondy and Frost (2002, p. 54-55), Jadyn's treatment reflects that which may be commonly provided by educators, including speech-language pathologists, considering institutional restraints and reimbursement.

Another deviation from the PECS protocol included use of the prompting hierarchy employed in the current study. The educator used a least-to-most prompting hierarchy that included verbal prompts and encouraged spontaneous requesting over responding to repeated prompts that could be interpreted as communication bids from the adult. The least-to-most prompting methods included an expectant delay, a gestural cue (i.e., pointing to the sentence strip), a spoken cue (i.e., "I" or "I want"), a spoken cue combined with a gestural cue (i.e., pointing to each word on the sentence strip while saying "Say it. I want _____."), and a physical prompt (i.e., hand over hand). These adaptations were based on three factors: (a) the child's speech and language intervention goals, (b) the child's ability to use spoken language for non-communicative purposes, and (c) the child's parentally reported ability to discriminate between pictorial symbols. The

picture exchange system was used as a scaffold to promote requesting with the expectation that the use of picture exchange would be faded independently by the client as the use of spoken requesting increased.

In the present study, spoken language and picture exchange requests occurred during snack time at the beginning of each treatment session. Schwartz and colleagues (1998) found that, of 18 children with disabilities, 3 of whom were diagnosed with Down syndrome, spontaneous requesting occurred most frequently during snack and free play and that requesting occurred more often than commenting, protesting, and responding to a communication bid. A study by Bruce and Vargas (2007) also found higher rates of communication among the children studied with severe developmental delay to occur during activities involving eating.

Prior to commencement of the current study, parental report was used to determine desirable and undesirable stimuli for the participant. Sigafoos and Mirenda (2002) found expressive language to be promoted best when preferred objects or activities are used in treatment. Moreover, Bondy and Frost (2002) incorporate periodic assessment of desirable items in their PECS protocol.

Chapter 3

Results

The purpose of the current study was to determine if picture communication symbols are effective in increasing spoken language (speech) requests in a child with language impairment who also has Down syndrome. This study did not determine the effects on paralinguistic behaviors (e.g., gestures, facial expressions, etc.); therefore, these behaviors were not recorded or required for a correct response. The educator measured only the number and type of intelligible words including a subject, verb, and direct object. Qualitatively, the participant consistently maintained a flat affect when requesting and often looked down at the communication book or at the item he/she wanted rather than gaze shifting, making eye contact with the educator, or gesturing to the item or educator.

Descriptions and examples of acceptable responses are detailed in Table 8. For purposes of the current study, a spontaneous request was defined as a request spoken by the participant with no cues provided beyond the natural cue of available snacks. Correct responses included three intelligible words or word approximations of "I/Jadyn" + "want" + an available item regardless of how many or what picture symbols were placed on the sentence strip. Unlimited prompting (i.e., the offering of snack) was provided and the correct response accepted as long as no cues beyond the natural cue were provided. A correct response included three words, with words denoted by breaks in phonation. The participant was allowed to say either "I" or "Jadyn" for the subject of the request. If the participant spoke synonyms for the verb "want" (e.g., "need"), the response was accepted and considered correct as long as the verb used is considered socially acceptable for a

request. For example, “I need cookie” was an acceptable response, but “I see cookie” was not considered correct. If the participant restarted or self-corrected his/her response, the correction was accepted. For example, if the participant spoke, “I want, I want cookie” the spoken request was considered a restart and correct response, and he/she received a cookie with spoken reinforcement (i.e., the educator said, “Yes, I want cookie”). If the participant said, “I cookie, I want cookie,” the response was considered a repair, and the participant received a cookie with spoken reinforcement (i.e., “Yes, I want cookie”).

The treatment continued beyond the dates of the current study to include requests during free play and inclusion of descriptors in spoken requests. The data for those activities are not presented in this study; however, the participant successfully used picture symbols to increase the complexities of requests with a highly motivating activity.

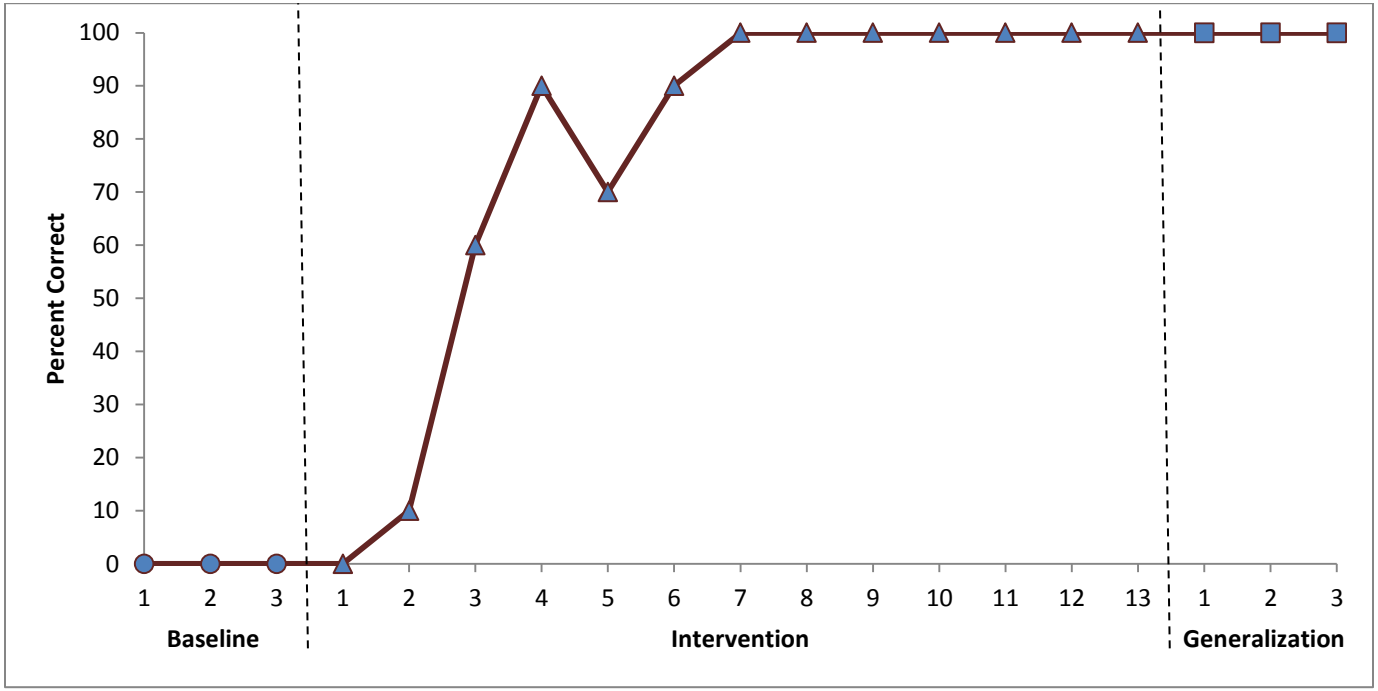
Analysis

Intervention research designs that “meet the standards of scientific research methodology are single subject and group designs” (Gillis & Butler, 2007, p. 534). Unlike group designs which might provide the statistical power to analyze group differences between means, single-subject designs examine the change in a behavior over a time period (Gillis & Butler, 2007). Visual inspection allows for the examination of the functional association between an independent variable (e.g., an intervention) and a dependent variable.

Results of the baseline, intervention, and generalization phases of this study are displayed in Figure 1. Each data point reported in the X-Y graph corresponds to one treatment session. It has often been perceived that single-subject designs are less scientific than group designs due to a lack of statistical analysis; however, this is the

Figure 1

Percentage of Acceptable Spoken Requests Per Trial Set



traditional way in which single-subject designs have been evaluated (Perdices & Tate, 2009).

During baseline, Jadyn did not make spoken requests for a snack item. Using a field of two, he/she spoke ten correct requests out of a set of ten trials by the seventh intervention session. When the field was increased to three and progressed to a maximum of 12, Jadyn maintained 100% accuracy in all trial sets of ten.

Chapter 4

Discussion

The present study demonstrates effective use of a picture exchange system to promote the use of spoken language or speech for requests in one young child with Down syndrome who also had a language impairment. Several studies and meta-analyses have discussed the increase in spoken language measured via words or vocalizations as coinciding with the use of picture exchange systems (Flippin et al., 2010; Bondy & Frost, 1994; Howlin et al., 2007; Ganz et al., 2009; Lancioni et al., 2007; Charlop-Christy et al., 2002; Tincani et al., 2006; Schwartz et al., 1998; Sulzer-Azaroff et al., 2009; Tincani, 2004; Kravits et al., 2002; Carr and Felce, 2007; Preston and Carter, 2009). It is unknown why use of picture exchange systems correlate with an increase in spoken language (speech). It might be due to the provision of a visual scaffold and an understanding of communicative intent as many of these increases were noted during the later phases of picture exchange such as when sentence structure is taught. Jadyn often pointed as he/she produced spoken requests when his/her communication binder was not available, as if he/she was pointing to the symbols on the sentence strip. He/she was also immediately rewarded with the requested item when his/her intent was conveyed using spoken language (speech).

In addition to showing efficacy for requesting, the participant generalized the communicative behaviors targeted in the treatment protocol. Jadyn quickly generalized spoken requests for snack items, which was the intervention objective, to make requests for the preferred activity of riding an elevator. The elevator was known to be highly

motivating to Jadyn as he/she was observed to run to it upon arrival to the instructional setting; therefore, the symbol for elevator was available in his/her communication binder.

Jadyn consistently placed the picture symbol for elevator in the appropriate position on the sentence strip and spoke the request using 3 intelligible words (i.e., "I want elevator"). During this extended treatment time, he/she frequently spoke the request without the use of the picture symbols and often pointed to three horizontal points on his/her abdomen, on the wall, or in the air as he/she spoke the words, similar to the way he/she pointed to the three symbols when using the scaffolding sentence strip provided by the educator in the communication binder.

Later in the treatment program, more complex syntax integrating descriptors was targeted with the use of picture symbols representing elevators in specific buildings. Jadyn used four picture symbols to request specific elevators in walking proximity to the intervention classroom (e.g., "I/Jadyn" + "want" + [building] + "elevator"). He/she consistently placed the name/picture of a specific building as well as the picture symbol for elevator. The spoken requests were less intelligible as they are more phonetically complex, but Jadyn consistently placed four picture symbols and, with cues, spoke the request with three words (i.e., "I want elevator") and often four (e.g., "I want Carnegie elevator").

Limitations

There are several limitations to the present study, which should be carefully considered when interpreting the results and generalizing intervention to other participants, settings, and contexts. Most notably, this study included only one participant, in one setting, and in one context. Ideally, intervention needs to prove

efficacious for numerous participants across multiple studies in various settings and contexts.

Second, the present study did not rule out developmental maturation or exclude the occurrences in other contexts, such as the home setting. Although the intervention was conducted over a relatively short period of time, developmental changes may have positioned the participant to be highly responsive to the treatment protocol. The use of picture exchange was also reported by the participant's parent in his/her school environment. Educational efforts in both the school and home environments may have affected the participant's response to the intervention protocol.

Third, the results from the current study were conducted with visual analysis, demonstrating a correlation between the picture exchange protocol used and an increase in spoken requests made. Visual analysis is a traditional approach to interpret single-subject research (Perdices & Tate, 2009). Complimenting this analysis with other forms of measurement would have strengthened the merits of the findings. Percides and Tate (2009) share that "visual analysis emphasizes clinical rather than statistical significance" (p. 913). As such, the inclusion of multiple forms of analysis would strengthen the findings mentioned here.

Fourth, Horner et al. (2005) explain that single-subject designs should include methods for evaluating procedural fidelity. Inter-rater reliability was not conducted on the measured behaviors. High agreement between the educator and one or more coders on the measurement variable would have provided increased reliability and validity for the findings.

Fifth, the intervention described in this study was not the only objective or teaching methodology used with the participant. Other teaching efforts may have supported Jadyn's requesting growth in the current study. In addition to teaching requesting behaviors using picture exchange, as part of the overall speech-language therapy plan, the educator also taught Jadyn joint attention during the treatment period. The decision to target an increase in joint attention was based on several research articles which discuss the positive effects of targeting this prelinguistic behavior and provide evidence of the link between joint attention and later language development.

McCathren (2000) reported intervention targeting prelinguistic communication skills to be potentially beneficial for increasing the following behaviors: eye contact, conventional gestures, intentional communication, and vocalizations (p. 21). As well, McCathren, Yoder, and Warren (1999) found that rates of joint attention and communication may predict future expressive vocabulary in children including those with Down syndrome. In a separate study by Yoder, Warren, Kim, and Gazdag (1994), milieu teaching proved beneficial for children with intellectual disability, absence of spoken language (speech), and difficulty with intentional requesting, all of which were existent with Jadyn.

Joint attention was not included as a measurement variable in the current study because it was not a part of the picture exchange protocol. This detail is included to more accurately explain the treatment method used during the present study and highlight factors that confound treatment efficacy. That said, the participant's generalization of requesting behaviors is strong support for the effectiveness of the picture exchange intervention. The joint attention objective may have supported this development.

Lastly, the child participant may have been highly responsive to the treatment protocol due to the intensity and individualization in which it was administered. This study employed individualized instruction with one or more educators which is not always feasible in all educational settings. This speaks to external validity.

Conclusion

This study offers preliminary evidence for further investigation into the use of picture exchange for promotion of spoken language (speech) in individuals with language impairment, including children diagnosed with Down syndrome and other significant disabilities. A picture exchange system may be beneficial to increase spoken language or speech when used with young children who have Down syndrome and severe communication impairments.

The methodology employed in the current study was single-subject design. The procedures fulfilled a considerable number of important aspects of single-subject research delimited by Horner et al. (2005). For example, the present study had a demonstration of a functional association between the treatment and a behavior change, there was a well-defined dependent variable, there was repeated measurement of the dependent variable over time, there was a description of the baseline phase with sufficient observations to evaluate the independent variable, and there was a detailed description of the procedures and setting so that other researchers could replicate the results.

Future research should include multiple participants with varying types of developmental disabilities and degrees of delay. Studies are needed which include multiple contexts and settings, control for developmental maturation and other communication treatment, and that analyze the maintenance of speech gains. No

paralinguistic behaviors were explored quantitatively in the present study; therefore, including measurement of such behaviors in future research would round out the current study's findings.

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