The Effects of Picture Exchange Communication System Training on the Communication Behaviors of Young Children with Autism or Severe Language Disabilities

THESIS

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

By

Angela Welch

Graduate Program in Education

The Ohio State University

2010

Master's Examination Committee:

Dr. Sheila Alber-Morgan, Advisor

Dr. Diane Sainato
Abstract

Difficulties with communication, including impaired oral language and social relationships, are diagnostic characteristics of autism (American Psychiatric Association, 2000). The Picture Exchange Communication System was developed as an alternative for those with limited verbal skills, including people with autism, to communicate (Bondy & Frost 1994, 2001, 2002). Previous research has demonstrated its effectiveness with preschool children (Charlop-Christy, Carpenter, Loc, Leblanc, & Kellet, 2002; Frea, Arnold, & Vittimberga, 2001; Ganz, Parker, & Benson, 2009; Ganz & Simpson, 2004; Jurgens, Anderson, & Moore, 2009). A changing criterion design was used to examine the effects of PECS training on three young children with disabilities who were non-verbal and attended a preschool classroom. Two out of three of the children emitted independent picture exchanges in Phase 1 post-training probes. Time allowed for one participant to begin Phase 2 training, but he did not demonstrate independent picture exchanges. In contrast to previous research, the participants in this study failed to reach mastery due to several possible confounding variables. Limitations, directions for future research, and implications for practitioners will be discussed.
Acknowledgments

I would like to thank Dr. Sheila Morgan and Dr. Ju Hee Park for their help with planning and conducting this research and preparing the manuscript. I would also like to thank Courtney Fleming for assistance with planning the project and collection of interobserver and procedural reliability data. I appreciate assistance from Dr. Paula Rabidoux and Steve Rosenzweig in setting up the video recording equipment and scheduling rooms to conduct the intervention.
Vita

May, 2003 ......................................................B.A. Biology, Youngstown State University

May, 2006 ......................................................B. S., Special Education, Youngstown State University

2006-2007 .....................................................Multiple Disabilities Teacher, Coventry Local Schools, Akron, Ohio

2007-2009 .....................................................Intervention Specialist, Hamilton Local Schools, Columbus, Ohio

Fields of Study

Major Field:  Education
List of Tables

Table 1 Demographic and School Related Information for Each Participant .................. 30
Table 2 Characteristics of Classroom Staff ..................................................................... 32
Table 3 Task Analysis of Picture Exchange ..................................................................... 36
Table 4 MSWO Preference Results .................................................................................. 50
Table 5 MSWO Results from Second Administration ..................................................... 52
Table 6 Interobserver Agreement Results ......................................................................... 58
Table 7 Procedural Integrity Results ................................................................................ 59
List of Figures

Figure 1 Billy's PECS Training Results ............................................................................. 54
Figure 2 Sally's PECS Training Results ........................................................................... 56
Figure 3 Mark's PECS Training Results ........................................................................... 57
Chapter 1: Introduction

The DSM-IV diagnostic criteria for autism include communication impairments (American Psychiatric Association, 2000) as a required feature of the disorder. Delays in communication are observable early in life for individuals with autism, in areas of understanding phrases, understanding and producing single words, and using gestures (Mitchell et al., 2006). Estimates of the percentage of individuals with autism who are nonverbal range from 19% to 59% (Fombonne, 1999).

It is important to develop communication skills because verbal skills are a strong predictor of other adaptive behaviors for individuals with autism (Venter, Lord, & Schopler, 1992). Poor expressive language is associated with higher levels of challenging behavior among individuals with disabilities (Murphy, Beadle-Brown, Wing, Gould, Shah, & Holmes, 2005). Given the high rates of impaired communication and potential impacts on other areas of development, it is important to develop effective interventions that improve communication for individuals with autism.

Types of AAC systems

Augmentative and alternative communication (AAC) refers to supports used when natural speech is insufficient for communication (Murray & Goldbart, 2009). The two main categories of AAC systems are aided and unaided. Unaided systems do not require additional materials, and include natural gestures, eye gaze, and manual signs. Aided systems use specific materials to support communication. They range from “low-
tech” systems, such as picture symbols or word cards, to “light tech” systems with single-message speech generating devices, to “high tech” systems that include programmable computer-based devices. The Picture Exchange Communication System (PECS) is an example of a low tech system.

**PECS**

PECS was developed to overcome limitations with earlier methods of training individuals with autism to communicate. Previously introduced methods, including imitation training and picture systems with a pointing response, required prerequisite skills, such as sitting and eye contact. It can be time-consuming to develop these repertoires, and the PECS system allows learners to more quickly acquire a functional communication system (Frost & Bondy, 1994). Also, pointing systems can be difficult for the listener to interpret, as touching of pictures without the intent to communicate can be difficult to distinguish from communication attempts. Additionally, if the listener is not already attending to the learner, he or she might not notice that the learner is pointing to the pictures. PECS overcomes these limitations by teaching the learner to persist in communication attempts, gain the listener’s attention, and deliver the picture. Imitation training and pointing systems have a greater risk of producing prompt-dependent responses, in which the learner waits for a cue such as “What do you want?” before communicating. PECS was designed to increase spontaneity eliminating verbal cues, physical prompting only when the learner initiates a request (for example, by reaching for the item) and by fading physical prompts. PECS involves six phases of training. Only
Phases 1 and 2 were implemented in the present study, but each phase will be described below.

**Phases of PECS Training**

**Phase 1: How to communicate**

In this phase, the child learns to pick up a single picture, reach toward a communication partner, and release the picture in his or her hand. This skill is taught with two trainers initially. One trainer, in front of the child, acts as the communication partner. The second trainer, behind or next to the child, provides physical prompts. No verbal prompts are used throughout the training. A trial begins with the communication partner presenting a preferred item. The physical prompter waits until the learner initiates, for example by reaching for the item, and then provides an immediate physical prompt. By waiting for initiation, spontaneity is developed with a decreased risk of prompt-dependency. Over subsequent trials, physical prompting is faded until the learner independently exchanges the picture.

**Phase 2: Distance and persistence**

Phase 2 teaches the learner to walk to the communication book, remove a single card from the cover of a communication book, and walk to the communication partner. These skills are taught gradually, by slowly increasing the distance between the child, the communication partner, and the communication book. As in Phase 1, no verbal prompts are used. The second trainer waits for initiation, and uses physical prompts which are faded from the end of the sequence, using backward chaining.
**Phase 3: Picture Discrimination**

Picture discrimination is taught in two sub-phases. First, the learner discriminates between a picture of a highly preferred item and a neutral item. When this skill is mastered, the learner discriminates between pictures of preferred items. To begin, the communication partner arranges two pictures on the cover of the communication book, and presents a neutral item and a preferred item. As soon as the child touches the picture of the preferred item, social reinforcement such as praise is delivered, to immediately reinforce the new skill. When the preferred card is exchanged, the child receives the item. If the child touches the nonpreferred icon, no social reinforcement is offered and the child receives the nonpreferred item when he exchanges the card. If this happens, an error-correction strategy is used as follows:

1. **Model-** The trainer models the correct response by pointing to the picture of the preferred item.

2. **Prompt-** The trainer prompts the child to exchange the correct picture, for example, by holding her hand open near the picture. Social praise is used to reinforce the correct exchange.

3. **Switch-** A brief pause or single trial of a non-related, mastered skill is performed.

4. **Repeat-** The communication partner again offers the preferred and nonpreferred items to give the child a new opportunity to request.

This error-correction procedure prevents reinforcement of prompted responses by requiring a correct response before delivering the desired item. If the learner continues to exchange the non-preferred picture, the error correction procedure can be repeated up to
three times. If the child is still not successful, only one picture is shown on the book so that the child can return to a previously mastered skill.

When discrimination between preferred and nonpreferred pictures has been mastered, discrimination between preferred pictures is introduced. When the child exchanges a picture, a correspondence check is performed by presenting both items to the child and allowing him to choose. If he chooses the item that corresponds to the icon he exchanged, the correspondence check demonstrates accurate picture discrimination. If the child picks the other item, the correspondence check shows that the child did not accurately discriminate between pictures. Then, the error-correction procedure will be used, as explained above.

Phase 4:  Sentence structure

The student learns to arrange multiple icons on a strip, to communicate the phrase “I want” plus the specific item, and give the entire strip to the communication partner. This skill is taught through backward chaining. To begin the “I want” icon is already on the sentence strip. When the learner initiates by handing a single card to the communication partner, he is physically prompted to put the card on the sentence strip and exchange the sentence strip. Next, he is taught to arrange the “I want” card and the item picture on the strip. The child then learns to point to each picture on the strip after exchanging it. A time delay procedure with differential reinforcement is used to encourage verbalization. If the child verbalizes, he receives a greater quantity of the reinforcer. However, verbalization is not required, and the learner will still receive reinforcement without talking.
When the student has learned to combine icons on the sentence strip, he will next learn to use attributes to request specific items. First, the child learns to arrange three icons on the sentence strip, without having to discriminate between attribute icons. When this skill is mastered, the child learns to discriminate between high and low preference attributes. For example, if the child liked red candy but not blue candy, he would learn to select the red icon. The four-step error correction procedure, explained under Phase 3, is used here again to teach picture discrimination. When this skill is mastered, the student learns to discriminate between preferred attributes, using correspondence checks as outlined in Phase 3. Eventually, the student will learn to use a variety of attributes and apply them to many preferred items.

*Phase 5: Responding to “What do you want?”*

In addition to spontaneously requesting items, the student learns to answer the question “What do you want?” by exchanging the sentence strip. This skill is taught using a progressive-time delay, with an immediate prompt to begin with increasing time delay to the prompt over subsequent trials. The learner continues to have many opportunities to spontaneously request items.

*Phase 6: Commenting*

In this phase, the learner will spontaneously comment and will respond to questions including “What do you see?”, “What do you hear?”, “What do you have?”, and “What is it?”. To begin this training, the environment is arranged so there is something interesting to comment on. For example, the teacher and student look through an album of favorite photos. First, the student will learn to respond to a single question
without discriminating. The teacher asks the target question (e.g., “What is it?”), and immediately prompts the learner to arrange a sentence strip with the comment icon (e.g., “It is a”) and the icon corresponding to the item. This exchange is reinforced socially, without giving the item to the student. Using social reinforcement only is important, because the skill is a comment rather than a request. Over subsequent trials, the time delay to the prompt is lengthened until the student independently exchanges the sentence strip with the comment icon. Next, the student learns to discriminate between the “I want” icon and commenting icons. The four-step error correction procedure, explained above for Phase 3, is used to teach picture discrimination.

Research on Acquisition of PECS

Several studies show that PECS training has been effective. Most of the studies on PECS showed that participants have learned PECS relatively rapidly, although some participants have needed more training or have not acquired the skills. Studies have demonstrated that PECS training is effective through Phase 1 (Ganz et al. 2009), Phase 2 (Angermeier, Schlosser, Luiselli, Harrington, & Carter, 2008), Phase 3 (Frea et al., 2001; Jurgens et al., 2009; Kravits, Kamps, Kemmerer, & Potucek, 2002; Park, 2009), Phase 4 (Ganz & Simpson, 2004; Stoner et al., 2006; Tincani, Crozier, & Alazetta, 2006), and Phase 6 (Charlop-Christy et al., 2002; Schwartz, Garfinkle, & Bauer, 1998).

In contrast, Tincani (2004) and Ganz, Simpson, et al. (2008) demonstrated that some participants did not master Phase 1. In an alternating treatments design comparing PECS with sign-language training Tincani found that one participant quickly acquired PECS through Phase 3, but a second participant did not show improvement in Phase 1.
after 11 training sessions. Ganz, Simpson et al. showed that two participants mastered PECS through Phase 4, but a third participant received 31 Phase 1 sessions without improvement. In a subsequent study (Ganz, Cook, Corbin-Newsome, Bourgeois, & Flores, 2005), this participant learned to make requests by exchanging objects in clear containers.

In addition to these studies showing some participants did not master Phase 1, Stoner et al. (2006) reported that some participants had difficulty in Phases 2 and 3. Three of five nonverbal adults with mental retardation in this study met the criteria through Phase 4. A fourth participant mastered Phase 1 but did not progress in Phase 2. The authors reported that this participant was unable to discriminate between a preferred and nonpreferred item, and so training was discontinued. It is anecdotally reported that this participant began training in an object-based communication system with his residential staff, but the results of this training are not reported. A fifth participant achieved mastery of Phase 3 prior to summer break. When data collection resumed in the fall she had not maintained Phase 1 skills, and was not successful in retraining, which the authors attributed to her increased seizure activity. There were no obvious differences between the IQ scores of participants who mastered PECS and those who did not, nor were there obvious differences between their pre-treatment methods of communication.

In contrast to studies reporting that some participants failed to meet mastery criteria, Carré et al. (2009) showed that some learners needed modifications to master Phase 3. Two out of three participants needed modification in size, brightness, contrast, or type of icon used to master discrimination. Although the number of training sessions
required to master Phase 3 was not reported, the authors state that these modifications were effective for both learners.

In summary, several studies have demonstrated the effectiveness of PECS training. A few studies have shown that participants did not master Phase 1 or 2 of PECS, or needed modifications to master Phase 3.

*Amount of training required to reach mastery criteria*

It is difficult to directly compare the amount of training needed to master PECS, because of difference in training intensity and mastery criteria. However, for those studies that measured mastery by the number of sessions (rather than the duration of training) it is possible to determine the range of training needed to meet study-specific mastery criteria. For some participants, Phase 1 training has required as few as 2 training sessions (Park, 2009) or as many as 15 session (Stoner et al., 2006). Although these studies had different mastery criteria, with Park requiring 2 consecutive sessions with 80% correct responding and Stoner et al. requiring 3 consecutive sessions with 90% correct responding, visual analysis of the Stoner et al. results show that even if Park’s criterion was applied, 14 training sessions would have been needed.

The length of training required for Phase 2 ranges from 2 sessions (Park, 2009) to 16 (Tincani et al., 2006). Mastery criteria varied between the studies, with Park requiring 80% on two consecutive sessions, and Tincani et al. requiring 80% in a single session. The difference in mastery criteria does not explain the difference in length of training required, as Tincani et al. required less stringent criteria for mastery yet reported a longer amount of training required.
Training required in Phase 3 ranged from 3 sessions (Stoner et al., 2006) to 25 sessions (Ganz, Simpson, et al., 2008). The difference cannot be explained by different mastery criteria, as the study in which more training was required had more stringent mastery criteria (80% correct versus 90% correct, each for three consecutive sessions).

Training for Phase 4 ranged from 3 sessions (Stoner et al., 2006) to 40 sessions (Ganz, Simpson, et al., 2008). Again, the difference cannot be attributed to mastery criteria, as the study in which more sessions were needed employed less stringent criteria.

Use of Probes

Although most studies have collected data during training sessions in which prompting was provided, three studies (Angermeir et al., 2008; Ganz et al., 2009; Park, 2009) have collected data from probes without prompting. Ganz et al. was unique among these studies because they used a differential reinforcement procedure. If a participant reached for an item, the experimenter paused for five seconds to give the child an opportunity to exchange a picture, then allowed 10 seconds to access the item. If the child used a picture, he received the item immediately for 10 seconds. If the child verbalized to request, with or without a picture exchange, he or she received the item immediately and had access to it for 20 seconds. Angermier et al. and Park used probe sessions throughout training, while Ganz et al. provided 10 PECS training sessions prior to the first probe session.
Generalization of PECS skills

Generalization of PECS can be considered on a continuum, with one end representing minimal changes between training and generalization conditions, and the other end representing significant changes. The success of generalization depends partly on how significant these differences are, and partly on the use of prompting to promote generalization.

At one end of the continuum are studies in which only the communication partner changes. The setting remains the same, as well as the procedures. No other activity is conducted at the time. Generalization has been demonstrated under these conditions for Phase 2 (Ganz, Sigafoos, Simpson, & Cook, 2008), Phase 3 (Park et al., 2009; Tincani, 2004), and Phase 4 (Tincani et al., 2006) of PECS.

Changing the setting to examine PECS use during ongoing activities in the natural environment represents additional changes from training to generalization conditions. Frea et al. (2001) demonstrated that a child who had learned PECS at a table in the preschool environment generalized PECS requests to two play centers in the preschool, during ongoing free play in which peers were present. In this study, the verbal prompt “What do you want?” was provided once at the beginning of each generalization session.

Generalization that includes both different communication partners and different settings during ongoing activities represents additional changes between training and generalization conditions. Results under such conditions are mixed, and the use of prompting may contribute to differences in results. Stoner et al. (2006) showed that three adults with developmental disabilities successfully generalized use of PECS Phase 4 to
fast-food restaurants with minimal verbal or gestural prompting. The communication partners were untrained community members. However, two studies that did not provide any prompts for PECS use in generalization settings showed low levels of PECS mands in the new condition (Carré et al., 2009; Jurgens et al., 2009). In the first study, three elementary age children received PECS training through Phase 3, beginning in a separate area of their special education classroom, and gradually introduced into the classroom. Low levels of generalization were observed in both settings, although the students used PECS more frequently at school than at home. In the second study, a 3-year old boy with autism demonstrated low levels of PECS mands in free play generalization settings at home and at school, but did demonstrate higher levels of verbal mands and other verbalizations, compared to baseline, in these settings (Jurgens et al., 2009).

Other studies have examined generalization to untrained stimulus items, using the same settings and communication partners. Marckel, Neef, and Ferreri (2006) and Ben Chaabane, Alber-Morgan, and DeBar (2009) demonstrated generalization of PECS improvisation skills, which required combining descriptors of function, color, and shape to ask for items whose icons were missing. Both studies demonstrated that participants generalized improvisation skills to untrained items.

Effects on verbalization

The evidence for the impact of PECS on verbalization is mixed, with some studies suggesting that verbalization increases with PECS use, some suggesting individual participants had different responses to PECS, and some showing no impact of PECS on speech. There is no evidence to suggest that the use of PECS decreases verbalization.
A common feature of studies in which PECS has increased verbalization for all participants is that the participants demonstrated some pre-intervention verbalization or echolalia. These studies continued through Phase 3 (Kravits et al., 2002; Tincani, 2004), Phase 4 (Anderson, Moore, & Bourne, 2007; Jurgens et al., 2009; Ganz & Simpson, 2004), or Phase 6 (Charlop-Christy et al., 2002; Travis & Geiger, 2010). Not all studies examined differences in verbalization across phases, but from those that did, the most significant increase was found in Phase 4 (Jurgens; Ganz & Simpson).

In contrast to these results, other studies have found that PECS increased verbalization for some, but not all, participants (Ganz et al., 2009; Park, 2009; Tincani et al., 2006; Schwartz et al., 1998). It is possible that some of these studies did not show increases in verbalization because they did not continue through Phase 4 (Ganz et al., Park), which has been associated with the biggest gains in verbalization. Interestingly, Tincani reported that of two participants, the one who increased in verbalization was trained through Phase 4 and the participant who showed no increase in verbalized was trained through Phase 2. Individual participant characteristics may also contribute to the differences in verbalization after PECS training. Tincani reported that the participant who did show increases in verbalization had word approximations during baseline, while the other participant had no verbalizations. However, Schwartz et al. reported no pre-intervention differences distinguishing participants whose verbalizations increased and those that did not.

Whereas some researchers have found that PECS increased verbalization for all or a subset of participants, Ganz, Simpson, et al. (2008) found that PECS did not increase
verbalization for any of the three participants. It is possible that these results differ from
others reported because of the pre-existing verbalization skills, unusually slow
acquisition of PECS, and the lack of use of a time-delay procedure in Phase 4. One of
these participants did not master Phase 1. Of the two participants who mastered through
Phase 4, one had no intelligible speech, and the other was able to imitate some
approximations. Additionally, Howlin, Gordon, Pasco, Wade and Charman (2007) found
that students whose teachers had been trained in PECS did not have significantly higher
levels of verbalization than children whose teachers had not been trained.

In summary, evidence for the impact of PECS on speech is mixed. Training
through Phase 4 and use of a time-delay are correlated with higher levels of verbalization.
Pre-intervention speech may predict impact of PECS on verbalization, but this has not
been systematically addressed yet.

Adaptations to PECS protocol

Various modifications to the standard PECS protocol have also been effective.
Some studies have modified PECS procedures because the participants were not
successful using the standard PECS procedures, whereas other studies have modified the
procedures from the inception of training because of unique needs of the participants.
Other research has expanded on the standard PECS protocol by teaching additional skills.
Some researchers have changed specific components of the PECS protocol, although
these changes were not necessitated by unique participant characteristics, response to
intervention, or new skills being taught.
Studies in which participants were not successful with the standard PECS protocol have modified Phase 1 (Ganz et al., 2005), Phase 3 (Carré et al., 2009), and Phase 4 of PECS (Tincani et al., 2006). When a participant did not make progress despite extensive training in Phase 1, Ganz et al. (2005) adapted the PECS protocol by using objects rather than icons. The participant was trained to touch a clear box containing a preferred item. Next, the participant was taught to pick up boxes containing items, with photographs attached. Then, the child was taught to discriminate between boxes containing preferred and nonpreferred items, and then boxes with two preferred items. Correspondence checks were performed, as described in the PECS manual. Finally, the boxes were removed and the child was taught to exchange photographs of preferred items. Once training was modified, the participant mastered through the modified Phase 3b in 55 training sessions. Carré et al. (2009) modified the PECS Phase 3 procedure to aide discrimination. Phase 3a began with the discrimination of a blank card and the picture card corresponding to a preferred item. If the child selected the blank card, they received no items. When children mastered the discrimination between a blank card and a picture card, discrimination between a neutral item and a preferred item was introduced, according to the standard Phase 3a procedure. To make icons more discriminable, color, size, and type of symbol were changed. The additional cues were faded over subsequent trials. Tincani et al. (2006) modified Phase 4 of the PECS protocol to increase vocalization. After a picture exchange, a 5-second delay was introduced before reinforcement was delivered. If the participant verbalized a word or a word
approximation, immediate reinforcement was delivered. The 5-second time delay increased verbalization for both participants with whom it was used.

Other studies have modified PECS procedures from the outset of the study due to unique participant characteristics. Charlop, Berry, Malmberg and Berquist (2008) demonstrated that adding Braille labels to picture cards allowed a visually impaired therapist to correctly respond to picture exchanges, without decreasing the picture exchange behaviors of three children with autism. Lund and Troha (2008) modified PECS for students with visual impairments by using tactile cards and a least-to-most prompting hierarchy after initial training with full hand-over-hand prompting. One student mastered discrimination of symbols, corresponding to PECS Phase 3 skills. A second participant mastered Phase 1 and made progress but did not master Phase 2. A third participant made progress in Phase 1 although it was not mastered. The student who made the most progress received the most training as a multiple-baseline design was used.

Other studies have expanded the PECS procedures to teach additional skills. Schwartz et al. (1994) and Cannella-Malone, Fant, and Tullis (2010) have used PECS to teach children to communicate with their peers. Schwartz et al. taught children to exchange PECS with peers after they mastered Phase 4 by arranging the environment so that only the peers had access to preferred materials, and providing verbal and physical prompts. The program evaluation data indicates that the procedure was successful, although experimental controls were not in place. Cannella-Malone et al. trained students to use PECS with peers for requests, greetings, and responses to requests. This
intervention was effective for both participants, although one participant did not maintain initial increases in greetings throughout the duration of intervention.

In addition to using PECS to communicate with peers, other researchers have expanded the PECS protocol to teach improvisation skills (Ben Chaabane et al., 2009; Marckel et al.; 2006). Improvisation requires the learner to combine icons in new ways when there is no available icon that corresponds to a desired item. For example, if a child wanted a strawberry Starburst® but did not have a “candy” icon, he could improvise by requesting “red square.” Marckel et al. trained two boys with autism, ages 4 and 5, using a multiple-baseline across descriptors. Both participants learned to make requests using function, color, and shape descriptors. Ben Chaabane et al. taught parents to teach their child improvisation with the same attributes. Both participants were successful and generalized the skills to untrained items.

The research discussed above has modified the PECS protocol when learners did not acquire skills, or to address unique learning needs. Other studies have explored picture-based communication systems that differed from PECS from the outset for other reasons. Research has examined the effectiveness of using one trainer (Ganz et al. 2008; Gregory, Deleon, & Richman, 2009; Sigafoos et al. 2009), constant time delay not requiring initiation (Gregory et al., 2009; Chambers & Rehfeldt, 2003), and verbal prompts (Sigafoos et al., 2009)

Sigafoos et al. (2009) adapted the PECS protocol by using only one trainer rather than two, and using verbal prompts. The individual in this study mastered the exchange of one picture with a nearby trainer in six training sessions.
Ganz et al. (2008) used only one prompter to teach Phase 2 skills of traveling to a communication book and a communication partner to a 12-year-old boy with autism who had already acquired Phase 1 PECS skills. This training was successful, and the participant generalized the skills to additional, untrained communication partners and spontaneously gestured to get a communication book that was out of reach.

Gregory et al. (2009) used a procedure that differed from the standard PECS protocol by using only one trainer and physically prompting without waiting for initiation. During discrimination training, only one preferred item was available. If the picture corresponding to the other item was exchanged, no reinforcer was provided. Thus, previously mastered picture cards were placed on extinction when new cards were introduced. This study found that all six students mastered exchange of a single card, and four out of six students mastered discrimination of multiple pictures. The two students who did not master discrimination had poor pre-intervention matching and imitation skills.

These studies were not designed to systemically evaluate the necessity of specific components of the PECS protocol. However, the results described above suggest that the use of one prompter, constant time delay rather than waiting for initiation, and verbal prompts may be effective for some learners. Additional research is needed to confirm this.

Comparison of PECS and other interventions

Some research has compared PECS with other interventions, including manual sign, speech-generating devices, naturalistic language training, and verbal modeling.
These studies have examined the amount of training required to reach mastery criterion, participant preference, and generalization. Results have varied. In some studies, PECS was acquired more rapidly than sign (Adkins & Axelrod, 2001; Chambers & Rehfeldt, 2003) or verbal modeling with time delay (Ganz et al., 2010). Other studies have shown that results are different across participants for PECS and sign language (Gregory et al., 2009; Tincani, 2004) and naturalistic language training (Yoder & Stone, 2006). Some studies have found no difference in the length of training required (Sigafoos et al., 2009). It is hypothesized that individual pre-existing skills, such as imitation, matching, or joint attention, may predict which system will be acquired most rapidly, but more research is needed to make definite conclusions about the impact of these variables on the selection of an AAC system.

**PECS and VOCA**

Sigafoos et al. (2009) compared a form of exchanged-based communication with a speech generating device with a 15-year old male with Down syndrome and autism. Their exchange-based procedure differed from the PECS protocol in that only one trainer was used, and the prompter did not wait for the participant to initiate a request. Rather, after a time delay, the communication partner used graduated guidance to prompt the picture exchange. These results found no difference in the amount of training required for acquisition of picture exchange or speech generating device response. When both forms of communication were available, the participant chose the picture exchange slightly more often, but generally selected whichever system was closer to him.
**PECS and sign**

In studies comparing PECS and manual sign, two have found that PECS was acquired more rapidly for all participants (Adkins & Axelrod, 2001; Chambers & Rehfeldt, 2003) while two have found that results vary for individual participants (Gregory et al., 2009; Tincanci, 2004).

Adkins and Axelrod (2001) used an alternating-treatment design to compare the effectiveness of PECS training with sign training for a 7-year old boy with PDD. He acquired PECS responses with fewer training sessions, and showed a greater number of PECS responses generalized to other settings.

Chambers and Rehfeldt (2003) also found that PECS was acquired more rapidly than sign language, in their study of four adults, ages 19 to 40 with severe to profound mental retardation. Three out of four participants met criterion more quickly with PECS than with manual signs. A fourth participant was making more progress with PECS than with sign, but dropped out of the study due to medical reasons before meeting mastery criteria for PECS. Of the three participants who met mastery criteria with PECS, two also met mastery criteria with sign language, but training took more sessions. Three participants generalized PECS requests across settings, and two participants generalized sign requests across settings. All four participants demonstrated more requests for items not in view with PECS than with sign, and one participant had no requests for items not in view using sign.

In contrast to the work of Adkins and Axelrod (2001) and Chambers and Rehfeldt (2003), others have found more variable results. Gregory et al. (2009) assessed
preexisting imitation and picture-matching skills and then taught exchange-based communication, which was similar to PECS, and sign language, to six children with autism, ages 7 to 17. They found that for the three children with preexisting imitation and picture-matching skills, both systems were acquired rapidly. Of the three children with neither preexisting imitation nor picture matching skills, one learned the exchanged-based communication but not sign. The other two participants did not meet mastery criteria in either system. All participants learned to exchange a single picture, but the two who did not meet mastery criteria were unable to discriminate between pictures. The procedure used was different from the PECS protocol because rather than using a correspondence check, in which the child can request any of the items for which icons are displayed, in this training only a single item was available, although the child was presented with a field of pictures. If the child selected a card other than that which corresponding to the available item, he did not receive reinforcement. It is possible that this is a less effective method than correspondence training with error correction, because previously reinforced picture exchanges are placed on extinction. Rather than reinforcing requests based on what the child desires, the child must discriminate which item is available.

Whereas other studies suggest that PECS may be acquired more rapidly or that both systems are acquired at equal rates, Tincanci (2004) found that one participant learned PECS more quickly and another participant learned sign more quickly. In this alternating treatments design, the child for whom PECS was more effective had poor pre-treatment imitation skills and the child for whom sign was more effective had moderate
pre-treatment imitation skills. Both children had increased levels of verbalization, although during the course of intervention the participant for whom PECS was superior began to show declining levels of verbalization. A time-delay procedure was effective in restoring verbalization to higher levels. These results suggest that PECS may be more effective than sign for children with poor pre-intervention imitation skills, although these results are preliminary and more research is needed.

In summary, comparisons of PECS and sign language suggest that individuals will respond differently to the two alternative communication systems. Pre-intervention matching and imitation skills may predict response to treatment, but more research is needed in this area.

**PECS and other teaching methods**

In addition to comparisons with speech-generating devices and sign language, PECS has also been compared with Responsive Education and Prelinguisitic Milieu Teaching (RPMT) and verbal modeling. Results suggest that pre-treatment levels of joint-attention may predict response to PECS training.

Yoder and Stone (2006) compared PECS to RPMT with a randomized group design with 36 nonverbal preschoolers with autism. RPMT is a naturalistic intervention in which the therapist engages the child in a turn-taking routine and then prompts the child to initiate and respond to joint attention. They found that for children with low-levels of pre-treatment joint attention, PECS training increased frequency of requesting more than RPMT. For children with higher level of pre-treatment joint attention, RPMT
increased requesting more than PECS. These results suggest that PECS is better suited to
children with low pre-treatment initiations of joint attention than RPMT.

Ganz, Heath, Rispoli, and Earles-Vollrath (2010) compared PECS training
through Phase 2 and verbal modeling with noncontingent reinforcement for a three-year
old boy with autism. In the verbal modeling intervention, the therapist held up a desired
item and modeled the name of the item. If the child imitated the name, he would receive
the item. If he did not imitate or approximate the name, the therapist repeated the name
up to three times, before giving him the item. Thus, reinforcement was noncontingent,
but the child would receive immediate reinforcement for verbalization and would
experience a delay in reinforcement if he did not verbalize. PECS training was effective
at increase picture exchange requests, and verbal modeling with noncontingent
reinforcement was not effective at increasing speech.

Purpose of the study

The study was designed to replicate Ganz, Simpson, et al. (2008) while
addressing specific limitations. As in previous research, the present study attempted to
determine the effectiveness of PECS on increasing spontaneous requests, as well as its
effect on verbalization. This present study extends earlier work by including a participant
younger than 3 years of age, using probes rather than training sessions to collect
acquisition data, and assessing procedural integrity.

Only a few studies have included children younger than 3 (Park, 2009; Yoder &
Lieberman, 2010; Yoder & Stone, 2006a, 2006b) although the PECS system is designed
to be used with children as young as 2 (Frost & Bondy, 1994). The present study included one child who was under 3 when the study began.

Much previous work has collected acquisition data during training sessions by determining the percentage of trials without prompting. This may be problematic for two reasons. First, it may overestimate the skills of the participant. A child could meet mastery criteria of 90% correct, yet consistently need a prompt on the first trial of every session. It is possible that without this prompt, the child would perform the skill. It is not possible to determine this if acquisition data is collected during training sessions. Therefore, collecting data during unprompted probes is a more convincing demonstration that the learner has acquired the skill. Secondly, some phases of PECS teach increasingly complicated skills throughout the phase. For example, in Phase 2, the learner initially has to remove the card from the cover of a book and hand it to a communication partner who is very close. Later in the phase, the learner must travel a distance to the book and to the communication partner. A child may demonstrate a high percentage of unprompted responses early in the training. However, the skill demonstrated at that time may be a less complicated skill. Therefore, it may appear that the child has met mastery criteria, yet the skill required is not the terminal skill of the phase. By using a probe in which the environment is arranged to require the terminal skill of the phase, the percentage of correct responding is always measuring the same skill and accurately reflects acquisition of the terminal behavior of the phase.
Only some previously published research reports procedural integrity (e.g., Ben Chaabane et al., 2009; Marckel et al., 2006; Yoder & Stone, 2006a, 2006b). The present study will add to existing literature by including procedural reliability data.

Research Questions

The following research questions were addressed in the study:

1. Does PECS training increase unprompted picture exchange skills in preschool students with language impairments?

2. Does PECS training increase word utterances in preschool students with language impairments?
Chapter 2: Method

The purpose of this chapter is to describe the participants, settings, interventions, and data collection procedures used in this study.

Participants

The participants in this study attended an inclusive Early Childhood Education (ECE) classroom affiliated with a university. The children were selected for this study because they did not use speech or an alternative communication system to make requests. All of the children had the motor skills necessary for the intervention. They could grasp, reach, and walk independently.

Prior to beginning the study, the protocol was approved by the Institutional Review Board. The experimenter obtained written consent from the parents or guardians of the students, and from the teacher and assistants involved in the study (see Appendix A). Table 1 shows demographic and school related information for each participant.

Billy

Billy was 2 years and 6 months old at the beginning of the study. He was Chinese American, and English was not the primary language used in his home. Billy’s parents spoke and wrote English fluently outside of the home. Billy’s teacher reported that he was diagnosed with autism, but the records from this diagnosis were not available for review. According to educational records, the Batelle Developmental Inventory 2nd
edition yielded the following percentile rank scores in January 2009: Adaptive 1; Personal Social 9, Communication 0.1, Motor 0.1, Cognitive 14; BDI-2 Total 0.3. According to teacher report and experimenter observation, Billy was nonverbal. He occasionally made vowel and consonant sounds. The classroom staff taught Billy to request visible items by pointing to himself. Billy was observed to use this sign independently. He typically avoided social contact, and moved away when approached by peers or adults. Billy engaged in repetitive behavior, including dropping toys and opening and shutting doors. The teacher reported that Billy had untreated dental problems which contributed to frequent food refusal.

**Sally**

Sally was three years, four months old at the beginning of the study. She was Caucasian, and qualified for early intervention services for language and global developmental concerns. During the course of the study, Sally was diagnosed with autism, according to teacher report. She had tuberous sclerosis complex (TSC), a genetic disorder that can cause benign tumor growth in the brain, lungs, and kidneys. Symptom severity varies widely among individuals. Seizures occur in 70 to 80% of affected individuals (Crino, Nathanson, & Henske, 2006) and 40 to 45% have co-morbid autism or pervasive developmental disorder (Smalley, 1998). Sally experienced daily seizures, and took seizure-control medications throughout the study. Surgery to remove growths from the brain with the goal of improved seizure control was scheduled for the summer following the study.
The teacher obtained permission from parents for the researcher to review educational records. According to Sally’s records, The Preschool Language Scale-4 was administered in November, 2009. Sally’s standard score on the auditory comprehension sub-test was 50, and her standard score on the expressive communication subtest was 54. Her standard score on the Adaptive Behavior Assessment System, Second Edition, was 54, as measured in March 2010.

According to Sally’s records, she had glasses, but she did not wear them to school at any point during the study. According to Sally’s teacher, the growths in her brain were in the area of the optic nerve and could be impairing Sally’s vision. According to teacher and parent reports, and experimenter observations, Sally was nonverbal. She attempted to obtain objects by reaching and climbing on furniture, rather than seeking assistance. During free play activities, classroom staff modeled manual signs, including “more” and “all done” and physically prompted Sally to sign, but Sally did not independently use signs. The teacher reported that Sally’s mother had requested evaluation by a dietician because of frequent food refusal at home.

Mark

Mark was 3 years and 2 months old at the beginning of the study. He was Caucasian. According to educational records, the Battelle Developmental Inventory 2nd edition was administered in January 2009 with the following standard deviation scores: Personal Social -1.73, Receptive Communication -3.00, Expressive Communication -3.00, Cognitive -2.27, Adaptive -1.47, Gross Motor -3.00, Fine motor -1.67.
According to parent and teacher reports and experimenter observations, Mark did not use speech functionally. He occasionally repeated sounds others made, and used consonant-vowel verbalizations while playing alone. Mark made requests by leading an adult by the hand to a desired item and crying. The classroom staff used modeling and physical prompts to teach Mark to use manual signs during free play activities, but he did not use any signs independently.

The teacher reported that Mark had been referred for an evaluation for autism. He was on a waiting list for the evaluation at the conclusion of the study. Mark engaged in repetitive movements, including jumping, clapping, and hand-flapping. During free play he manipulated play materials and walked around the play area. He moved away when approached by peers.
<table>
<thead>
<tr>
<th>Age, at the start of the study</th>
<th>Billy</th>
<th>Sally</th>
<th>Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>Chinese-American</td>
<td>Caucasian</td>
<td>Caucasian</td>
</tr>
<tr>
<td>Diagnosis</td>
<td>Autism</td>
<td>tuberous sclerosis</td>
<td>--</td>
</tr>
<tr>
<td>PLS-4 c (Standard score)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auditory comprehension</td>
<td>--</td>
<td>50</td>
<td>--</td>
</tr>
<tr>
<td>Expressive communication</td>
<td></td>
<td>54</td>
<td></td>
</tr>
<tr>
<td>VABS-II (Standard score)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication</td>
<td></td>
<td>51</td>
<td></td>
</tr>
<tr>
<td>Daily Living Skills</td>
<td>--</td>
<td>60</td>
<td>--</td>
</tr>
<tr>
<td>Socialization</td>
<td></td>
<td>61</td>
<td></td>
</tr>
<tr>
<td>Motor skills</td>
<td></td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Adaptive behavior composite</td>
<td></td>
<td>52</td>
<td></td>
</tr>
<tr>
<td>BDI-2</td>
<td>Percentile rank</td>
<td>Standard deviation</td>
<td></td>
</tr>
<tr>
<td>Personal Social</td>
<td>9</td>
<td>-1.73</td>
<td></td>
</tr>
<tr>
<td>Receptive Communication</td>
<td>--</td>
<td>-3.00</td>
<td></td>
</tr>
<tr>
<td>Expressive Communication</td>
<td>--</td>
<td>-3.00</td>
<td></td>
</tr>
<tr>
<td>Combined comm. score</td>
<td>0.1</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>Cognitive</td>
<td>14</td>
<td>-2.27</td>
<td></td>
</tr>
<tr>
<td>Adaptive</td>
<td>1</td>
<td>-1.47</td>
<td></td>
</tr>
<tr>
<td>Gross Motor</td>
<td>--</td>
<td>-3.00</td>
<td></td>
</tr>
<tr>
<td>Fine Motor</td>
<td>--</td>
<td>-1.67</td>
<td></td>
</tr>
<tr>
<td>Combined motor score</td>
<td>0.1</td>
<td>--</td>
<td></td>
</tr>
</tbody>
</table>

Table 1 Demographic and School Related Information for Each Participant
Classroom Staff

One head teacher and three assistants consented to participate in the study. Table 2 shows the characteristics of the classroom staff participants.

Tom

Tom was an undergraduate psychology major who had worked in the Early Childhood Education class for five quarters before participating in the study. He had previously worked a child who used a picture exchange communication system. This child had been trained prior to working with Tom, and so Tom was aware of how to respond to requests, but had not been trained in prompting procedures. He worked four days per week in the morning class for the duration of the study, and served as a prompter for Billy.

Becky

Becky was an undergraduate Speech and Hearing Sciences major. She had worked in the classroom for two quarters prior to her participation in the study, and had no previous experience with PECS. She worked in the classroom three afternoons per week and served as the primary prompter for Sally. When Linda was unavailable, Becky served as the prompter for Mark.

Linda

Linda was an undergraduate Human Development and Family Sciences major. She had worked in the classroom for two quarters before participating in the study. She
had no prior experience with PECS, and worked three afternoons per week throughout the study. Linda was the primary prompter for Mark. When Becky was unavailable, Linda served as the prompter for Sally.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Tom</th>
<th>Becky</th>
<th>Linda</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major</td>
<td>Psychology</td>
<td>Speech and Hearing Sciences</td>
<td>Human Development and Family Sciences</td>
</tr>
<tr>
<td>Experience in ECE</td>
<td>5 quarters</td>
<td>2 quarters</td>
<td>2 quarters</td>
</tr>
<tr>
<td>Child prompted</td>
<td>Billy</td>
<td>Sally and Mark</td>
<td>Mark and Sally</td>
</tr>
</tbody>
</table>

*Table 2 Characteristics of Classroom Staff*

*Experimenter*

The experimenter in this study was a graduate student in the Special Education program at The Ohio State University. The experimenter earned a Bachelor of Science in Education at Youngstown State University in 2006, majoring in Special Education, Moderate/Intense. She had Ohio Licensure in Special Education, Moderate/Intense. She had taught students with special needs in public schools for three years prior to the study.

*Setting*
Baseline and preference assessments were conducted in the classroom. Training sessions and post-training probes were conducted in one of two quiet rooms in other areas of the building. A conference room and a clinic room were used, depending on room availability. Each setting will be described below.

**Classroom**

The morning class had nine students, consisting of five students with disabilities and four peer models. A head teacher and two to three assistants were available daily. The afternoon class had ten students, including six with disabilities and four peer models. The same head teacher, a student teacher, and two to four assistants worked in the class. A speech pathologist, occupational therapist, and physical therapist also worked in the classroom during both morning and afternoon sessions weekly. The daily schedule included free play, free choice gross motor activities in a separate room or outside, circle time, snack, and art. During the free play and gross motor activities, the teacher and aides moved around the class, encouraging children to interact and explore materials. The staff used incidental teaching to encourage Sally, Mark, and Billy to sign.

The classroom had a row of windows on one side. There were coat hooks labeled with the children’s names and photographs, two kidney shaped tables with child-sized chairs, and a low book case. There was a sensory table with materials such as rice or corn that were changed periodically. A wide variety of age appropriate toys were available during free play, including a play kitchen, doll house, puzzles, cars, and blocks. The toys were stored on open shelves that were easily accessible to the children. A bathroom was attached to the classroom. A sink, microwave, and refrigerator were
available in the classroom. One corner of the room was used for circle time, and it had a movable flannel board and CD player. A one-way window provided a view of the classroom from an attached observation room.

*Conference room*

The conference room was approximately 20 by 30 feet. Tables and chairs were moved out of the way to make a clear area for instruction to take place on the floor. Chairs were arranged in a diagonal line to indicate to the instructor the area of the room that would appear in the frame of the video camera. There was a row of windows along one wall, a sink, and cabinets.

*Clinic room*

The clinic room was approximately eight feet by 10 feet. All furniture was removed from the room prior to each session. There was a one-way mirror on one wall. There was no furniture or equipment in the clinic room beside experimental materials.

**Materials and Equipment**

The materials used in the study include preferred items, picture cards, communication book, timer, and videotaping equipment.

**Preferred items**

Preferred items were initially identified using a questionnaire adapted from the Reinforcer Assessment for Individuals with Severe Disabilities (RAISD; Fisher, Piazza, Bowman, & Amari, 1996) with parents and the teacher. The items indicated in this questionnaire were used to conduct multiple-stimulus without replacement preference assessment (MSWO; DeLeon & Iwata, 1996, see Appendix B). For Sally and Mark,
follow-up questions and repeated preference assessments were conducted because they lost interest in the items during training. For all three children, additional items were added to the brief preference assessments at the beginning of the sessions as the teacher reported they became interested in new items in the classroom.

*Picture cards and communication book*

Picture cards were made using Boardmaker software and printed in color. For Billy and Mark, pictures were two-inch square. Sally’s pictures were four-inch square, because of concerns about her vision. All pictures were laminated. For Billy, Velcro was applied to the back of pictures. It was noted in Phase 1 training that the Velcro stuck to the carpet, as the training was conducted on the floor. Pulling a picture off of a surface is not typically introduced until Phase 2, and so Velcro was removed until Phase 2 training began. For Sally and Mark, Velcro was not used until the introduction of Phase 2. From the beginning of Phase 2, a communication book was used. The communication book was a six inch by nine inch binder that was one inch in depth. Four pieces of Velcro were placed on the front cover.

*Video-recording equipment*

A Hitachi video camera was used to tape baseline, post-training probe, and training sessions. It was placed on a tripod, or held by the prompter during post-training probes. Sessions were viewed and scored using the attached flip-screen.

*Timer*

A MotivAider® (a vibrating timer), set to 10-second intervals, was used to indicate when the child had had sufficient time to use a preferred item.
Definition and Measurement of the Dependent Variable

The dependent variables measured in this study were unprompted picture exchanges and word utterances.

*Unprompted Picture Exchanges*

An unprompted picture exchange was defined as exchanging a picture with the communication partner without any prompts to request a preferred item. The specific behaviors required for the communication response vary across phases. Phase 1 required the participant to pick up the card, reach toward the communication partner, and release the card in her hand. Phase 2 required the participant to go to the communication book five feet away, pick up the picture, go to the communication partner five feet away, and release the picture. The task analysis results of Park (2009) were used to determine these skills.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Steps</th>
<th>Number of Steps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1</td>
<td>(1) Pick up the picture of a preferred item</td>
<td>3/4</td>
</tr>
<tr>
<td></td>
<td>(2) Reach toward the communication partner</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(3) Release the picture into the communication partner’s hand</td>
<td></td>
</tr>
<tr>
<td>Phase 2</td>
<td>(1) Go to the communication book five feet away from him</td>
<td>4/4</td>
</tr>
<tr>
<td></td>
<td>(2) Pick up the picture of a preferred item from the book</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(3) Go to the communication partner five feet away from him</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(4) Release the picture into the communication partner’s hand</td>
<td></td>
</tr>
</tbody>
</table>

*Note.* This task analysis is adapted from Park (2009)

*Table 3 Task Analysis of Picture Exchange*
Each of these behaviors was scored as Independent, Prompted, or No correct response for each trial. An independent behavior was performed by the child without any assistance. If the communication partner provided verbal prompts (e.g., “What do you want?”), visual prompts (e.g., an expectant look), or physical prompts (e.g., holding out her hand) the behavior was scored as prompted.

Unprompted picture exchanges were measured in blocks of 10 trials. Calculating the percentage of independent communication responses required two steps. First, the number of trials in which all steps were completed independently was divided by 10, the total number of trials. This value was multiplied by 100% to obtain the percentage of unprompted trials. Secondly, percentage of the terminal behavior completed was determined by multiplying the percentage of unprompted trials by the number of steps required in that phase out of the total steps required in the terminal behavior. In Phase 1, the percentage of unprompted trials was multiplied by 3/4. In Phase 2, percentage of unprompted trials was multiplied by 4/4. Weighting the percentage of unprompted trials in this way is necessary because the behaviors performed in each phase are different.

Word utterances

Clearly spoken words or word approximations emitted by the child were counted as word utterances. Only utterances referring to the requested items were counted. Word approximations were defined as vowel and consonant combinations (e.g., “wa” to request
“water”) approximating the names of items. Words were recorded verbatim from videotapes and in live data collection sessions.

In each trial, word utterances were recorded as utterance (U) or no relevant utterance (NU). The percentage of trials with utterances was calculated by dividing the number of trials with utterances by the total number of trials and multiplying by 100%.

Independent Variable

The independent variable is PECS training (Frost & Bondy, 2002). Children were trained with systematic fading of physical prompts to exchange picture cards for highly preferred items. Procedures described by Frost and Bondy were conducted for Phases 1 and 2. Children received training up to four days per week, depending on their attendance and the availability of classroom staff to act as prompters.

A mastery criterion was set as eight of 10 trials correct for two consecutive data collection sessions. However, because the behavior required in each phase is different, eight out of 10 correct trials in Phase 1 do not represent the same behavior as eight out of 10 correct trials in Phase 2. Rather, this formula is used to determine the mastery criteria in each phase: The fraction of the terminal (Phase 2) behavior demonstrated in a single trial is multiplied by the percentage of independent trials required (80%). Therefore, mastery in Phase 1 is defined as $\frac{3}{4} \times 80\%$, or 60%. In Phase 2, mastery is defined as $\frac{4}{4} \times 80\%$, or 80%.

Experimental Design

A changing criterion design (Cooper, Heron, & Heward, 2007) was used to examine the effectiveness of the intervention. This was used because the behavior being
measured changes incrementally across phases of the intervention. Each phase was a pre-
requisite for subsequent phases, and each additional phase required new skills.

The criterion for each phase required the child to perform that portion of the
terminal behavior which was taught with no prompting in 80% of trials. To master each
phase and progress to the next phase of instruction, the student needed to meet the criteria
for two consecutive post-training probe sessions.

Procedures

*General procedures*

Preference assessments were conducted to identify items to use in training. Baseline
measurement sessions were conducted to determine if the students had pre-existing picture
exchange communication skills. Training for the classroom staff was implemented to teach
paraprofessionals how to prompt PECS skills. PECS training was conducted as described in
the PECS manual (Frost & Bondy, 2002). With the exception of the first day of training in
each phase, post-training probes with no prompting were conducted daily. Then, the training
session was conducted. All acquisition data was obtained from post-training probes.

*Preference assessment*

A preference assessment was conducted to identify motivating items for the child to
request. A questionnaire adapted from the Reinforcer Assessment for Individuals with
Severe Disabilities (RAISP; Fisher et al., 1996) was sent home to parents (see Appendix B).
They were asked to list the child’s preferred items and activities in several areas, including
preferred visual stimuli, preferred auditory stimuli, preferred toys, and preferred foods. The
experimenter conducted an interview with the teacher based on the Reinforcer Assessment
for Individuals with Severe Disabilities (RAISD; Fisher, et al., 1996) for each participant (see Appendix C). The teacher was asked to list the child’s preferred items and activities in the same areas as parents, and the experimenter asked follow-up questions to obtain more detail. Based on teachers’ and parents’ reports, a list of possible items was generated.

The child’s preferences for these items were determined with a multiple-stimulus without replacement preference assessment (MSWO; DeLeon & Iwata, 1996) (see Appendix D). The experimenter offered four to nine stimuli to the child and said “Pick one.” The experimenter recorded the child’s selection, and gave him a small portion of edible items or brief access (10-15 seconds) to tangibles. The first selected item was removed from the array, and the experimenter presented the remaining items to the child, and said “Pick one.” This process was repeated until one stimulus remained. The procedure was repeated until the child consistently demonstrated the same preferences across two consecutive sessions. The percentage of selection was determined by dividing the number of trials a stimulus was selected by the number of trials the stimulus was available and multiplying by 100%. This percentage was averaged across sessions, and items were ranked. Items that were chosen in at least 20 % of opportunities were offered to the child in teaching sessions.

For Sally and Mark, eight weeks elapsed between preference assessments and the beginning of training, because a multiple-baseline design across participants was originally planned, and because of spring break in the school schedule. It was noted at the beginning of training that Sally and Mark lost interest in items more quickly than Billy, and so additional preference assessments were conducted.
Baseline

Baseline data were collected to measure pre-existing skills in using picture cards to make requests. First, the experimenter conducted a brief preference assessment to select the target item for the session. Items identified from preference assessments were presented with the direction “Pick one.” If the child reached for an item, he had brief access (30 seconds) to it. The selected item was removed, and the remaining items were presented again with the direction, “Pick one.” If the child reached for an item, he was allowed brief access to it. Thus, two preferred items were identified for use in the baseline session.

Baseline sessions were designed to measure skills taught in Phase 3B, because it was originally planned that the study would teach through that phase. Baseline sessions were conducted in a corner of the classroom, with furniture moved out of the way. The experimenter sat on the floor, five feet away from the child, with the two preferred items. The communication book was on the floor near the experimenter, with pictures of the two preferred items. If the child came to the book, selected a picture, and handed it to the experimenter, she offered the tray and said “Take it.” If the child chose an item the experimenter recorded the choice (see data sheet in Appendix E, adapted from Park, 2009). Even if the item did not correspond to the picture the child selected, he or she was allowed brief access to it. If the child reached for an item without exchanging a picture, he or she was allowed brief access to it. In either case, after the child accessed the item, the trial ended, and the next trial began with the experimenter moving five feet from the child, and placing the communication book with the pictures five feet from the child. If the child continued to engage with the item after 30 seconds, the experimenter gently took it back. If the child did
not attempt to reach for an item or a picture within 10 seconds, the experimenter recorded
“No response.” The next trial then began with the experimenter re-arranging the pictures and
the items, with the child again having 10 seconds to either reach for the items or the pictures.

Training for classroom staff

The experimenter trained members of the classroom staff in using PECS. Staff
training included an overview and rationale for the use of PECS and a summary of first three
stages. Then the staff received detailed instructions in using Phase 1, including guided notes
(Appendix F) and role play with feedback. If the staff made errors in the procedure, the
experimenter explained it again and conducted the role play again. Training continued until
the staff member demonstrated 100% correct performance of the steps (see data collection
form in Appendix G). When participants working with that prompter mastered Phase 1,
similar procedures were used to train the staff in Phase 2 of PECS. The experimenter
explained the procedural integrity checklist (see Appendix H). The data collection forms and
procedural reliability checklists are adapted from Park (2009).

PECS training

The experimenter used the procedures described in the PECS manual (Frost &
Bondy, 2002) to teach the picture exchange skills. It was originally planned that students
would learn Phase 1 through Phase 3. Due to time constraints, one participant received
training through Phase 2, and two participants received training through Phase 1. In Phase 1,
students learned to take a picture and give it to an adult to receive a desired item. In Phase 2,
students learned to go to the communication book, remove a picture, and deliver it to the
communication partner.
A brief preference assessment was conducted at the beginning of each session to identify a reinforcing item. As was described in the baseline condition, the experimenter offered the items identified in formal preference assessment and allowed the child to pick. The item chosen was used for the training session. If the child lost interest in the item during the training session (i.e. no longer consumed it when offered), the preference assessment was repeated and a different target item was used until the child lost interest in it. Each training session continued for 10 trials, or until the child did not demonstrate interest in any items or attempted to leave the training area rather than engaging with items. Training continued for each phase until the child demonstrated 80% independent trials for two consecutive post-training probe sessions.

Phase 1 training

After the brief preference assessment, Phase 1 training sessions began with the experimenter arranging the environment. One picture corresponding to the target item was placed in front of the child. The prompter sat behind the child, and the experimenter sat facing the child on the floor. The experimenter enticed the child to reach for the item by showing it. No verbal prompts were used. As soon as the child began to reach for the item, the prompter used a hand-over-hand physical prompt to assist the child in picking up the picture and handing it to the experimenter. As soon as the child released the picture into the experimenter’s hand, she provided the desired item, labeled it verbally, and praised the child (e.g., “Candy! Good job!”). For edibles, the child received a small bite or sip. For tangibles, the child was allowed brief access (approximately 10 seconds). If the child attempted to reach the other preferred items not being used in the current trial rather reaching for the
picture or the current item, the trial was stopped. Another brief preference assessment was
conducted, and the newly identified item was used to conduct the trial.

A slightly different procedure was used with inedible items for Mark. It was noted
that when items were removed, Mark lost interest. He wandered around them room,
attempted to leave the teaching setting, or played with dust on the floor. The teacher reported
that this was typical of Mark’s behavior in the classroom. He did not typically attempt to
retrieve items that were removed. Multi-piece items were identified through preference
assessment (e.g., box of toy cars, pot of plastic letters, and six piece put-in puzzle). When
these items were used, the base of the item stayed in front of Mark and was not removed.
The experimenter offered one piece at a time. After Mark placed the piece in the container
(e.g., car in box, letter in slot, or piece in puzzle) another piece was offered. The timer was
not used in this procedure.

Over subsequent trials, the prompter reduced the physical assistance to the child,
beginning with the behaviors at the end of the sequence. Specifically, the prompter reduced
physical guidance as the child released the picture into the experimenter’s hand. Once the
child performed this step independently, the prompter reduced physical guidance during the
reaching step. When the child was reaching and releasing the picture without help, the
prompter reduced physical guidance as the child grasped the picture. Phase 1 training
continued until the child reached mastery criteria of 80% of trials independent for two
consecutive sessions. Training sessions were videotaped using a camera set on a tripod.
Procedural integrity data were collected from the video after the session (see Appendix H).
Phase 2 training

The first skill taught in Phase 2 was removal of the picture card from the cover of the communication book. Rather than placing the pictures on the floor, as in Phase 1, the pictures were velcroed to the front of a binder. The same procedures of gradually reducing physical guidance described in Phase 1 were used to teach this skill. Billy was observed to throw the communication book, and so the prompter used one hand to hold the book down to the floor and the other hand to prompt. Once the child was independently removing the picture from the book and exchanging it, the distance between the child and the experimenter was gradually increased. The experimenter held the desired item, and moved back from the child about one foot. After the child grasped the picture card, the prompter provided physical guidance from behind the child for him or her to move to the experimenter. Across subsequent trials, the experimenter gradually moved until she was five feet from the child. The prompter reduced physical guidance until the child independently grasped the picture, moved to the experimenter, and released it in his or her hand.

Next, the distance between the child and the communication book was gradually increased. The teacher remained five feet away from the child, and gradually moved the communication book across subsequent trials until it was five feet from the child. The prompter provided physical guidance from behind the child to help him or her move to the book, grasp the picture, move to the experimenter, and release the picture. Physical prompts were faded until the child completed all of these steps independently. If Billy attempted to throw the communication book, an error correction procedure was used. The trial in which throwing was attempted was discontinued and not counted. The experimenter presented the
item, and the prompter waited until Billy initiated by reach for the item. Then he prompted him to complete the trial correctly, while holding down the communication book. The prompter was able to fade his holding of the book, until Billy was performing the skills without the book being held and without throwing being observed. Training continued until the child completed this skill with 80% independent trials across two consecutive teaching sessions. As described above for Phase 1 training, if the child attempted to access other preferred items, another brief preference assessment was conducted and training resumed with the newly identified item. Training sessions were videotaped. The second observer reviewed the videotape and recorded procedural reliability data (see Appendix H).

*Post-training probe sessions*

Post-training probes were conducted to measure the child’s acquisition of picture exchange communication skills (see Appendix E). A post-training probe was not conducted on the first day of training in any phase, as the child had not yet received instruction. Beginning on the second day of each phase, and continuing throughout the phase, each daily session began with a post-training probe and was followed by a training session. The prompter was not involved with the child during the post-training probes. He or she either sat in a different area of the room, or held the video camera. No prompting was provided during post-training probes. If the child used the picture exchange skill to request the item, the experimenter gave the item, verbally labeled it, and praised the child (“Rice! Good job!”). If the child reached for the item without using the picture exchange skill, the experimenter allowed access to the item without saying anything.
Phase 1 Post-Training probes

Post-training probes were very similar to training, except that no prompting was provided. If the child correctly exchanged the card, he or she received the item and verbal praise. If the child reached for the item rather than the picture, the experimenter provided the item without saying anything. If the child attempted to access other preferred items, beside the target, a brief preference assessment was conducted. No data was collected from a trial interrupted by a preference assessment, and it did not count toward the total number of trials. Videotapes were reviewed and trials were scored as independent, prompted, or no correct response. Verbalizations were scored as well.

Phase 2 Post-Training probes

Phase 2 post-training probes were arranged with the communication book and the experimenter five feet from the child. The procedures were similar to Phase 2 training, except that no prompting was provided. If the child attempted to reach the item rather than the card, he was given access to the item without verbal praise. As described above for training sessions, brief preference assessments were repeated if the child attempted to access other items, beside the target item being used in the trial. The current trial was discontinued and not counted as part of the total number of trials. No data was recorded for a trial interrupted for a new preference assessment.

Interobserver Agreement

Reliability was measured with inter-observer agreement (IOA) conducted by one independent trained observer, who was a doctoral student in the special education program at The Ohio State University. Observations were conducted in an average of 20% of the
baseline and post-training probe sessions for each child, using videotapes (see Appendix I). Agreement was defined as both observers scoring all behaviors in the trial the same way (independent, prompted, or no response). IOA was calculated by dividing the number of agreements by agreements plus disagreements and multiplying by 100%. The observer met 95% agreement on three consecutive training sessions before scoring actual experimental sessions.

**Procedural integrity**

To ensure fidelity of the application of the independent variables, a procedural reliability checklist was used (see Appendix H). Checklists developed by Park (2009) were used to determine how accurately the trainers implemented the procedures for baseline, Phases 1 and 2 training, and Phases 1 and 2 post-training probes. The baseline and Phase 1 training checklists each had six steps and Phase 2 training had 10 steps. Phase 1 and 2 post-training probes each had six steps for the checklists. The total percentage of steps completed correctly across all 10 trials was calculated to determine the procedural reliability. The second observer scored an average of 20% of sessions. Procedural reliability was scored from videotaped session.
Chapter 3: Results

This chapter presents the results of the study. First, the results of the preference assessment are examined. Next, the results of the teacher training will be discussed. Thirdly, the experimental results of the PECS training will be reported. Data is presented to show the percentage of correct picture exchanges in each baseline and post-training probe session for each participant. Interobserver agreement and procedural integrity data are also reported. Interobserver agreement data will be presented as the percentage of trials with exact agreement between the two observers. Procedural integrity data is reported as the percentage of steps on the procedural integrity checklist which were conducted correctly.

Preference assessment results

A multiple-stimulus without replacement assessment was conducted with Billy, Sally, and Mark. The percentage of opportunities in which an item was selected was averaged across trials. The resulting average percentages were ranked to determine a hierarchy of preference. The results are presented in Table 4 below. Items with greater than 20% selection were chosen for training, and are listed in bold type.
<table>
<thead>
<tr>
<th>Rank</th>
<th>Billy</th>
<th>Sally</th>
<th>Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Item</td>
<td>% of selection</td>
<td>Item</td>
</tr>
<tr>
<td>1</td>
<td>Juke box</td>
<td>66%</td>
<td>Push top ball toy</td>
</tr>
<tr>
<td>2</td>
<td>Ball ramp</td>
<td>61%</td>
<td>Mirror</td>
</tr>
<tr>
<td>3</td>
<td>Moon toy</td>
<td>55%</td>
<td>Peg board</td>
</tr>
<tr>
<td>4</td>
<td>Mirror</td>
<td>15%</td>
<td>Barn toy</td>
</tr>
<tr>
<td>5</td>
<td>Push-top ball toy</td>
<td>8%</td>
<td>Goldfish</td>
</tr>
</tbody>
</table>

*Note.* Items appearing in bold type were selected in more than 20% of opportunities, and thus were used in training.

*Table 4 MSWO Preference Results*

Billy’s most preferred item was the toy juke box, which he chose in 66.6% of opportunities. His next most preferred item was the ball ramp (61%), followed by the moon toy (55%), mirror (15%) and the push-top ball toy (8%). For Sally, the most
preferred item was the push-top ball toy, chosen in 66.5% of opportunities, followed by the mirror (62.5%), peg board (31.25%), and barn (29%). Mark’s most preferred item was juice (73.2%), followed by book (60%), ball ramp (43.2%), car ramp (31.6%), and Goldfish™ crackers (0%).

Due to a change in experimental design and the students’ spring break, training began several weeks after preference assessment for Sally and Mark. Both students lost interest in items during training and so preference assessments were conducted again for these students, using additional items that the teacher reported they enjoyed. The results of the follow-up preference assessments are reported in Table 5.
<table>
<thead>
<tr>
<th>Item</th>
<th>% of selection</th>
<th>Item</th>
<th>% of selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice</td>
<td>100%</td>
<td>Juice</td>
<td>58.25%</td>
</tr>
<tr>
<td>Water</td>
<td>50%</td>
<td>Puzzle</td>
<td>47.75%</td>
</tr>
<tr>
<td>Barn</td>
<td>33%</td>
<td>ABC magnets</td>
<td>40.25 %</td>
</tr>
<tr>
<td>Pasta</td>
<td>22.5%</td>
<td>Car ramp</td>
<td>30 %</td>
</tr>
<tr>
<td>Pegboard</td>
<td>18%</td>
<td>Box of toy cars</td>
<td>27.75 %</td>
</tr>
<tr>
<td>Push-top ball toy</td>
<td>12.5%</td>
<td>Dog toy</td>
<td>14.25%</td>
</tr>
<tr>
<td>Mirror</td>
<td>7%</td>
<td>Bead stacker</td>
<td>10.5 %</td>
</tr>
<tr>
<td>Ball ramp</td>
<td>--</td>
<td></td>
<td>9.5 %</td>
</tr>
<tr>
<td>book</td>
<td>--</td>
<td></td>
<td>9 %</td>
</tr>
</tbody>
</table>

*Note.* Items appearing in bold type were selected in more than 20% of opportunities, and thus were used for training.

*Table 5 MSWO Results from Second Administration*
For Sally, the most preferred item was rice, chosen in 100% of opportunities, followed by water (50%), barn toy (33%), pasta (22.5%), push-top ball toy (12.5%), and mirror (7%). Sally did not consume the rice, water, or pasta, but instead played with the uncooked materials. Similar materials were available in a sensory exploration table in the classroom. It was observed during the study that she also enjoyed playing with dried oatmeal in the classroom, and this was added to the brief preference assessment at the beginning of sessions. Mark’s MSWO yielded the following results: juice (58.25%), puzzle (47.75%), ABC magnets (40.25%), car ramp (30%), box of toy cars (27.25%), dog toy (14.25%), bead stacker (10.5%), ball ramp (9.5%), and book (9%).
Results of PECS training

The percentage of independent picture exchanges during each baseline and post-training probes are reported below for each participant. Horizontal lines indicate mastery criteria in each phase. Mastery criteria are based on the task analysis presented in Table 3.

Billy

Billy’s PECS training results are presented in Figure 1.

Figure 1 Billy’s PECS Training Results
Billy did not make any independent picture exchanges during baseline, as shown by Figure 1. In the first five post-training probes in Phase 1, he did not have any independent picture exchanges. Billy started to engage in independent picture exchanges beginning in his sixth post-training probe at 22.5%. This increasing trend continued in the next two data collection sessions, with 67.5% and 75% independent responses, respectively. Billy met the mastery criteria of two consecutive sessions with greater than 60% independent responses in the 8th post-training probe. He did not exhibit any independent picture exchanges in Phase 2 of training, as measured in 14 post-training probes.

*Sally*

Sally’s PECS training results are presented in Figure 2.
Sally did not show any independent picture exchanges during baseline, as shown in Figure 2. In the first three post-training probes she continued to show no independent picture exchanges. Beginning with the fourth post-training probe she began to respond, with 15% independent picture exchanges. An upward trend was seen for the rest of Phase 1, with the exception of the 7th probe, in which a lower level of responding was observed. The final session was at 67.5% independent responding. Data collection concluded before Sally met mastery criteria, which required two consecutive sessions at or above 60% independent correct responding.

Mark

Mark’s PECS training data are presented in Figure 3.
Mark did not demonstrate any independent picture exchanges, as shown in Figure 3. He had no independent picture exchanges during baseline. During post training probes, he continued to show no independent picture exchanges throughout 11 post-training probes.
Interobserver agreement

Interobserver agreement was collected in 20.7% of sessions, distributed across baseline and post-training probe sessions. Agreement was defined as trials in which all behaviors were scored the same way. The number of agreements was divided by agreements plus disagreements and multiplied by 100%. The percentage of sessions scored and the average percentage agreement is presented in Table 6.

<table>
<thead>
<tr>
<th></th>
<th>Billy</th>
<th>Sally</th>
<th>Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%Agreement</td>
<td>%Sessions</td>
<td>%Agreement</td>
</tr>
<tr>
<td>Baseline</td>
<td>100%</td>
<td>25%</td>
<td>100%</td>
</tr>
<tr>
<td>Phase 1</td>
<td>100%</td>
<td>25%</td>
<td>95%</td>
</tr>
<tr>
<td>Phase 2</td>
<td>100%</td>
<td>14%</td>
<td></td>
</tr>
</tbody>
</table>

*Table 6 Interobserver Agreement Results*

Agreement ranged from 70% to 100%, with an average of 96.3% agreement. For Billy, interobserver agreement during baseline was 100%, across baseline, Phase 1 and Phase 2. For Sally, IOA was 100% during baseline and averaged 95% during Phase 1, with a range of 90 to 100%. For Mark, IOA was 100% in baseline, and 85% in Phase 1, with a range of 70% to 100%.
Procedural integrity

Procedural integrity was calculated by a trained observer using videotapes of sessions. This observer used the procedural integrity checklist to determine how many steps of the checklist the experimenter and classroom staff completed correctly. Results are presented in Table 7.

<table>
<thead>
<tr>
<th></th>
<th>Billy</th>
<th>Sally</th>
<th>Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Phase 1</td>
<td>100%</td>
<td>99.05%</td>
<td>96.25%</td>
</tr>
<tr>
<td>training</td>
<td></td>
<td>(98.1%-100%)</td>
<td>(92.5%-100%)</td>
</tr>
<tr>
<td>Phase 1 probe</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Phase 2</td>
<td>100%</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>training</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phase 2 probe</td>
<td>100%</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

Table 7 Procedural Integrity Results

Procedural integrity data was collected on 25% of baseline sessions. Procedural integrity was collected on 25% of Phase 1 training and probe sessions for Billy, 25% of Phase 1 training and probe sessions for Sally, and 18% of Phase 1 training and probe sessions for Mark. Procedural integrity was collected on 14% of Phase 2 training and
probe sessions for Billy. Overall, 20.7% of experimental sessions were scored for procedural integrity.

Procedural integrity was 100% across conditions for Billy. For Sally, procedural integrity during baseline and Phase 1 probes was 100%. During Phase 1 training, procedural integrity ranged from 98.1% to 100%, with a mean of 99.05%. For Mark, procedural integrity during baseline and Phase 1 probe sessions was 100%. During Mark’s Phase 1 training, procedural integrity ranged from 92.5% to 100%, with a mean of 96.25%. In the session for which procedural integrity of Mark’s Phase 1 training was lower (92.5%), the same step was scored as incorrect for four out of 10 trials. This was step 5b on the Treatment Integrity data sheet, which requires that the physical prompter begin the prompt within 5 seconds of the child initiating interest in the item.

On four out of 10 trials, the prompter did not complete this step correctly, by either waiting too long to begin a prompt, or by using a physical prompt that was insufficient for Mark to correctly perform the behavior.

In teacher training sessions, all of the staff members demonstrated correct prompting procedures with 100% of steps correct in their first attempt with each role play.
Chapter 4: Discussion

This study was designed to examine the effectiveness of PECS in three young children with significant communication impairments. Specifically, the study asked if PECS was effective for increasing children’s independent picture exchange skills, if it increased their verbalization. Two of the three participants showed an increase in independent communication behaviors in Phase 1 of training. One of these participants met mastery criteria and continued to Phase 2 training. However, this child did not show any increase in picture exchange use during Phase 2. A third participant did not show any increase in independent communication behavior during Phase 1 of training. None of the participants demonstrated relevant verbalizations during training. This chapter draws conclusions about each research question based on the results of the study, discusses limitations, and examines directions for future research and practice.

Discussion of results by research question

Question 1: Does PECS training increase the unprompted picture exchanges in preschool students with language impairments?

In general, there was some evidence that PECS training increased picture exchanges, but the evidence was less strong than in other published studies. One out of three participants mastered Phase 1, one participant made progress in Phase 1 without meeting mastery criteria, and one participant showed no increase in picture exchanges during Phase 1. The only participant who reached Phase 2 did not have any independent picture exchanges in that phase.
Although it is difficult to directly compare the amount of training needed to reach mastery because of difference in intensity of training and mastery criteria, the majority of previously published research suggests that these results are unusual, particularly Mark’s results and Billy’s Phase 2 results. With the exception of Ganz, Simpson, et al. (2008) and Tincani (2004), several authors reported no participants receiving this amount of training without some increase in independent picture exchanges (Angermier et al., 2008; Carre et al., 2009; Ganz and Simpson, 2004; Jurgens et al., 2009; Kravits et al., 2002; Park, 2009; Stoner et al., 2006; Tincani et al., 2006).

The use of probes may have interfered with acquisition of PECS for all participants, because reaching for items without using pictures was reinforced with delivery of the item. Several previous studies demonstrating relatively rapid acquisition of PECS collected acquisition data during training sessions which included prompting (Carre et al., 2009; Charlop-Christy et al., 2002; Frea et al., 2001; Ganz & Simpson, 2004; Jurgens et al., 2009; Kravits et al., 2002; Schwartz et al., 1998; Tincani, 2004; Tincani et al., 2006; Stoner et al., 2006). However, three studies in which probes were used (Angermier et al., 2008; Ganz et al., 2009; Park, 2009) did not report difficulties with acquisition. One of these studies used differential reinforcement, so that exchanging a picture card resulted in more immediate and longer access to preferred items than merely reaching for the item (Ganz), while the other two studies used probes without differential reinforcement.

In addition to the use of probes, lower procedural reliability may have prevented Mark from acquiring PECS skills. Procedural integrity was collected in two training
sessions for Mark, one with each prompter who worked with Mark. When procedural integrity was collected with Linda, Mark’s primary prompter, it was calculated to be 92.5%. With Becky, who occasionally worked with Mark, procedural integrity was 100%. Linda was the primary prompter for Mark. Although it may appear that 92.5% is still quite high, closer inspection shows that the same step was missed on four out of 10 training trials. The prompter did not prompt within five seconds of Mark initiating interest. According to the PECS training manual, the physical prompt should begin as the student is reaching for the reinforcing item, and the prompt should be immediate (Frost & Bondy 2002). In the training session that was scored, Linda provided immediate prompts in 60% of trials, and thus inadequate prompting may have interfered with Mark’s ability to acquire the behavior.

Difficulty identifying reinforcers is another factor that may have contributed to Mark’s failure to acquire PECS skills. In the first two training sessions, Mark selected items in the initial preference assessment, but did not try to reach them again after being allowed short access to the items. According to the teacher, this behavior is typical of Mark. She reported that he usually did not try to get items back that were removed by adults. Potential reinforcers with multiple pieces were identified by talking to the teacher and conducted a preference assessment (puzzle, cars to place in a box, letters to place in a pot). The PECS protocol was changed, so that the base of the item (tray for the puzzle, the box for the cars, and the pot for the letters) was not removed between trials. Instead, a new trial was initiated as soon as Mark placed a single piece into the toy. The new trial was initiated by showing another piece to place into the item. This procedure was
effective in maintaining Mark’s interest in the item. However, it is different than previously researched studies, and may have slowed Mark’s acquisition.

During Phase 2 training with Billy, throwing the communication book may have slowed acquisition of PECS skills. According to Billy’s teacher, and experimenter observation, Billy repeatedly threw many items. He often threw items rather than playing with them. This behavior did not occur in Phase 1 because the communication book was not yet introduced. Therefore, rather than quickly beginning to move the communication partner away from the child, several training sessions were conducted for Billy to be able to independently remove the picture from the book. Throwing behavior was reduced by having the prompter hold the book down to the floor with one hand and use the other hand to prompt the exchange.

In summary, the current study provides some evidence that PECS training increases picture exchanges, but the evidence is less strong than in most previous research. While it is possible that the termination of data collection due to the end of the school year may explain this lack of acquisition, the majority of previous research suggests that the amount of training provided would be expected to be sufficient to increase independent picture exchanges. The use of probes may have slowed acquisition for all participants. Additionally, for Mark, difficulty identifying reinforcers and lower procedural reliability may have interfered with learning PECS. Billy’s frequent throwing of the communication book in Phase 2 may also have contributed to failure to demonstrate independent picture exchanges.
Question 2: Does PECS training increase word utterances in preschool children with significant language impairments?

Billy, Sally, and Mark did not demonstrate word utterances during the course of the study. These results provide no evidence that PECS increases the frequency of word utterances.

Published studies have shown mixed results, with some studies showing an increase in verbalizations for all participants (Anderson et al., 2007; Charlop-Christy et al., 2002; Ganz & Simpson, 2004; Jurgens et al., 2009; Kravits et al., 2002; Tincani, 2004; Travis & Geiger, 2010), others showing an increase for some participants (Ganz et al., 2009; Park, 2009; Schwartz et al., 1998; Tincani et al., 2006) and other studies showing no effect on verbalizations (Ganz et al., 2008; Howlin et al., 2007). Research in which verbalization increased with the use of PECS has shown that the greatest increase typically began in PECS Phase 4, and was most likely with participants who demonstrated pre-training echolalia or language, even if limited. Given that this study went only through Phase 2 with one participant and Phase 1 with two participants, and two of the three students were reported not to say any words prior to training, these results are consistent with previous work (Ganz, Simpson, et al., 2008; Ganz & Simpson, 2004; Jurgens et al., 2009; Tincani, 2004; Tincani, et al., 2006).
Limitations and directions for future research

There were several limitations of this study, which include limitations of the procedures, limitations of the setting, and confounding variables unique to the individual participants. Each will be considered below.

In addition to low procedural reliability, difficulty identifying reinforcers, and probes which may have reinforced incorrect responding, which have already been discussed, the procedures may have been further limited by a lack of sensitivity in the probes. Post-training probes may not be sensitive enough to detect improvement during Phase 2 of training, because they require the terminal behavior for that phase, while Phase 2 training proceeds gradually. Over the course of training, the communication book and partner are gradually moved away from the child, until they are at a distance of five feet. However, the post-training probe only measured the child’s ability to travel the full five feet to the communication book and the communication partner. Future research could minimize this problem by using probes that require the same level of skill observed during training sessions, and changing the requirements on subsequent probe sessions.

In addition to the limitations of the procedures, the setting may have presented limitations, including the use of a large room which increased Sally’s wandering, the use of multiple training settings, and the end of the school year. Originally, the training and probe sessions were scheduled to take place in a large conference room. However, it was noted during the first training session that Sally ran around the room in a repetitive manner, rather than engaging with the items. This behavior interfered with the training session. According to the teacher, Sally frequently engaged in repetitive running.
Therefore, Sally’s sessions were rescheduled for a small clinic room. Due to time limitations in setting up the environment for each session, Mark and Sally’s sessions were held in the same room. Therefore, when Sally’s sessions were changed, Mark’s were as well. However, the small room was not available on Wednesdays, and so the larger room was used once a week. Future research conducted in applied settings could be improved by minimizing confounding variables by using a consistent setting. Lack of time to continue data collection due to the end of the school year was another limitation to the study. It is possible that with additional training the participants may have made more communication responses using PECS.

In addition to limitations associated with the procedures and settings, confounding variables unique to the individual participants limit the generalizability of the findings to other subjects. Billy’s family did not use English at home, which may have reduced the likelihood of Billy using word utterances during training conducted in English. Future research could exclude participants who do not speak English at home. Also, Billy exhibit frequent throwing of the communication book, which may have interfered with acquiring the picture exchange skill. Future research could exclude participants with specific interfering behaviors. However, students with autism have higher levels of stereotypic behaviors, which may interfere with PECS training. Future research could examine the effectiveness of specific techniques to reduce interfering behavior during PECS training (holding down the communication book, using a soft book that is less likely to be thrown).
During the course of the study, the medication used to control Sally’s seizures was changes in preparation for her brain surgery. She experienced a temporary increase in seizures, which may have slower her acquisition of the skill. She also had frequent absences due to medical appointments.

*Future Directions for Research*

In addition to addressing the limitations described above, future research could examine staff training to implement PECS and research on PECS in different settings. In this study, staff training included verbal explanations with guided notes, modeling, and role plays. Two of the three trainers achieved high levels of procedural integrity using these methods. A third trainer exhibited errors in a specific step, by waiting too long to begin physical prompts. Additional research to examine the particular elements of the training package that are most important would be helpful to streamline the training process. Also, research could compare methods for addressing staff errors in implementing the PECS protocol.

In this study, the students did not have the pre-requisite skill of sitting at table calmly for instruction, so the training was conducted on the floor. According to the PECS manual, training should begin in a structured environment and be generalized across all environments. Additional research could examine the ideal characteristics of the initial training environment. It is possible that the pictures were less salient to the children, because they were on the floor rather than a table.
Implications for research and practice

Practitioners implementing PECS can learn from these results that immediate prompting more likely to result in effective learning, and that it is important to design effective staff training procedures that include on-going error correction. Howlin et al. (2007) examined the effectiveness of a 2-day PECS training workshop for teachers, followed by half-day in class monthly consultations for 5 months. They found an initial increase in the use of PECS among the children, compared to children whose teachers had not received training. However, once the consultations stopped the gains were not maintained. This result suggests that teachers need ongoing support to implement PECS effectively.

Also, practitioners should be alert to interfering behaviors that may slow the rate of learning PECS skills. In this study, Billy was observed to throw the communication book, which may have slowed his rate of learning in Phase 2. As is described in the PECS manual (Frost & Bondy 2002), the physical prompter prevented this behavior by holding the book down to the floor.

Summary

The present study demonstrates that PECS Phase 1 was effective for some but no all participants, and that PECS Phase 2 was not effective. It suggests that procedural integrity is an important component of the training, particularly in ensuring that prompts are delivered immediately. It demonstrates that some prompters may need additional error correction procedures to be effective in prompting. The results of the present study
are somewhat different than previously published research which suggested that Phase 1 and 2 skills were acquired quickly.

This study extended previous research by demonstrating the effectiveness of Phase 1 training procedures with an individual diagnosed with Tuberous sclerosis, and with a child age 2.5.
LIST OF REFERENCES


improvisation with the picture exchange communication system to children

(2006). Early language and communication development of infants later
diagnosed with Autism Spectrum Disorder. *Developmental and Behavioral
Pediatrics, 27*, S69-S78.

Chronicity of challenging behaviours in people with severe intellectual
disabilities and/or autism: A total population sample. *Journal of Autism and
Developmental Disorders, 35*, 405-418.


System Training on Spontaneous Communicative Behaviors of Young Children
with Autism Spectrum Disorders* (Doctoral dissertation).

System: Communicative Outcomes for Young Children with Disabilities. *Topics
in Early Childhood Special Education, 18*, 144-159.

comparison of picture exchange and speech-generating devices: Acquisition,


Appendix A: Consent forms
The Ohio State University Parental Permission
For Child’s Participation in Research

**Study Title:** The Effects of Picture Exchange Communication Training on the Communication Behaviors of Young Children with Autism or Severe Language Disabilities

**Researcher:** Dr. Sheila Morgan

**This is a parental permission form for research participation.** It contains important information about this study and what to expect if 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 permit your child to participate, you will be asked to sign this form and will receive a copy of the form.

**Purpose:** This study is being done to find ways to increase the functional communication skills of young children with disabilities. Specifically, this research will examine the effects of teaching children to use the Picture Exchange Communication System (PECS) in order to ask for preferred items or activities. We will also be teaching typically developing peers to be communication partners. We will not be asking for access to
school records. However, we will need to request your child’s diagnosis information from
the classroom teacher. The following are the procedures for children who need PECS
training to communicate and for the communication partners.

Procedures/Tasks

For Children with Disabilities who need PECS training

- Parents will complete a questionnaire on children’s preferences.
- Children will complete a preference assessment to identify what they like.
- Children will be taught to use PECS in order to request a preferred item.
- Children will be videotaped during training sessions and free play.

For Typical Peers who will be communication partners

- Your child will be taught how to interact with a child with disabilities who
  uses picture cards to request things.
- Then your child will participate in training sessions with a child with
  disabilities who is learning to use picture cards to make requests.
- Interactions between children with disabilities and your child will be observed
  and videotaped during training sessions and free play

Duration:

The study will last approximately 16 weeks. Your child will be involved in teaching
sessions of about 15 minutes in length, 3 times a week. Your child will be observed
during free play activities during 10-minute sessions during the course of the study.

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:

- Risks: We do not anticipate any risks, side effects, or discomforts. However, if your child becomes uncomfortable or unwilling to participate during any session, the session will end, and your child will be directed to another activity.
- Benefits: Picture cards are already used to some extent in your child’s classroom. By participating in the research, your child may learn to use picture cards more quickly. It is possible that your child may interact more with other children in the classroom by participating in this study.

Confidentiality:

Efforts will be made to keep 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.

Incentives:

Neither you nor your child will be paid to take part in the study.

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 Sheila Morgan at 614-247-8714.

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 Sheila Morgan at 614-247-8714.

To return this form:

If you chose to have your child participate, you can sign the consent form (p. 4 of this letter) and return it to the researcher in the enclosed self-addressed stamped envelope. You can keep this letter for your records. You will be provided with a copy of the attached form.
**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 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 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**

AM/P

M

**Relationship to the subject**

**Date and time**

---

**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.
Appendix B: Reinforcer Assessment Parent Questionnaires
Reinforcer Questionnaire- adapted from The Reinforcer Assessment for Individuals with Severe Disabilities (RAISD)

Child’s name: _____________________________      Date: _____________

Your child will be participating in PECS (picture exchange communication training) in the classroom. This will teach him or her to use picture cards to ask for things. We’d like to know more about what your child likes so that we can use those items during teaching.

Please complete and return this questionnaire, so we know more about what items and activities your child prefers.

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

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

____________________________________________________________________
____________________________________________________________________
____________________________________________________________________

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

____________________________________________________________________
____________________________________________________________________
____________________________________________________________________

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

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

____________________________________________________________________
____________________________________________________________________
____________________________________________________________________

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

____________________________________________________________________
____________________________________________________________________
____________________________________________________________________

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

____________________________________________________________________
____________________________________________________________________
____________________________________________________________________

7. Some children really enjoy feeling different sensations such as splashing water in a sink, a vibrator against the skin, or the feel of air blow on the face from a fan. What activities like this do you think your child most enjoys?
8. Some children really enjoy it when others give them attention such as a hug, a pat on the back, clapping, say “Good job,” etc. What forms of attention do you think your child most enjoys?

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________

9. Some children really enjoy certain toys such as puzzles, toy cars, balloons, comic books, flashlights, bubbles, etc. What are your child’s favorite toys or objects?

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________

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

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________

Thank you! Please return this questionnaire to your child’s teacher.
Appendix C: Reinforcer Assessment Teacher Questionnaire
The Reinforcer Assessment for Individuals with Severe Disabilities (RAISD)

Child’s name: ______________________________      Date: _____________

Name of reporter: ___________________________

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 client. 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 favorite? What does she do when she plays with a mirror? Does she prefer to do this alone or with another person?)

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

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

____________________________________________________________________

RESPONSE TO PROBE QUESTIONS:

____________________________________________________________________

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

____________________________________________________________________
RESPONSE TO PROBE QUESTIONS:

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

RESPONSE TO PROBE QUESTIONS:

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

RESPONSE TO PROBE QUESTIONS:

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

RESPONSE TO PROBE QUESTIONS:

16. Some children really enjoy touching things of different temperatures, cold things like snow or an ice pack, or warm things like a hand warmer or a cup containing hot tea or coffee. What activities like this do you think ______________________ most enjoys?
17. Some children really enjoy feeling different sensations such as splashing water in a sink, a vibrator against the skin, or the feel of air blow on the face from a fan. What activities like this do you think ___________________________ most enjoys?

RESPONSE TO PROBE QUESTIONS:

18. Some children really enjoy it when others give them attention such a hug, a pat on the back, clapping, say “Good job,” etc. What forms of attention do you think ___________________________ most enjoys?

RESPONSE TO PROBE QUESTIONS:

19. Some children really enjoy certain toys such as puzzles, toy cars, balloons, comic books, flashlights, bubbles, etc. What are ___________________________’s favorite toys or objects?

RESPONSE TO PROBE QUESTIONS:

20. What are some other items or activities that ___________________________ really enjoys?

RESPONSE TO PROBE QUESTIONS:
Appendix D: Multiple Stimulus Without Replacement Data Collection Form
Multiple-Stimulus without Replacement Preference Assessment

Child’s Name: ___________
Preferred item(s)  1. _________________________
                     2. _________________________
                     3. _________________________
                     4. _________________________
                     5. _________________________
                     6. _________________________
                     7. _________________________
                     8. _________________________

<table>
<thead>
<tr>
<th>Preferred items</th>
<th>Rank in which item was chosen</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Trial 1</td>
</tr>
<tr>
<td>Date:</td>
<td>Date:</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix E: Baseline Data Collection Form
Data Collection Form for Child
(Adapted from Park, 2009)

Child’s Name: ______________ Date: ______ Session: Baseline_____
Training Phase ______

Preferred items: __________________________________________________
Observer: _____________________________ Interobserver agreement Yes No

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
<th>T6</th>
<th>T7</th>
<th>T8</th>
<th>T9</th>
<th>T10</th>
<th>S/T</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Picture exchange:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I: Independent response</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P: Prompted response</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N: No correct response</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Go to communication book</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I: Independent response</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P: Prompted response</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N: No correct response</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Select the correct picture</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I: Independent response</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P: Prompted response</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N: No correct response</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pick up the picture</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I: Independent response</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P: Prompted response</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N: No correct response</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reach toward the communication partner</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I: Independent response</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P: Prompted response</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N: No correct response</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Release the picture</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I: Independent response</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P: Prompted response</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N: No correct response</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Choose the correct item during correspondence check</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I: Independent response</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P: Prompted response</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N: No correct response</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Preferred item used in each trial
*Distance between child and experimenter
*Distance between child and book

*T: Trial; S/T: Subtotal
Picture Exchange Communication System (PECS) Staff Training 1

Objectives: After today’s training, you will be able to:

1. Describe the purpose of the Picture Exchange Communication System (PECS).
2. State the objective of the first phase of the Picture Exchange Communication System.
3. Describe the role of the physical prompter in Phase 1 of the Picture Exchange Communication System training.
4. Demonstrate the role of the physical prompter in a role play.

Objective 1: Describe the purpose of the Picture Exchange Communication System (PECS).

PECS is a way to teach nonverbal people to communicate. When people can’t use speech to ask for things, they express themselves in other ways, such as gestures, crying, or other behaviors. How does (child’s name) express himself? (Discuss)

We want (child’s name) to be able to express himself more clearly, so that he can calmly ask for things, and other people can understand what he wants.

Through PECS training, (child’s name) will learn to hand a picture of what he wants to someone, in order to make a request.

Objective 2 State the objective of the first phase of the Picture Exchange Communication System.
PECS is a 6 phase procedure. The students in our study will learn the first 3 phases. In Phase 1, the child will have one picture. The child will learn to give the picture to communication partner to make a request.

The child will learn this sequence of skills in Phase 1:

1. Pick up the picture
2. Reach to the communication partner
3. Release the picture

(I demonstrate the skill the child will learn at the end of Phase 1).

Objective 3: Describe the role of the physical prompter in Phase 1 of the Picture Exchange communication system training.

When we do PECS training, there are three people involved:

1. The child
2. The communication partner
3. The prompter- that’s you!

The job of the physical prompter is to physically help the child exchange the picture card, without saying anything.

(Demonstrate the physical arrangement- the prompter is behind the child).

We will work together to perform this series of steps:

1. The communication partner (Angela) will show the child a toy he likes.
2. We will wait- not saying anything!
3. The child will reach for the toy.
4. As he is reaching, the physical prompter (you!) will physically guide the child to pick up the picture, reach toward the communication partner, and release the picture into the partner’s hand.

5. The child gets the toy!

Objective 4: Demonstrate the role of the physical prompter in a role play.

(Role play- Angela as the prompter, the other adult as the learner. In the first role play, I describe what I’m doing, in the 2nd role play, do it without talking. In the 3rd role play, switch roles).

As the physical prompter, you have 3 jobs:

1. Wait for the student to initiate.

2. Physically prompt the student to exchange the picture.

3. Over time, reduce physical prompts until the child exchanges the picture by himself.

Let’s look at each job:

1. Wait for the student to initiate

Why do we do this?

- So that the child does not become dependent on our prompting

- So that the child learns the reason he should exchange a picture is because he wants something, not because we told him to

What does it look like?

The child reaching for the item

Signing “my turn” by pointing to himself
No verbal prompts while we wait (don’t say, “What do you want?”)

2. Physically prompt the student to exchange the picture

   When? As soon as the child begins to reach for the item

   How?
   
   • Place your hand on the back of the child’s hand
   
   • Lead the child to pick up the picture, reach toward the communication partner, and release the picture into the communication partner’s hand
   
   • Remember, no verbal prompts

   What if the child doesn’t reach for the item?

   Keep waiting

   No verbal prompts

   If the child is tired of the item, the communication partner will use a new toy

3. How to gradually fade prompting

   When?

   Physical prompts will be reduced in the release stage first

   Take your hand off the child’s hand right before he releases the picture

   When the child can release the picture by himself, reduce physical prompts in the reach stage

   When the child can reach by himself, reduce physical prompts in the pick up stage

   Role play- I demonstrate how to reduce prompts in the release stage

   Student demonstrates
Role place- I demonstrate how to reduce prompts in the reach stage

Student demonstrates

Role place- I demonstrate how to reduce prompts in the pick-up stage

Student demonstrates

Potential problem:

The child has been doing well, so you fade physical prompts during the reaching stage.

The student picks up the picture, reaches toward the communication partner, but he drops the picture. What do you do?

Start the trial over. Put the picture back in front of the child, and wait for him to initiate.

Then, physically prompt the whole sequence (pick up, reach, release), so that the child performs the skill correctly.

Why? If you just pick up the picture and hand it to the child when he drops it, he might get confused about what he really needs to do.

Picture Exchange Communication Training- Staff Training 2:

Objectives: In today’s training, you will learn to:

1. Describe the goal of PECS Phase 2 training
2. Describe the role of the physical prompter in PECS Phase 2
3. Demonstrate the role of the physical prompter in PECS Phase 2

Objective 1: Describe the goal of PECS Phase 2 training

At the end of Phase 2 training, the student will be able to walk to his communication book, take off the picture, walk to the communication partner, and give her the picture.
In Phase 1 of training, the communication partner and the picture were always right in front of the child, waiting for him to communicate. But in real life, communicating is more complicated. Phase 2 prepares students to communicate in the real world by teaching them to walk a distance to get a picture, and walk to a communication partner. We will break this skill down into steps, and teach one step at a time.

Step 1- Taking the picture off the communication book

Instead of putting the picture on the floor in front of the child, it will be Velcroed to the communication book. Just like in Phase 1, Experimenter will hold up a toy or food that the child likes. We will wait for initiation- it might be reaching for the item, or it might be reaching for the picture.

If the child has trouble getting the picture off the book, the prompter will assist. Help the child by putting your hand over his hand and guiding him to pull the picture off the book. Don’t pull the picture off yourself, or pick up it up- make sure the child’s hand pulls the picture off when you prompt.

At this stage, the child should not need prompting to exchange the picture.

Fade the prompt the removing the picture from the communication book.

Objective 2: Describe the role of the physical prompter in Phase 2

What to do in Step 1 of Phase 2:

1. Wait for the initiation.
2. Prompt the child to pull the picture of the book, if needed. Prompt by guiding the child to pick up the picture.
3. Fade the prompt.
Objective 3: Demonstrate the role of the physical prompter in PECS Phase 2

Step 2: Increasing the distance between the communication partner and the student

Once the child is independently pulling the picture off the communication book, Experimenter will very gradually move away from the child. On each trial she will move a little more, until the child is walking five feet to reach her.

The job of the physical prompter is to wait, and watch the student. The child may perform the skill independently, because Experimenter will move only a little on each trial. However, if the child pauses at all once he starts approaching, the prompter’s job is to immediately physically prompt the child to walk toward the communication partner.

Do not talk to the student, just physically guide him or her, by standing behind or next to the student and guiding him.

What to do in Step 2 of Phase 2:

1. Watch the student.
2. If he does exchanges the picture independently, great! You don’t have to prompt.
3. If he pauses, physically prompt right away!
4. No verbal prompts.
   (role play)

What if he makes an error?
If the child makes a mistake, we will start the trial over. We will put the picture back on the book, and wait for initiation.

Then the physical prompter will help, to make sure the child does not make a mistake again.

When do we have to start the trial over?

1. If the child drops the picture
2. If the child pauses for more than a few seconds, and you cannot prompt right away
3. If the child walks to Experimenter but does not exchange the picture (role play)

Step 3: Increasing the distance between the student and the communication book

When the child can independently go to the communication partner, without any help from the prompter, we will teach him to walk to the communication book.

At the beginning of this step, the communication partner, Experimenter, will be close to the child. Very gradually we will increase the distance between the child and the communication book.

What to do in Step 3 of Phase 1:

1. Watch the child to see if he independently gets the picture and exchanges it.
2. If the child starts to get the picture but pauses, physically prompt right away.
3. If the child goes toward Experimenter without getting the picture, this is a mistake. We will start the trial over, and provide a physical prompt.

(Demonstrate the physical set up)

When the child can walk 5 feet to get the picture, we will gradually move the communication book to the side, so that the child walks 5 feet to get the picture, and 5 feet to the communication partner.
child

Communication

partner
Appendix G: Teacher Training Data Collection Forms
<table>
<thead>
<tr>
<th>Scenario</th>
<th>+</th>
<th>-</th>
<th>+</th>
<th>-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wait for initiation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>If child needs help to remove picture, provide hand over hand physical prompt</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do not prompt exchange</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No verbal prompt</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% correct</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Scenario</th>
<th>+</th>
<th>-</th>
<th>+</th>
<th>-</th>
</tr>
</thead>
<tbody>
<tr>
<td>If the student pauses, provide immediate physical prompt</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical prompt is from behind or next to child</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No verbal prompt</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% correct</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Scenario</th>
<th>+</th>
<th>-</th>
<th>+</th>
<th>-</th>
</tr>
</thead>
<tbody>
<tr>
<td>If the student make an error, do not prompt him to complete that trial</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wait for initiation in new trial</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Provide a full physical prompt</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No verbal prompt</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% correct</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>If the student make an error, do not prompt him to complete that trial</td>
<td>+ -</td>
<td>+ -</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
<td>-----</td>
<td>-----</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wait for initiation in new trial</td>
<td>+ -</td>
<td>+ -</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Provide a full physical prompt</td>
<td>+ -</td>
<td>+ -</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No verbal prompt</td>
<td>+ -</td>
<td>+ -</td>
<td></td>
<td></td>
</tr>
<tr>
<td>% correct</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix H: Procedural Integrity Forms
### Treatment Integrity Checklist: Baseline Probe
(Adapted from Park, 2009)

<table>
<thead>
<tr>
<th>Procedures</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
<th>T6</th>
<th>T7</th>
<th>T8</th>
<th>T9</th>
<th>T10</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Brief preference assessment</strong> (if needed including the 1st trial)</td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
</tr>
<tr>
<td>1 Experimenter placed preferred items in front of child</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td> </td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td><strong>2a</strong> If child displayed interest in an item:</td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
</tr>
<tr>
<td>Experimenter immediately allowed child to consume a small amount of edible item or to access the toy for about 30 seconds</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td> </td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td><strong>2b</strong> If child displayed no interest in any items:</td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
</tr>
<tr>
<td>Experimenter withdrew the items and presented other preferred items</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td> </td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td><strong>3</strong> After preference assessment</td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
</tr>
<tr>
<td>4 Experimenter placed two preferred item pictures on the book cover about 5 ft away from child</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td> </td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td><strong>5a</strong> If child exchanged a picture for requesting item:</td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
</tr>
<tr>
<td>Experimenter conducted correspondence check by presenting two items in front of child and saying “Take it”</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td> </td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Immediately after child selected any one item, experimenter gave child access to it without saying anything</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td> </td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td><strong>5b</strong> If child reached any item without using picture:</td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
</tr>
<tr>
<td>Experimenter allowed child to access it without saying anything</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td> </td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td><strong>5c</strong> If child made no attempt:</td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
</tr>
<tr>
<td>Experimenter began the next trial (except the 10th trial)</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td> </td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
</tbody>
</table>

---

Child’s Name: ___________ Date: ____________ Session: BL ____
Observer: _______________
During trial, experimenter provided neither verbal nor physical prompt for picture exchange (e.g., “Pick up the picture”)

<table>
<thead>
<tr>
<th>Trial</th>
<th>+</th>
<th>+</th>
<th>+</th>
<th>+</th>
<th>+</th>
<th>+</th>
<th>+</th>
<th>+</th>
<th>+</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
</tbody>
</table>

* T: Trial, S: Sub-total of incorrectly performed trials, N: Not applicable
<table>
<thead>
<tr>
<th>Procedures</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
<th>T6</th>
<th>T7</th>
<th>T8</th>
<th>T9</th>
<th>T10</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Brief preference assessment</strong> (if needed including the 1st trial)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Experimenter placed preferred items in front of child</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>N</td>
</tr>
<tr>
<td>If child displayed interest in an item:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experimenter immediately allowed child to consume a small amount of edible</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>item or to access the toy for about 15-30 seconds</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>If child displayed no interest in any items:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experimenter withdrew the items and presented other preferred items</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>N</td>
</tr>
<tr>
<td>After preference assessment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Experimenter placed a picture of the preferred item in front of child</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>N</td>
</tr>
<tr>
<td>4 Experimenter presented preferred item slightly out of reach of child</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>N</td>
</tr>
<tr>
<td>If child picked up and exchanged picture for requesting item:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Immediately after child released picture into experimenter’s hand, she</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>gave child access to it, saying &quot; (Name of the item). Good job&quot;</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>N</td>
</tr>
<tr>
<td>5a If child reached item without using picture:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experimenter allowed child to access it without saying anything</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>N</td>
</tr>
<tr>
<td>5c If child attempted to access other items:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experimenter repeated preference assessment</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>N</td>
</tr>
<tr>
<td>6 During trial, experimenter provided neither verbal nor physical prompt</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>for picture exchange</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>N</td>
</tr>
</tbody>
</table>
# Treatment Integrity Checklist: Phase 2 Post-Training Probe

(Adapted from Park, 2009)

<table>
<thead>
<tr>
<th>Procedures</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
<th>T6</th>
<th>T7</th>
<th>T8</th>
<th>T9</th>
<th>T10</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brief preference assessment (if needed including the 1st trial)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Experimenter placed preferred items in front of child</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>2a If child displayed interest in an item:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>2b If child displayed no interest in any items:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>After preference assessment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Experimenter placed the picture on the cover of the communication book which was about 5 ft away from child</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>4 Experimenter presented preferred item to child about 5 ft away from child</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>5a If child reached for picture, removed it from book, went to experimenter, and released picture to her hand:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>5b If child failed to exchange picture and reached item without using picture:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>5c If child attempted to access other items:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>6 During trial, experimenter provided neither verbal nor physical prompt for picture exchange</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td></td>
</tr>
</tbody>
</table>
Data Collection Form: Treatment Integrity Phase 1 Training  
(Adapted from Park, 2009)

Child’s Name: ___________ Date: ___________ Session: Phase 1 ____
Observer: _______________

<table>
<thead>
<tr>
<th>Procedures</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
<th>T6</th>
<th>T7</th>
<th>T8</th>
<th>T9</th>
<th>T10</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brief preference assessment (if needed including the 1st trial)</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>N</td>
</tr>
<tr>
<td>1  Experimenter placed preferred items in front of child</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>N</td>
</tr>
<tr>
<td>2a If child displayed interest in an item:</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>N</td>
</tr>
<tr>
<td>Experimenter immediately allowed child to consume a small amount of</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>N</td>
</tr>
<tr>
<td>edible item or to access the toy for about 15-30 s</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>2b If child displayed no interest in any items:</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>N</td>
</tr>
<tr>
<td>Experimenter withdrew the items and presented other preferred items</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>N</td>
</tr>
<tr>
<td>3  After preference assessment</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>N</td>
</tr>
<tr>
<td>Experimenter placed a picture of the preferred item in front of child</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>N</td>
</tr>
<tr>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>4  Experimenter presented preferred item slightly out of reach of child</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>N</td>
</tr>
<tr>
<td>5a If child picked up picture and released it into experimenter’s hand:</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>N</td>
</tr>
<tr>
<td>Immediately after child released picture into experimenter’s hand,</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>N</td>
</tr>
<tr>
<td>experimenter gave child access to it until the piece was inserted,</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>for toys saying “(name of item) good job!”</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>5b If child did not attempt or failed to pick up and exchange picture:</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>N</td>
</tr>
<tr>
<td>Within 5 seconds of the child initiating interest in the item, the</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>teacher started a physical prompt for the child to pick up picture,</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>reach experimenter, and/or release picture</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>5c If the child made an error, such as dropping the picture, a new trial</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
<td>N</td>
</tr>
<tr>
<td>was started</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>During trial, both adults provided no verbal prompt for picture exchange (e.g., “Pick up the picture”)</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td></td>
</tr>
</tbody>
</table>
Data Collection Form: Procedural Integrity (Phase 2 Training)
(Adapted from Park, 2009)

<table>
<thead>
<tr>
<th>Procedures</th>
<th>T₁</th>
<th>T₂</th>
<th>T₃</th>
<th>T₄</th>
<th>T₅</th>
<th>T₆</th>
<th>T₇</th>
<th>T₈</th>
<th>T₉</th>
<th>T₁₀</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brief preference assessment (if needed including the 1st trial)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Experimenter placed preferred items in front of child</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>2a</td>
<td>If child displayed interest in an item:</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Experimenter immediately allowed child to consume a small amount of edible item or to access the toy for about 15-30 seconds</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>2b</td>
<td>If child displayed no interest in any items:</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Experimenter withdrew the items and presented other preferred items</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>After preference assessment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Experimenter or prompter placed the picture on the cover of the communication book</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Experimenter presented preferred item to the child</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>If necessary, experimenter moved back from child by a few inches up to 5 ft</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>If necessary, experimenter increased the distance between child and book by a few inches up to 5 ft</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>7a</td>
<td>If child reached for picture, removed it from book, went to experimenter, and released picture to experimenter’s hand:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Immediately after child released picture into experimenter’s hand, experimenter gave child access to it (for 10-15s for toys), saying “(Name of the item)” “good job”</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>7b</td>
<td>If child did not attempt or failed to reach for picture, remove it from book, go to experimenter, and release picture to experimenter’s hand:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Within 5 seconds of the child initiating interest in the item, the teacher started a physical prompt for the child to pick up picture, reach experimenter, and/or release picture</strong></td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td><strong>If necessary, teacher gradually faded physical prompt from back end of the sequence</strong></td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>If the child made an error, such as dropping the picture, a new trial was started</strong></td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>During trial, both adults provided no verbal prompt for picture exchange (e.g., “Pick up the picture”)</strong></td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>