GENERALIZATION TRAINING FOR IMPROVISATIONAL SKILLS USING A PICTURE EXCHANGE COMMUNICATION SYSTEM

Thesis

Presented in Partial Fulfillment of the Requirements for the Degree Master of Arts in the Graduate School of The Ohio State University

By

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ABSTRACT

The Picture Exchange Communication System (PECS) can be a successful way for children who have language impairments to minimize communication difficulties (Mirenda & Erickson, 2000). Teaching improvisational skills can enhance the efficiency of PECS. The current study sought to replicate and extend the study by Marckel et al. (2006) on improvisation training. Procedures were modified to examine the extent to which training diverse exemplars from different stimulus classes concurrently (rather than sequentially, as in Marckel et al.) would facilitate generalization across descriptor classes. When the picture representing a desired item was unavailable, four children with ASD were taught to construct and exchange a sentence strip that contained an “I want” picture and descriptors corresponding to the desired item (e.g., “I want eat orange square” to request a cheese cracker). A multiple baseline design across participants demonstrated all participants generalized this skill across locations and listeners. Mixed results of multiple exemplar training on response generalization suggest this may be a promising strategy. Two participants generalized improvisational skills to request items that were not visible, demonstrating pure mands. Pure mand training was conducted with the remaining two participants by contriving motivation for preferred items and using a time-delay prompt. Results showed these procedures were effective in teaching participants to improvise when emitting pure mands.
DEDICATION

Dedicated to my friends and family
March 2001 ........................................B.A. Sociology,

The Ohio State University

1999-2003 ........................................Behavioral Therapist

Franklin County Board of Developmental Disabilities

2003-2005 ........................................Program Supervisor,

Step By Step Academy

2005-2006 ........................................Clinic Director,

Step By Step Academy

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Fields of Study

Major Field: Education
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Autism Spectrum Disorder (ASD) is a neurobehavioral disorder characterized by impairment in reciprocal social interaction, impairment in communication, and the presence of repetitive and stereotypic patterns of behaviors, interests, and activities (American Psychiatric Association, 2000). There are a number of communication impairments that may be present in individuals diagnosed with ASD. These impairments can be impairments in receptive language, repetitive language, non-vocal communication, and expressive language. For instance, individuals with ASD can have difficulties in developing receptive language skills (i.e., understanding what others are saying; Peeters & Gillberg, 1999). Some children with ASD may use repetitive or rigid language, such as repeating the same word or phrase over and over again (Athens, Vollmer, & Sloman, 2008). Deficits in non-vocal communication such as the use of eye contact, gestures, and facial expressions are also common among individuals with ASD. Deficits in communication skills can lead to a number of problems.

Communication impairments can make it difficult for individuals with ASD to interact with others. This may lead to problems forming and sustaining social relationships. Individuals with communication impairments can also have problems expressing their needs and wants. For example, if an individual has limited vocal abilities
he/she may have trouble describing certain types of food he/she may want. Deficits in communication skills may result in the individual engaging in challenging behaviors, such as aggression towards others, self-injurious behaviors, and/or property destruction as a non-vocal form of communication (Carr & Durand, 1985). These types of behaviors can jeopardize the health and safety of individuals with ASD and cause a strain on their relationships with others.

There are several strategies that have been used to help individuals communicate their wants and needs. One example would be functional communication training (Wacker et al., 1998). Functional communication training is an intervention strategy that involves identifying the function or purpose of the challenging behavior and then teaching a functionally equivalent communicative behavior (Durand & Carr, 1991). For example, if the function of a child’s tantrum is to gain access to food, he/she can be taught to make the sign for “eat” in place of having a tantrum when hungry. Teaching appropriate forms of non-vocal communication can be a successful way for children who have language impairments to meet their communication needs and in turn can decrease behavior problems (Durand 1999; Mirenda, 2001; Shafer, 1993).

There are various forms of non-vocal communication that can be taught to individuals with language impairments such as, sign language, picture systems, and voice output devices. These non-vocal methods of communication are commonly referred to as augmentative and alternative communication. Augmentative and alternative communication (AAC) includes all forms of communication other than speech that are used to express thoughts, needs, wants, and ideas (American Speech-Language-Hearing Association, 2002). AAC can be classified as either aided or unaided. Unaided AAC
systems, such as sign language, do not require any external device for the individual to perform the communicative act. Aided AAC requires the use of some kind of transmission device to deliver the message. This can include picture communication symbols, line drawings, and electronic speech-generating devices (Mirenda, 2003).

**Picture Exchange Communication System**

The Picture Exchange Communication System (PECS) is an aided, symbol-based form of AAC that is often used successfully by individuals with ASD to minimize communication difficulties (Mirenda & Erickson, 2000). PECS is currently used worldwide by individuals of various ages. It is based on the principles of applied behavior analysis and B.F. Skinner’s functional analysis of communication that was introduced in the book, *Verbal Behavior* (1957; Bondy & Frost, 2002). Using the PECS protocol, individuals are trained to initiate requests through picture exchanges with a communicative partner, to travel when necessary to make requests, and to discriminate between multiple pictures. In addition, students learn to use sentence structure to make a request in the form of “I want (item),” to request specific preferred items using a descriptive vocabulary, and to respond to questions and make comments (Bondy, 2001).

Studies have shown that most children taught PECS acquire independent use of this low cost system, and that gains can be generalized across communicative partners and to untrained settings (Bondy & Frost, 1994; Chambers & Rehfeldt, 2003; Charlop-Christy, Carpenter, Le, LeBlanc, & Kellet, 2002; Ganz, Sigafoos, Simpson and Cook, 2008; Magiati & Howlin, 2003; Schwartz, Garfinkle, & Baur, 1998). Bondy and Frost (1994) reported that 85 young children with ASD who had no functional communication prior to treatment learned how to use the PECS system. Over 95% of these children
learned to exchange two or more pictures to emit requests. Similarly, in a study by Schwartz et al. (1998), the effects of PECS training showed an increase in requests for 31 preschool children with ASD and developmental delays. This study also followed 18 preschool children with developmental delays and found that participants generalized the use of PECS to untrained school settings. Ganz et al. (2008) found that following PECS training a 12-year-old boy with ASD generalized his communication skills using PECS across a variety of instructors.

Another benefit of PECS is an increase in social communication (Carr & Felce, 2007; Charlop-Christy et al., 2002; Kravits, Kamps, Kemmerer, & Potucek, 2002; Canella-Malone, Fant, & Tullis, 2010; Stahmer & Ingersoll, 2004). In a study by Canella-Malone et al. (2010), two females with developmental disabilities learned to greet peers, request desired items from peers, and to respond to requests for items from peers appropriately by using PECS. Both participants in this study increased their social interactions with peers by using PECS. Charlop-Christy et al. (2002) reported that, following PECS training, 3 school-aged children with ASD increased requests and initiations with others. Ancillary measures of social-communicative behaviors recorded in this study also showed an increase in participants’ joint attention, eye contact, or toy play following PECS training.

Additionally, PECS can support children who have language impairments in meeting their communication needs and this in turn can lead to a decrease in behavior problems (Buckley & Newchok, 2005; Charlop-Christy, et al., 2002; Frea, Arnold, & Vittimberga, 2001; Kern, Gallagher, Staosta, Hickman, & George, 2006). Buckley and Newchock (2005) assessed the effects of PECS training on the aggressive behaviors
emitted by a 7-year-old boy with ASD. Experimenters conducted a functional analysis and determined the participant’s aggressive behaviors were maintained by access to preferred items. The participant was taught to request desired items using the PECS protocol and a decrease in aggressive behaviors followed. In another study, Frea et al. (2001) taught a 4-year-old boy with ASD and extreme aggressive behavior to use PECS in a preschool classroom. Results indicated that using icons to request desired items and activities was an effective intervention for decreasing the participant’s aggressive behaviors in a brief amount of time. These studies have demonstrated that teaching an appropriate form of non-vocal communication, such as PECS, can provide a replacement for aggressive behaviors that can jeopardize individuals’ health or safety.

Studies have shown that PECS provides individuals who have language impairments with a low cost form of functional communication that can be easily acquired and generalized across untrained people and settings, can increase social initiations and interactions, and decrease problem behaviors. However, implementation of this system does have limitations. These problems include limited response generalization, the storage and organization of icons in the communication binder, and access to all needed pictorial representations of desired items.

One problem experienced with PECS is limited response generalization. Marckel, Neef, and Ferreri (2006) examined the effects of teaching two children with ASD to request items using icons that represented functions, colors, or shapes of the desired item. Results showed that participants learned to mand for items using descriptor icons and to generalize the use of descriptor icons to mand for novel items. Although within-class generalization of descriptors occurred (as shown through the participants’ use of
combinations of descriptor classes to make requests for untrained stimuli), response
generalization across descriptor classes did not occur. That is, generalization probes were
conducted across untrained descriptors (i.e., size) and the use of novel descriptors when
making requests was not observed.

Another limitation of PECS is that as students expand their vocabulary the
number of pictures in their communication binder increases. This can make transporting
the communication binder cumbersome and finding a certain picture time-consuming.
Additionally, most communication books or binders have space limitations, which restrict
the number of pictures that can be held in the binder at one time (Bondy, 2001).

A third limitation is when using PECS in the natural environment individuals will
likely encounter a desired item they do not have a pictorial representation for or the
picture might have gotten lost. If the picture of the desired item is not available,
requesting this item may not occur and the individual may engage in inappropriate
behaviors to get his or her needs or wants met (Sundberg & Partington, 1998).

**Improvisational Skills**

To address some of these limitations, students can learn to problem solve to make
communicating with PECS more effective. One form of problem solving is
improvisation. Parsonson and Baer (1978) define improvisation as “finding a substitute to
replace the specifically designated, but currently unavailable, tool ordinarily used to solve
the problem” (p. 363). Parsonson and Baer (1978) examined the effectiveness of
strategies to teach improvisation. In this study, 5 preschool children were taught to
improvise using various tools during play. For example, when given a toy bench with
wooden pegs to hammer in, children were taught to use alternative tools (e.g., film
canister) when the hammer was missing. Training included the use of a variety of exemplars within each class of tools (i.e., hammers, containers, and shoelaces) and the delivery of praise and descriptive feedback following only the first successful, novel improvisation of a probe item. Results showed all 5 participants increased generalized improvisation within each trained tool class. None of the participants generalized the use of improvisational skills across tool classes.

However, problem solving using improvisation can be a difficult skill for many individuals with ASD to acquire. Improvisation requires an individual to vary his or her response, while one of the common characteristics of individuals with ASD is rigidity of responding (Kanner, 1943; Turner, 1999). Studies that examined improvisational skills among individuals with ASD and developmental delays found these skills did not occur prior to being specifically taught (Chabanne, Alber-Morgan, & DeBar, 2009; Marckel et al., 2006).

Marckel et al. (2006) examined the effects of teaching improvisational skills using PECS. In this study, two participants diagnosed with ASD were taught to improvise when the picture representing a desired item was unavailable, by constructing and exchanging a sentence strip that contained an “I want” picture and one or more descriptors corresponding to the desired item. For example, pictures of the descriptors, “eat”, “circle”, and “black” were used to request an Oreo when the specific picture was unavailable. The improvisation training was conducted sequentially across descriptor classes (i.e., functions, colors, and shapes) and in a different order for each participant. The participant had to meet the mastery criterion for the first descriptor before training on the second descriptor began, and so on. As additional descriptor classes were added, the
participant was required to use previously mastered and newly trained descriptors to request an item. The results of this study showed that training increased the number of improvised requests made by the participants.

Chaabane, et al. (2009) examined the effects of parent-implemented PECS training on improvisation of mands by two children with ASD. Results showed that the training procedures used in the Marckel study could be implemented by parents to teach children with ASD to use novel pictorial response forms.

When individuals who are using PECS do not have a pictorial representation for a desired item in their communication binder, they can learn to improvise and use another picture or combination of pictures to solve this problem and request what they want. Learning to improvise in this manner can enable the PECS user to get his or her needs or wants met and decrease maladaptive behaviors that may occur when an individual cannot communicate effectively.

**Generalization Skills**

Baer, Wolf, and Risley (1968) define a behavior change as having generality “if it proves durable over time, if it appears in a wide variety of possible environments, or if it spreads to a wide variety of related behaviors” (p. 96). Once an individual has learned a skill, the skill must be generalized in order for it to be used in a functional manner in everyday life. However, generalization of skills does not always occur naturally (Stokes & Baer, 1977). It is therefore necessary to plan for generalization. Stokes and Baer (1977) outlined techniques to assess or program generalization. One of these techniques is training sufficient exemplars. Training sufficient or multiple exemplars involves systematically choosing and training multiple, relevant exemplars to promote
generalization to untrained stimuli and responses. Research shows multiple exemplar training is an effective strategy for promoting generalization (Gena, Krantz, McClannahan, & Poulson, 1996; Reeve, Reeve, Townsend, & Poulson, 2007).

Sprague and Horne (1984) examined the effects of training sufficient exemplars on generalized vending machine use among six, severely handicapped high school students. Experimenters compared teaching a single vending machine, three similar vending machines, and three machines that sampled the range of stimulus and response variation in a defined class of vending machines. Results showed the third approach of selecting exemplars that adequately reflect the stimulus and response variation expected in the generalization context was the most effective strategy for teaching generalized responding.

As mentioned above, Marckel et al. (2006) found individuals learned to generalize improvisational skills using PECS across untrained settings, people, and stimuli. When generalization probes were conducted across an untrained descriptor class (i.e., size), making requests using icons from this novel descriptor class was not observed, indicating that response generalization did not occur. Limited response generalization is a problem because it means that more time needs to be spent in the training phase of a skill. Marckel et al. (2006) trained improvisation skills by teaching one descriptor class at a time (i.e., functions). Teaching individuals to request items using icons from multiple descriptor classes (i.e., functions, colors, and shapes) at once might allow the experimenter to teach fewer exemplars that represent a greater diversity. This could reduce training expenditure and promote response generalization across descriptor classes.
**Pure Mand Training**

The design of PECS was influenced by the functional analysis of communication outlined in B.F. Skinner’s book, *Verbal Behavior* (Bondy, Tincani, & Frost, 2004). In this analysis, Skinner defines a number of verbal operants. One of these operants is the mand. Skinner (1957) defines a mand as “a verbal operant in which the response is reinforced by a characteristic consequence and is therefore under the functional control of relevant conditions of deprivation or aversive stimulation” (p.36). Requesting desired items is an example of the verbal operant referred to as the mand. The PECS protocol begins with training on manding or requesting desired items. When a student requests a desired item that is not present in the immediate environment, without the presentation of an instruction such as, “What do you want?” and receives access to the requested item, this can be described as a pure mand.

As individuals’ communication skills develop, they learn to communicate about items that are not present in their immediate environment (Bondy & Frost, 2002). Marckel et al. (2006) found that participants spontaneously used improvisational skills with PECS to request items that were not visible without specific training. If some students with ASD do not generalize pure mands, it would be beneficial to assess the effects of teaching procedures on improvised requests for items that are not present. The PECS protocol outlines a strategy for contriving motivation for students to request items that are not visible by gradually or slowly putting items away. For example, the instructor would entice the student with a preferred item and then put the item in a cupboard when the student approaches. The student would then request the recently removed item by
exchanging the corresponding picture. Studies show contriving motivation for a preferred item and prompting and fading are effective procedures for teaching students to request items that are not visible (Betz, Higbee & Pollard, 2010; Hall & Sundberg, 1987; Sundberg, Loeb, Hale, & Eigenheer, 2002). When teaching a student to improvise using PECS it would also be beneficial to teach the student to use these skills to request items that are not present. This would further increase the ability of non-vocal individuals to get their needs and wants met and increase the efficiency of the PECS system.

**Purpose**

The current study sought to replicate and extend Marckel et al. (2006) and to extend the literature on multiple exemplar training and manding using PECS. Procedures were modified to examine the extent to which training diverse exemplars from different stimulus classes concurrently, rather than sequentially, would facilitate generalization across descriptor classes. Additionally, this study examined the extent to which training procedures would facilitate generalization of improvisational skills using PECS to mand for items that were not visible.
CHAPTER 2: METHOD

Participants

Five boys with a diagnosis of ASD participated in this study. Participants were selected based on their diagnosis of ASD and their mastery of Phase III of PECS. Prior to the commencement of the study, the Institutional Review Board of The Ohio State University granted its approval of all research protocols. Next, the co-investigator contacted the director of Step by Step Academy (SBSA), an educational center for children with ASD and described the study and asked permission to conduct the study at the center. Once site permission (see Appendix A) was gained from the director of SBSA, the director distributed informational letters (see Appendix B) to all the parents of the students at the center. The informational letter described the purpose and procedures of the study and included a parental consent form. Once parental consent was obtained, the co-investigator screened potential participants by reviewing data from SBSA on the students’ performance with the skills outlined in Phases I, II, and III of PECS.

The first five students who had mastered PECS training through Phase III, who were using PECS as their primary mode of communication, and who were able to demonstrate match-to-sample skills per SBSA staff report were chosen to participate in this study. A verbal script for obtaining assent (see Appendix C) was reviewed with each participant prior to beginning the study. One student’s participation was discontinued.
when his mother requested that food and drinks not be used during the sessions, and no other highly preferred items could be identified.

All participants who completed the study regularly used PECS to make requests. They did not imitate vocal sounds and when vocalizations did occur they were not recognizable. Geoff, age 13, knew a number of signs and the staff at SBSA had been working with him to use both sign language and PECS to communicate. Tim, age 16, was deaf and had learned some signs that he would occasionally use to communicate. Scott, age 14, and Alex, age 9, used icons to comment on their environment in addition to using icons to request items.

Setting

The study was conducted at SBSA in various areas that were free from distractions. Location of training varied based on the availability of space within the center. Each space used had a table and chairs, training materials, and a video camera. An instructor from SBSA accompanied each participant and observed quietly during experimental sessions, each of which lasted approximately 15-20 min.

Materials

Three-ring binders were used as a communication board to teach improvisation skills using PECS to the participants. Each binder had four strips of Velcro® placed vertically on the front cover. An “I want” card was placed on the strip of Velcro® on the left-hand side of the binder. A sentence strip consisting of a piece of laminated card stock with Velcro® across it was attached to the PECS book horizontally at the bottom of the front cover. Inside the binders were plastic dividers or laminated pages of card stock with multiple Velcro® strips on each page to store pictures of various descriptors including
shapes, colors, functions, and sizes. For example, descriptor pictures included “black,” circle,” and “eat” that could be used to identify the attributes of an Oreo® cookie. Descriptor pictures were created from software designed to make icons (e.g., Boardmaker®, v.6). Additional teaching materials were preferred stimuli that were identified by conducting stimulus preference assessments with each participant.
<table>
<thead>
<tr>
<th>Phase</th>
<th>Alex</th>
<th>Geoff</th>
<th>Tim</th>
<th>Scott</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>Gummy worms, Jelly beans, Sprite, Cookies, Skittles</td>
<td>Starburst, Balloons, Balls, Gummy worms, Cookies, Cheeze-it’s, Pretzel Sticks, M &amp; M’s, Jelly beans, Skittles, Fruit-Roll Ups</td>
<td>Juice, Cookies, Cheeze-it’s, Pretzel Sticks, Skittles, Fruit Loops, Starburst, M &amp; M’s</td>
<td>Skittles, Sprite, M &amp; M’s, Cookies, Juice, Pretzel Sticks, Crayons, Books, Starburst, Jelly beans</td>
</tr>
<tr>
<td>Training</td>
<td>Gummy worms, Sprite, M &amp; M’s, Snake toy, Skittles</td>
<td>Starburst, Balloons, Cheeze-it’s, Pretzel Sticks, M &amp; M’s</td>
<td>Cookies, Pretzel Sticks, Skittles</td>
<td>Cheeze-it’s, Pretzel Sticks, Oreos</td>
</tr>
<tr>
<td>Within-class generalization</td>
<td>Juice, Cookies, Oreos, Jelly beans</td>
<td>Gummy worms, Balls, Cookies</td>
<td>Cheeze-it’s, Juice</td>
<td>Juice</td>
</tr>
<tr>
<td>Generalization across size</td>
<td>Gummy worms, Oreos, Sprite</td>
<td>Gummy worms, Cookies, Balls, Balloons</td>
<td>Juice, Cookies, Cheeze-it’s</td>
<td>Oreos, Cheeze-it’s, Juice</td>
</tr>
<tr>
<td>Generalization across person and location</td>
<td>Gummy worms, Sprite, Cookies</td>
<td>Gummy worms, Cookies, Balls</td>
<td>Juice, Pretzel Sticks, Skittles</td>
<td>Pretzel Sticks, Juice, Oreos</td>
</tr>
</tbody>
</table>

Table 2.1 Summary of Preferred Stimuli Used in Each Phase

**Dependent Measures**

Dependent measures were the number of unprompted icons exchanged to emit an improvised request during probe trials and the training sessions. Each improvised request consisted of four components. The first component was scored as correct if the “I want” icon was placed on the left hand side of the sentence strip. The first component of the
improvised request was scored as incorrect if the student did not place the “I want” icon on the left hand side of the sentence strip (e.g., placed it on the right side of the sentence strip or did not move the “I want” icon). The next three components were the use of three descriptor icons that corresponded with attributes (e.g., function, color, shape, or size) of the desired item. These components were scored as correct if the selected icons were placed on the sentence strip and the icons corresponded to the attributes of the desired item (e.g., using “eat, orange, square” to request a Cheeze-it®). Components were scored as incorrect if the icons used did not correspond with the attributes of the desired item (e.g., using “play, blue, circle” to request a Cheeze-it®). If the participant did not place an icon from an attribute category onto the strip, the component was scored as incorrect.

The overall percentage of correct components of improvised requests was calculated each session. For example, in a session with 10 trials a total of 40 components were scored. The total number of components completed correctly would then be divided by 40.

Mastery criterion for each phase in training was a score of 90% or higher on the components of an improvised request across 3 different items and across 3 consecutive sessions.

**Data Collection**

During baseline and improvisation training a brief preference assessment was conducted at the beginning of each session following the protocol listed below. The item the student selected during the brief preference assessment was recorded on the data sheet (see Appendix D) and used during the session. Data sheets contained a column to record the student’s performance on each of the four components of the request. If the student placed the “I want” icon on the left hand side of the sentence strip a plus sign (+) was
recorded in the first column. If the student did not place the “I want” icon on the left hand side of the sentence strip the experimenter recorded the prompt type used (e.g., gestural or physical). In the next column the experimenter recorded a (+) if the participant added a corresponding function icon to the sentence strip. If the participant did not place a function icon on the sentence strip or did not place a function icon on the strip that corresponded to the item presented (e.g., placed the “play” icon on the strip instead of the “eat” icon to request a Cheeze-it®) the prompt type used was recorded. In the remaining columns the experimenter recorded participant performance on selecting a corresponding color icon and shape icon in the same fashion.

Data sheets for additional phases indicated the phase being implemented at the top of the sheet (e.g., pure mand training, generalization, and probe). For pure mand training the “out of sight” item that was used was listed on the data sheet. The remaining sections of the data sheet remained the same as those used for improvisation training. The data sheets used for generalization training across person and location and generalization across attributes were identical to the sheet used for improvisation training.

**Interobserver Agreement**

The secondary observer scored sessions by watching video recordings of the session using a data sheet identical to that being used by the primary observer. Interobserver agreement (IOA) data scored by the secondary observer were compared to the data collected by the primary observer. An agreement was scored each time the primary and the secondary observer agreed on the occurrence or absence of the target behavior. IOA data were collected for 27% of total sessions across various experimental conditions for the four participants. Trial-by-trial IOA was calculated by dividing the
number of trials in agreement by the total number of trials and then multiplying by 100% (Cooper, Heron, & Heward, 2007). All IOA scores calculated were then averaged across sessions for each participant by study condition. Table 2.1 displays the means and ranges of the trial-by-trial IOA calculated during each condition of the study for each participant.

IOA for Alex was collected during 0% of baseline sessions, 14% of training sessions, 67% of the pure mand probes, 67% of generalization across size probes, and 67% of generalization across person and location probes. IOA for Geoff was collected for 26% of baseline sessions, 45% of training sessions, 0% of pure mand probes, 31% of generalization across size sessions, and 33% of generalization across person and location probes. IOA for Tim was collected for 38% of baseline sessions, 36% of training sessions, 8% of pure mand sessions, 33% of generalization across size sessions, and 67% of generalization across person and location probes. IOA for Scott was collected across 28% of baseline sessions, 25% of training sessions, 27% of pure mand sessions, 22% of generalization across size sessions and 0% of generalization across person and location probes.
Table 2.2 Percentage of IOA means and ranges (in parentheses) for Alex, Geoff, Tim, and Scott during baseline, training, and probe phases.

<table>
<thead>
<tr>
<th></th>
<th>Alex</th>
<th>Geoff</th>
<th>Tim</th>
<th>Scott</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Baseline</strong></td>
<td>n/a</td>
<td>100%</td>
<td>96% (75-100)</td>
<td>100%</td>
</tr>
<tr>
<td><strong>Training</strong></td>
<td>99% (98-100%)</td>
<td>99% (98-100%)</td>
<td>100%</td>
<td>99% (98-100%)</td>
</tr>
<tr>
<td><strong>Pure Mand</strong></td>
<td>100%</td>
<td>n/a</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td><strong>Generalization across size</strong></td>
<td>100%</td>
<td>98% (75-100%)</td>
<td>100%</td>
<td>98% (95-100%)</td>
</tr>
<tr>
<td><strong>Generalization across person and location</strong></td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>n/a</td>
</tr>
</tbody>
</table>

Experimental Design

A multiple baseline design across participants was used to evaluate the effects of training on improvised requests. Probe sessions were conducted to analyze if the training effects carried over to improvised pure mands, across descriptor classes, and for items in different settings with different instructors. If the participant did not demonstrate improvised requests during probe sessions, the skill was taught.

Assessments

**Stimulus preference.** Instructors at SBSA who worked with the participants on a regular basis were interviewed using the Reinforcer Assessment for Individuals with Severe Disabilities (Fisher, Piazza, Bowman, & Amari, 1996) to develop a list of the participants’ preferred items and activities (see Appendix E). These preferred items were then used in a multiple stimulus without replacement (MSWO) preference assessment (DeLeon & Iwata, 1996). Prior to the preference assessment, the participant was allowed
to experience each stimulus. The participant was presented with five to seven items placed in a straight line on the table in a random sequence. Items used were recorded on the preference assessment data sheet (see Appendix F). Tangible and edible items were not presented together in the same session. The items were about 5 cm apart and the participant was seated about 0.3 m from the stimulus array. The participant was asked, “What do you want?” and was then allowed to interact with the chosen stimulus for 30 s before the next trial began. When using food, the trial would end when the item was consumed. Once an item was chosen, it was removed from the array. The remaining stimuli were rotated and the trials continued in this fashion until all items had been selected. If the participant did not make a selection within 30 s, the trial and the session were terminated. All remaining items were scored as “not selected.” The assessment was repeated across five to 15 sessions to determine highly preferred edible and tangible items. The results of the preference assessment were then calculated by dividing the number of trials an item was selected by the number of trials the item was presented and multiplying by 100. Highest ranked items were used to teach improvisation skills.

Matching-to-sample. An assessment was conducted to determine if participants could demonstrate matching-to-sample skills for various attributes. The attributes assessed included prominent features of preferred items for each participant, such as color, size, and shape. Each session consisted of 10 trials. A maximum of three sessions were conducted in a day. Within the sessions, an array of four to six icons representing one attribute was placed on the front of the participant’s communication binder. The binder was set on a table in front of the student within his reach. The participant was then asked questions such as “What shape is this?” or “What color is this?” while the
experimenter held up a 3D item representing a specific, single attribute. For example, a solid-colored object such as a Goldfish® cracker was presented along with an array of four to six color icons. The participant would respond by selecting the corresponding descriptor icon (e.g., orange) from the array and placing the icon on the sentence strip located on the front of the communication binder. If the student did not demonstrate independent matching skills on 90% of the trials with any one of the attributes within three matching-to-sample assessment sessions, the experimenter began training on these skills. Responses were recorded on the matching-to-sample data sheet (see Appendix G). During matching-to-sample training, positive reinforcement procedures and the prompt-delay procedure outlined in the improvisation training protocol below were used. Mastery criterion for matching-to-sample training was independent matching to a corresponding attribute across at least five different items for a minimum of 90% of the trials across three consecutive sessions. Once a participant met mastery criterion for matching-to-sample skills across color, shape, size and function the experimenter conducted an assessment of improvisation skills.

**Improvisation skills.** Assessment of improvisation skills replicated those used in baseline procedures in Marckel et al. (2006). An assessment of improvisation skills was conducted to determine if the participants would use descriptor pictures to request preferred items when specific pictures of the items were unavailable in their communication binder.

A brief preference assessment was conducted at the beginning of each session to identify an item the participant wanted in that moment. During the brief preference assessment three to five items ranked the highest based on the initial preference
assessment were placed visible to the participant and out of his reach on a table. If the participant did not demonstrate interest in one of the stimuli (e.g., by gesturing toward an item) within 30 s of presentation the trial ended. The items determined to be preferred were then re-evaluated by conducting additional preference assessments following the procedures outlined above. If the participant did demonstrate interest in one of the stimuli (e.g., by gesturing towards an item), the other items were removed and the participant was given brief access to the item selected.

Before the start of the improvisation assessment the specific picture of the item being used was removed from the participant’s communication binder. The participant’s communication binder was then placed on the table within his reach. The front of the binder had an “I want” card and function, color, and shape descriptor icons that corresponded to the characteristics of the preferred item being presented (e.g., “eat,” “black,” “circle,” when presenting an Oreo® cookie). Additional descriptor icons that did not relate to the preferred item were also presented on the front of the book (e.g., “drink,” “red,” “triangle,” etc.). The “I want” card was placed on the strip of Velcro® on the left-hand side of the binder. The remaining three vertical strips of Velcro® each held one category of attributes. For example, the function icons were placed on the second Velcro® strip, the color icons on the third Velcro® strip, and the shape icons on the fourth Velcro® strip. The experimenter would then place the preferred item on the table 0.3 meters in front of the participant. If the participant did not make a request using the descriptor pictures within 10 s following the presentation of the preferred item, the experimenter would point to the communication binder and ask, “What do you want?” If no request was made within 10 s of asking, “What do you want?” the participant was
given access to the item for up to 30 s. If an attempt to request the item was made but did not meet the criteria for an improvised request (e.g., the participant put only one corresponding icon on the sentence strip) the participant was told, “Good trying” and was given access to the item for up to 30 s. At the end of the 30 s access period, the next trial began. If the preferred item was an edible, the access period ended once the participant had consumed the item. Small pieces of edible items were delivered to avoid satiation. During the access period, if the participant did not interact with the item by either making physical or eye contact for 10 s the access period ended. The next trial then took place with another set of preferred stimuli. Each improvisation skills assessment consisted of 10 trials. Data were collected until there was steady state responding or a downward trend in the data.

Training Procedures

**Improvisation training.** Each participant was trained on how to request a preferred item using three attribute icons (i.e., one function icon, one color icon, and one shape icon). Each training session consisted of 10 trials and a maximum of three training sessions were conducted in a day. A brief preference assessment following the procedure outlined above was conducted at the beginning of each session. The experimenter placed the preferred item on a table 0.3 meters in front of the participant. The participant’s communication binder was set up in the format previously outlined in the improvisation assessment section. If the participant did not make a request using the descriptor pictures within 10 s following the presentation of the single item, the experimenter pointed to the communication binder and asked, “What do you want?” The experimenter then gesturally or physically prompted the participant to remove the “I want” card and three
corresponding descriptor icons from the vertical strips in the front of the book and place them on the sentence strip. For example, the participant was prompted to place the pictures of “I want,” “eat,” “black,” and “circle” on the sentence strip to request an Oreo®. The experimenter began with a 0 s time delay for the prompt. The time delay was then faded by 2 s increments to a maximum of 10 s using a delay procedure described by Bondy and Frost (1994). For example, in the first trial a 0 s prompt delay would be used, in the second trial the prompt would be delayed by 2 s, in the third trial the prompt would be delayed by 4 s, and so on. Prompted or independent responses were followed by verbal praise, such as “good job” and brief access to the item. The protocol for the access period described in the improvisation assessment procedures was employed. Mastery criterion was independent improvisations on at least 90% of the four components of the trials across three consecutive sessions using three different items.

**Pure mand training.** After mastery criterion for improvisation training was met, pure mand probes were conducted as described below. Access to the items identified as highly preferred was restricted outside of training sessions to increase the probability that the participant was motivated to request the items. If the participant did not emit a pure mand request during probe trials, the participant was taught to make improvised pure mand requests. During training on this skill a previously trained, preferred item was presented for 2 s and then placed in a box that sat on the table out of the participant’s reach. Presentation of the communication binder and prompting procedures were consistent with those outlined above for improvisation training. Mastery criterion for each item was independent improvisations when the item was not visible on at least 90% of the components of the trials across three consecutive sessions.
**Generalization training.** Once the participant met the mastery criterion for improvisation training and pure mand training, generalization probes across an additional descriptor class (i.e., size) were conducted as described below. If generalization across size was not demonstrated, training on this additional descriptor class was conducted following the procedures outlined for improvisation training.

**Probes**

**Pure mand.** After mastery criterion for improvisation training was met, pure mand probes were conducted. Probes consisted of three separate single trials and access to the item to be tested was restricted for a minimum of 30 minutes before the probe. During the probe trial, the participant’s communication binder was placed on the table within his reach. The previously trained preferred item was presented for 2 s and then placed in a box that sat on the table out of the participant’s reach. If the participant did not make a request using the descriptor pictures within 10 s, the experimenter pointed to the communication binder and asked, “What do you want?” If the probe was successful, (e.g., the participant used the “I want” icon and a corresponding function, color, and shape icon) it was scored as a pure mand request. If no request was made within 10 s of asking, “What do you want?” the participant was given access to the previously trained item for up to 30 s and the probe trial ended. If an attempt to request the item was made but did not meet the criteria for an improvised request (e.g., only one icon was used to request the item or the icons used did not correspond to the item) the participant was told, “Good trying” and was given access to the item for up to 30 s, after which the probe trial ended. If the probe was unsuccessful, training to make a pure mand request began.
Generalization probes. Once the participant had met the mastery criterion for improvisation training and demonstrated pure mand requests, generalization across descriptor classes was tested. An item previously determined to be preferred was presented along with the communication binder. The binder contained attribute icons from two previously trained descriptor classes (e.g., function and shape) and attribute icons from an untrained descriptor class (i.e., size). If the probe was successful (e.g., the participant used the “I want” icon and corresponding function, size, and shape icons) the request was scored as an instance of generalization across descriptor classes. If the probe was unsuccessful (e.g., the corresponding size icon was not used) training on that descriptor class began following the procedures outlined in the improvisation training section.

Once the participant met mastery criterion on the fourth descriptor class, generalization probes were conducted using mastered items in a different location and by different people. Unlike the training setting in areas that were free from distractions, generalization probes were conducted in the participant’s regular classroom where other instructors, students and distractions were present. In addition, an instructor who worked at SBSA, rather than the experimenter, conducted the generalization probes across people. Instructors who frequently worked with the participant at SBSA and who had observed the experimental sessions were chosen to conduct the probes.

Treatment Integrity

Treatment integrity was evaluated by an observer trained to a minimum of 90% accuracy on sample criterion conditions. Treatment integrity data were collected for 25% of the total sessions for the four participants who completed the study. A treatment
integrity checklist listing the steps that were to be completed during each session was used (see Appendix H). When observing baseline sessions, the observer checked “yes” or “no” to indicate if the experimenter conducted the brief preference assessment, removed the specific picture of the item being used during training from the participant’s binder, and if the front of the binder had additional descriptor icons on it that did not relate to the preferred item. Baseline procedures were then listed and the observer scored a (+) if the experimenter followed the procedure and a (−) if the experimenter did not follow the procedure for each trial. If the procedure was not applicable for a trial, “N/A” was recorded. The treatment integrity checklist was identical for baseline and improvisation training phases. The checklist was modified to reflect the appropriate procedures for pure mand training (see Appendix J) and the generalization across size phase (see Appendix I). In the pure mand phase the brief preference assessment was omitted from the checklist and the observer scored whether or not the experimenter briefly presented a previously trained preferred item before placing it out of sight. For the generalization across size phase the checklist included setting out a tray with both the big and small versions of a preferred item on the table as a step to observe.

Treatment integrity data were calculated by dividing the number of steps performed accurately by the total steps and multiplying by 100. A mean of 98% (range, 86% to 100%) of the steps were scored correctly for both Geoff and Tim. A mean of 97% (range, 71% to 100%) of the steps were scored as correctly performed with Alex. A mean of 97% (83% to 100%) of the steps were scored correctly for Scott.
CHAPTER 3: RESULTS

Participant Data

Figure 3.1 shows the percentage of correct components of improvised requests for each participant during probe trials and training sessions.

Alex

During the pre-assessment, Alex demonstrated matching-to-sample skills for color and shape. Training sessions for matching-to-sample skills for size and function were conducted. Once Alex met criterion for matching-to-sample skills for size and function, baseline trials were initiated. During baseline, Alex made improvisations using only one corresponding descriptor icon to request preferred items. Alex’s responding was stable and the overall percentage of correct components of the four part improvised request was 25% for each baseline trial. Implementation of improvisation training resulted in an immediate increase in the percentage of correct improvisations. The percentage of correct responding remained high and slightly variable during training (M = 86%; range, 25% to 100%). Alex met criterion in 11 trials; however, improvisation training was inadvertently continued for 21 trials. During pure mand probes, Alex made improvised requests for items that were not visible with 100% accuracy on each of the probes. During the generalization probes, Alex demonstrated that he could use improvisational requests across an untrained descriptor class (i.e., size) with 100%
accuracy on each of the probes. During generalization across person and location probes, Alex demonstrated improvised requests with 100% accuracy on each of the probes.
Figure 3.1 Percentage of correct components of improvised requests for each participant during probe trials and training sessions.
Geoff

During the pre-assessment, Geoff demonstrated matching-to-sample skills for color and function. Training sessions for matching-to-sample skills for size and shape were conducted. Once Geoff met criterion for these matching-to-sample skills, baseline trials were initiated. During baseline, Geoff’s responding was low and stable (M = 22%; range, 0% to 25%). Implementation of improvisation training resulted in an immediate increase in the percentage of correct improvisations. During improvisation training, the percentage of correct responding remained high and slightly variable (M = 85%; range, 60% to 98%). Geoff met criterion for improvisation training in 11 trials. During pure mand probes, Geoff made improvised requests for items that were not visible with 100% accuracy. During generalization probes across descriptor classes, Geoff did not meet criterion for improvisational requests across an untrained descriptor class (i.e., size; M = 67%; range, 50% to 75%). Generalization across size training was conducted. The percentage of correct responding during training was high and criterion was met in six trials (M = 90%; range, 85% to 95%). When another generalization probe across the size descriptor class was conducted, Geoff responded with 100% accuracy. During generalization across person and location probes, Geoff demonstrated improvised requests with 100% accuracy on each of the probes.

Tim

During the pre-assessment, Tim demonstrated matching-to-sample skills for color, size, and shape. Training sessions for matching-to-sample skills for function were conducted. Once Tim met criterion for matching-to-sample skills for function baseline trials were initiated. During baseline, Tim’s responding was low and stable (M = 22%; range, 0% to 25%).
Implementation of improvisation training resulted in an immediate increase in the percentage of correct improvisations. During training the percentage of correct responding was high and stable (M = 86%; range, 70% to 98%). Criterion for improvisation training was met in 14 trials. Tim did not meet criterion during pure mand probes (M = 50%; range, 0% to 75%). Training on pure mand requests was conducted. The percentage of correct responding during pure mand training was high (M = 93%; range, 88% to 98%) and criterion was met in six trials. Tim responded with 100% accuracy during pure mand re-probes. Tim did not demonstrate generalization across descriptor classes (i.e., generalization across size) during probe trials (M = 58%; range 50% to 75%). Generalization across size training was conducted. The percentage of correct responding during training was high and Tim met criterion in three trials (M = 92%; range 90% to 95%). When another generalization across the size descriptor class was conducted, Tim responded with 100% accuracy. During generalization across person and location probes, Tim demonstrated improvised requests with 100% accuracy on each of the probes.

**Scott**

During the pre-assessment, Scott demonstrated matching-to-sample skills for color, size, and function. Training sessions for matching-to-sample skills for shape were conducted. Once Scott met criterion for matching-to-sample skills for shape, baseline trials were initiated. Scott’s responding during baseline was stable (M = 21%; range, 0% to 25%). The percentage of correct responding during improvisation training was high and slightly variable (M = 81%; range, 53% to 95%). Scott met criterion for improvisation training in eight trials. Scott did not meet criterion during pure mand
probes (M = 83%; range, 75% to 100%). Pure mand training was conducted. Responding during training was high and stable (M = 95%; range, 90% to 98%). Criterion for pure mand training was met in three training trials. When another pure mand probe was conducted, Scott did not meet criterion (M = 92%; range, 75% to 100%) and additional pure mand training trials were conducted. During the second set of training trials the percentage of correct responding was high and stable (M = 99%; range, 98% to 100%). Criterion was met in three trials. When another pure mand probe was conducted, responding occurred with 100% accuracy. Scott did not demonstrate generalization across descriptor classes during probes (M = 58%; range, 50% to 75%). Generalization across size training was conducted. The percentage of correct responding during training on using size descriptors during improvisations was high and stable (M = 93%; range, 90% to 95%). Criterion was met in three trials. When another generalization across size probe was conducted, Scott demonstrated that he could use improvisational requests across an additional descriptor class (i.e., size) with 100% accuracy. During generalization across person and location probes, Scott demonstrated improvised requests with 100% accuracy on each of the probes.
CHAPTER 4: DISCUSSION

The current study sought to replicate and extend Marckel et al. (2006). Procedures were modified to examine the extent to which training diverse exemplars from different stimulus classes concurrently (rather than sequentially, as in Marckel et al.) would facilitate generalization across descriptor classes. Additionally, this study examined the extent to which training procedures would facilitate generalization of improvisational skills using PECS to mand for items that were not visible.

Four participants diagnosed with ASD learned to improvise when the picture representing a desired item was unavailable, by constructing and exchanging a sentence strip that contained an “I want” picture and three descriptors corresponding to the desired item. For example, pictures of the descriptors, “eat”, “orange”, and “square” were used to request a cheese cracker when the specific picture was unavailable. A multiple-baseline design across participants illustrated the effects of multiple exemplar training on improvised requests using PECS. Implementation of training resulted in an immediate increase in the percentage of correct improvisations for each participant, demonstrating a clear functional relationship between improvisational skills and the training procedures. Results of the current study replicate previous findings that improvisation training is effective in teaching children with ASD to improvise when manding with PECS (Chabaane et al., 2009; Marckel et al., 2006). All participants generalized improvised
requests outside of the training area to various classrooms in their school. Participants also generalized requests from the experimenter to teachers at their school. These findings are consistent with research that shows PECS training is effective in facilitating generalization of requests across listeners and locations (Chambers & Rehfeldt, 2003; Ganz, et al., 2008; Schwartz et al., 1998).

Although all of the participants generalized improvisational skills across listeners and locations, three of the participants did not generalize improvisational skills across descriptor classes. Similar to previous research literature, the present study showed limited response generalization across classes (Gena, et al., 1996; Marckel et al., 2006; Parsonson & Baer, 1978). Following multiple exemplar training, one of the four participants, Alex, did use icons from a novel descriptor class (i.e., size) to emit improvised requests. This indicates that Alex generalized across classes, lending some support to previous research that shows the effectiveness of training diverse exemplars from different stimulus classes concurrently on facilitating generalization (Reeve et al., 2007).

Results showed that half of the participants generalized improvisational skills using PECS to request items that were not visible, demonstrating pure mands. These mixed results could have been due to differences in preliminary pure mand skills. The generalization of improvisational skills to emit pure mands by two of the participants is consistent with previous findings (Marckel et al., 2006). Training on improvising using pure mands was conducted by contriving motivation for preferred items using a strategy outlined in the PECS protocol and using a time-delay prompt. Results showed these procedures were effective in teaching participants to improvise when manding for items.
that were not visible. This supports previous findings on the effects of structured teaching trials on manding for items that are not visible (Betz et al., 2010; Hall & Sundberg, 1987; Sundberg, et al., 2002).

**Limitations**

Throughout the course of the study, several limitations were noted. Icons from the size descriptor class were not included in baseline trials. Therefore, it cannot be confirmed that improvisation training was responsible for facilitating Alex’s generalization across the size descriptor class. Also, data were not collected on generalization of improvised requests using size across listeners and location. There was an error during improvisational skills training with Alex. Alex met criterion for improvisational skills in 11 trials; however, training was inadvertently continued for 21 trials. The other participants in the study met criterion for improvisational skills in 8, 11, and 14 trials. Alex was the only participant who successfully demonstrated generalization across descriptor classes. This leads to the question of whether the other participants would have successfully demonstrated generalization across descriptor classes if they had additional practice with improvisational skills before probes.

Another limitation was that the pre-requisite skill of manding for items that were not visible using the corresponding picture (i.e., exchanging a “cookie” icon to request a cookie from a closed cupboard) was not assessed prior to training. Evaluating pure mand skills prior to improvisation training might have provided information on why some participants generalized improvisation skills to request items that were not visible, while others did not. The absence of maintenance trials was also a limitation.
Implications for Future Research

Additional research could replicate the current procedures, controlling for the procedural errors listed, to further evaluate the effectiveness of multiple exemplar training on promoting generalization of improvisational skills across descriptor classes. Multiple exemplar training in this study involved teaching diverse exemplars from different stimulus classes concurrently. Mixed results of this training on facilitating response generalization could be due to a lack of pre-requisite skills with the stimulus classes. In the pre-assessment phase matching-to-sample skills were tested for each of the stimulus classes (i.e., color, function, shape and size). If participants did not meet criterion for matching-to-sample skills for a particular class this skill was taught. However, visual matching-to-sample using descriptor icons is not synonymous with manding for items using descriptor icons. Bondy (2001) outlines the differences between simple matching-to-sample skills (i.e., matching a “red” icon to a red object) and manding using attributes (i.e., exchange the sentence strip to request “I want red skittle”). Being able to mand for items using a variety of descriptor icons from different stimulus classes (i.e., “I want circle cookie,” “I want big cracker”) might be a critical pre-requisite skill to teaching using diverse exemplars from different stimulus classes. Future studies could collect pre-assessment data on manding using icons from different stimulus classes to determine if this pre-requisite skill accounts for any differences in the outcomes following multiple exemplar training.

In the present study, participants were taught to mand using icons from multiple descriptor classes (i.e., functions, colors and shapes) concurrently. Participants met criterion in an average of 11 training sessions with a range from 8 to 14 sessions. It is
interesting to note this is a decrease from the average of 35 training sessions needed to meet criterion in Marckel et al. (2006), in which descriptor classes were taught sequentially. Future research could evaluate the effects of training descriptor classes concurrently versus sequentially on the number of trials to criterion.

As mentioned above, future studies could evaluate pure mands using corresponding icons prior to improvisation training in order to determine the likelihood that participants would be able to emit pure mands when improvising. Because the form of the pure mand response is not dependent upon prompts and the response may be used in a variety of situations, Shafer (1994) describes pure manding as the most functional type of requesting for the speaker. When children with ASD are first developing communication skills, explicit training on pure mands is an essential component in communication training (Barbera, 2007; Bondy, 2006; Sundberg, 1998). There are a number of studies on the effects of training procedures on pure mands using different response forms (e.g., vocalizations, sign language) (Betz et al., 2010; Hall & Sundberg, 1987; Sundberg, et al., 2002). Yet, there are few published studies on the effects of teaching procedures on pure mands using PECS. In 2009, an analysis was conducted of thirty-four peer-reviewed published reports on PECS (Sulzer-Azaroff, Hoffman, Horton, Bondy & Frost, 2009). The summary of this analysis lists only one study that looks specifically at pure mands. Additional evaluation of teaching procedures on pure mands using PECS would lend additional support to this modality.

Previous studies have shown the effects of training procedures on increasing requests for items from peers using PECS (Malone et al., 2009). Additional research could evaluate the effects of teaching improvised requests for items from peers.
Collecting maintenance data to assess the long-term effects of this intervention would also be beneficial.

**Summary**

Communication impairments are a defining feature of ASD. These impairments may result in the individual engaging in challenging behaviors as a non-vocal form of communication (Carr & Durand, 1985). Teaching appropriate forms of non-vocal communication, such as PECS, can be a successful way for children who have language impairments to minimize communication difficulties (Mirenda & Erickson, 2000; Shafer, 1993). The efficiency of PECS can be enhanced by teaching improvisational skills. The current study replicates previous findings that improvisation training was effective in teaching individuals with ASD to use descriptor icons to mand even when the picture representing the desired item was unavailable (Chabaane et al., 2009; Marckel et al., 2006). Participants also generalized this skill across locations and listeners increasing their opportunity to contact reinforcement in the natural environment.

The current study extended previous research by examining the extent to which training diverse exemplars from different stimulus classes concurrently, rather than sequentially, would facilitate generalization across descriptor classes. Generalization of improvisational skills across additional descriptor classes would make it easier to request using descriptors or features that most closely relate to desired items. This would also increase the likelihood that the listener would accurately deliver the desired item. Mixed results of multiple exemplar training on facilitating generalization of improvisation across classes suggest this may be a promising strategy that warrants future research.
It is common for individuals to want items or activities that are not present. Learning to improvise to request these items further increases the ability of non-vocal individuals to get their needs and wants met and increases the effectiveness of the PECS system. The outcomes of the present study show that contriving motivation for preferred items combined with time-delay prompting was an effective strategy for teaching improvisation of pure mands to individuals with ASD. These findings contribute to because the literature on training pure mands using PECS.
REFERENCES


APPENDIX A: SITE PERMISSION LETTER
To Whom It May Concern:

I am providing permission for Jamie Kirkpatrick to conduct research for her thesis in our center, Step by Step Academy where I am the Clinic Director.

I have received information on the study entitled Generalization Training for Improvisational Skills Using a Picture Exchange Communication System. I have also received a copy of the consent for participation, and I believe that the research study is in accordance with the standard teaching practices at our center. I understand that the subjects’ confidentiality will be protected and that I may withdraw consent at any time without penalty.

Please feel free to contact me at (614) 436-7837 if any additional information is needed.

Sincerely,

Christine Austin, BCaBA
Clinic Director

Cc. Nancy A. Neef, Ph.D., Advisor
APPENDIX B: PARENTAL CONSENT FORM
The Ohio State University Parental Permission

For Child’s Participation in Research

Study Title:
Generalization Training for Improvisational Skills Using a Picture Exchange Communication System

Researcher:
Nancy A. Neef, Ph.D., Principal Investigator, and her authorized representatives, Jamie Kirkpatrick, BCaBA and Alayna Haberlin, MA, BCBA.

Sponsor:
N/A

This is a parental permission form for research participation. It contains important information about this study and what to expect if you decide to participate and you permit your child to participate.

Your child’s participation is voluntary.

Please consider the information carefully. Feel free to discuss the study with your friends and family and to ask questions before making your decision whether or not to permit your child to participate. If you agree to participate and you permit your child to participate, you will be asked to sign this form and will receive a copy of the form.

Purpose:
For my thesis, I am looking at teaching children who are using the Picture Exchange Communication System (PECS) to request desired items when the exact picture for the item is missing. If your child does not use PECS, please discard this letter and we thank you for your time.

Procedures/Tasks:
During each session, your child will work for approximately 15-20 minutes on using descriptor pictures to ask for an item. For example, the child may use the pictures “black”, “circle”, and “eat” to request an Oreo®. The child will then be given praise and/or the desired item following requests. Parents will be participating in the research by completing a questionnaire about their child’s preferences.
Duration:

There will be 3-5 sessions held weekly for approximately 3 to 5 months. Session length will be approximately 15-20 minutes.

You and your child may leave the study at any time. If you or your child decides to stop participation in the study, there will be no penalty and neither you nor your child will lose any benefits to which you are otherwise entitled. Your decision will not affect your future relationship with The Ohio State University.

Risks and Benefits:

Participation in this study may benefit your child because s/he will receive extra practice on communication skills and may extend her/his current abilities using PECS.

A potential risk of participation is a breach of confidentiality. The likelihood of this occurring would be very low. A breach of confidentiality could occur by the video-recorder being stolen or someone breaking into the office where all paper documents (e.g., confidentiality forms or social validity forms) are kept. Potential harm or discomfort from this occurrence would be that people would know that your child participated in the study and her/his use of a communication system is being affected by this intervention. In an effort to minimize this risk, information that will be gathered through paper materials (e.g., informed consent, satisfaction surveys) and video tapes will be stored behind a locked door.

Confidentiality:

Efforts will be made to keep your information and your child’s study-related information confidential. However, there may be circumstances where this information must be released. For example, personal information regarding your child’s participation in this study may be disclosed if required by state law. Also, your child’s records may be reviewed by the following groups (as applicable to the research):

- Office for Human Research Protections or other federal, state, or international regulatory agencies;
- The Ohio State University Institutional Review Board or Office of Responsible Research Practices;
- The sponsor, if any, or agency (including the Food and Drug Administration for FDA-regulated research) supporting the study.

Incentives:

N/A
Participant Rights:

You or your child may refuse to participate in this study without penalty or loss of benefits to which you are otherwise entitled. If you or your child is a student or employee at Ohio State, your decision will not affect your grades or employment status.

If you and your child choose to participate in the study, you may discontinue participation at any time without penalty or loss of benefits. By signing this form, you do not give up any personal legal rights your child may have as a participant in this study.

An Institutional Review Board responsible for human subjects research at The Ohio State University reviewed this research project and found it to be acceptable, according to applicable state and federal regulations and University policies designed to protect the rights and welfare of participants in research.

Contacts and Questions:

For questions, concerns, or complaints about the study you may contact Jamie Kirkpatrick at (614) 537-6970 or at jkirkpatrick38@yahoo.com

For questions about your child’s rights as a participant in this study or to discuss other study-related concerns or complaints with someone who is not part of the research team, you may contact Ms. Sandra Meadows in the Office of Responsible Research Practices at 1-800-678-6251.

If your child is injured as a result of participating in this study or for questions about a study-related injury, you may contact Jamie Kirkpatrick at (614) 537-6970 or at jkirkpatrick38@yahoo.com.
Signing the parental permission form

I have read (or someone has read to me) this form and I am aware that I am being asked to participate in a research study and I am being asked to provide permission for my child to participate in a research study. I have had the opportunity to ask questions and have had them answered to my satisfaction. I voluntarily agree to participate in this study and to permit my child to participate in this study.

I am not giving up any legal rights by signing this form. I will be given a copy of this form.

Printed name of subject

Printed name of person authorized to provide permission for subject

Signature of person authorized to provide permission for subject

Relationship to the subject

Date and time

AM/PM

I would like your permission to videotape your son/daughter’s intervention sessions for data collection purposes. Videotapes will not be shown to anyone other than approved investigators. All data and videotapes will be stored in password protected electronic files and/or in locked cabinets accessible only to approved investigators. The videotapes will be destroyed at the end of the research study. Upon request, I will provide you with a copy of the videotape. If you do not wish to provide consent, your son/daughter will still be able to participate in the study. I thank you for considering this request. Please check the appropriate box below.

I agree that video footage may be used

I disagree that video footage may be used
Investigator/Research Staff

I have explained the research to the participant or his/her representative before requesting the signature(s) above. There are no blanks in this document. A copy of this form has been given to the participant or his/her representative.

<table>
<thead>
<tr>
<th>Printed name of person obtaining consent</th>
<th>Signature of person obtaining consent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tbody>
</table>

______________________________  AM/PM

Date and time
APPENDIX C: VERBAL ASSENT SCRIPT
Verbal Script for Obtaining Assent

“Hello, my name is Jamie Kirkpatrick. I am a graduate student at The Ohio State University and I am starting research that will be used in my thesis.

I am looking at teaching children who are using PECS to ask for items they want even when the exact picture for the item is missing. This will be done by having you practice using pictures that describe the item you want. For example, you will practice using the pictures “black”, “circle”, and “eat” to ask for an Oreo®. We will be working together for about 15 minutes each day, a few days each week for a couple of months.

I will be using a video camera to record each of our sessions.

Participation is voluntary. If you decide not to participate, there will be no penalty or loss of benefits to which you are otherwise entitled. You can, of course, say you do not want to participate at any time, without any penalty or loss of benefits to which you are otherwise entitled.

“Do you have any questions? Do you agree to participate?

If so, let’s begin…..”
APPENDIX D: DATA COLLECTION FORM
<table>
<thead>
<tr>
<th>Initial</th>
<th>Item</th>
<th>Adds &quot;I want&quot;</th>
<th>Attribute 1</th>
<th>Attribute 2</th>
<th>Attribute 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>0s</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
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<td>2s</td>
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<tr>
<td>4s</td>
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<tr>
<td>10s</td>
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</tr>
</tbody>
</table>

Total:_________

**Documentation Instructions**

Column 1 - Record experimenter initials.

Column 2 - Record item presented for student to request.

Column 3 - Record + if participant places "I want" icon on sentence strip. Record prompt type if the participant does not place the "I want" icon on the sentence strip.

Columns 4-6 - Record attribute icons selected and placed on sentence strip. Record a prompt type if no attribute icon is selected.

Prompt Key - PH = physical prompt     G = gestural prompt

57
APPENDIX E: REINFORCEMENT ASSESSMENT FORM
THE REINFORCER ASSESSMENT FOR INDIVIDUALS WITH SEVERE DISABILITIES (RAISD)

Name: ___________________________ Date: __________

Assessor: _________________________

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

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

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

________________________________________________________

RESPONSE TO PROBE QUESTIONS:

________________________________________________________

________________________________________________________

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

________________________________________________________

________________________________________________________

1
APPENDIX F: PREFERENCE ASSESSMENT DATA SHEET
Multiple Stimulus Without Replacement Data Sheet

Session #
APPENDIX G: MATCHING-TO-SAMPLE DATA SHEET
# Matching-to-Sample Data Sheet

**Student**

**Attribute**

<table>
<thead>
<tr>
<th>Date:</th>
<th>Initials:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trial</td>
<td>1</td>
</tr>
<tr>
<td>( +/-)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
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<th>Initials:</th>
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<tbody>
<tr>
<td>Trial</td>
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<tr>
<td>( +/-)</td>
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</table>

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<tbody>
<tr>
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<tr>
<td>( +/-)</td>
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<tr>
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<tbody>
<tr>
<td>Trial</td>
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<tr>
<td>( +/-)</td>
<td></td>
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</tbody>
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<tr>
<td>( +/-)</td>
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<tr>
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<tbody>
<tr>
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<tr>
<td>( +/-)</td>
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<th>Initials:</th>
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<tbody>
<tr>
<td>Trial</td>
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<tr>
<td>( +/-)</td>
<td></td>
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</tbody>
</table>

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</thead>
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<tr>
<td>( +/-)</td>
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</tbody>
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<tbody>
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<tr>
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</thead>
<tbody>
<tr>
<td>Trial</td>
<td>1</td>
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<td>( +/-)</td>
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</tbody>
</table>
APPENDIX H: TREATMENT INTEGRITY FORM FOR IMPROVISATION TRAINING
## TREATMENT INTEGRITY: IMPROVISATION TRAINING

Participant: ___________________________  Date: ________________

<table>
<thead>
<tr>
<th>Check if experimenter behavior occurs</th>
<th>Behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes □ No □ 3-5 preferred items placed on table and participant is given 30s to select one</td>
<td>An item that was ranked highly based on the preference assessment is placed 0.3 m in front of the participant</td>
</tr>
<tr>
<td>Yes □ No The specific picture of the item being used has been removed from the participant’s communication binder.</td>
<td>The participant’s communication binder is placed on the table within his/her reach</td>
</tr>
<tr>
<td>Yes □ No The front of the binder has additional descriptor icons that do not relate to the preferred item.</td>
<td>The front of the binder has an “I want” card and descriptor icons that correspond to the characteristics of the preferred item being presented</td>
</tr>
<tr>
<td>1 2 3 4 5 6 7 8 9 10</td>
<td>Time-delayed prompting as needed</td>
</tr>
<tr>
<td>□ □ □ □ □ □ □ □ □ □ □</td>
<td>Brief access to the requested item is given</td>
</tr>
<tr>
<td>□ □ □ □ □ □ □ □ □ □ □</td>
<td>During access period if participant does not interact with preferred item by making physical or eye contact within 10s the session will end</td>
</tr>
</tbody>
</table>

**Documentation Instructions**

Place a checkmark in the yes/no boxes to indicate if the behavior did or did not occur. Place a (+) or a (-) to indicate if the experimenter behavior occurred for each trial. If behavior is not applicable for a trial, write N/A in the box.
APPENDIX I: TREATMENT INTEGRITY PURE MAND FORM
**TREATMENT INTEGRITY: PURE MAND TRAINING**

Participant: ___________________________ Date: ______________

### Check if experimenter behavior occurs

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-5 preferred items placed on table and participant is given 30s to select one</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>The specific picture of the item being used has been removed from the participant’s communication binder.</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>The front of the binder has additional descriptor icons that do not relate to the preferred item.</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Behavior</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>The previously trained item will be presented for 2s and then placed in a box on the table out of the participant’s reach.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>The participant’s communication binder is placed on the table within his reach a minimum of 2s later</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>The front of the binder has an “I want” card and descriptor icons that correspond to the characteristics of the preferred item being presented</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Time-delayed prompting as needed</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Brief access to the requested item is given</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>During access period if participant does not make contact within 10s the session will end.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

**Documentation Instructions:** Place a checkmark in the yes/no boxes to indicate if the behavior did or did not occur. Place a (+) or a (-) to indicate if the experimenter behavior occurred for each trial. If behavior is not applicable for a trial, write N/A in the box.
APPENDIX J: TREATMENT INTEGRITY GENERALIZATION ACROSS SIZE FORM
TREATMENT INTEGRITY: GENERALIZATION ACROSS SIZE TRAINING

Participant: ___________________________ Date: ________________

Check if experimenter behavior occurs

- Yes   - No  3-5 preferred items placed on table and participant is given 30s to select one
- Yes   - No  The specific picture of the item being used has been removed from the participant’s communication binder.
- Yes   - No  The front of the binder has additional descriptor icons that do not relate to the preferred item.

Check if experimenter behavior occurs for each trial

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
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</tbody>
</table>

- A tray with the big/small preferred items will be placed on the table 0.3 meters in front of the participant.
- The participant’s communication binder is placed on the table within his/her reach.
- The front of the binder has an “I want” card and descriptor icons that correspond to the characteristics of the preferred item being presented.
- Time-delayed prompting as needed
- Brief access to the requested item is given
- During access period if participant does not make contact within 10s the session will end.

Documentation Instructions: Place a checkmark in the yes/no boxes to indicate if the behavior did or did not occur. Place a (+) or a (-) to indicate if the experimenter behavior occurred for each trial. If behavior is not applicable for a trial, write N/A in the box.