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The authors would like to thank “Elise’s” parents for allowing us to work with her in their home and providing helpful information and assistance

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Abstract

As aberrant behavior is often recognized as the number one form of communication, it becomes imperative that as parents, teachers, and educators we must address and systematically teach or provide all children with an effective means of communication. While many augmentative and alternative communication systems such as manual sign language and the Picture Exchange Communication System (Frost & Bondy, 1994) have shown tremendous success, some students with developmental disabilities students unique needs require more individually tailored communication training that necessitates empirical inquiry and use of collective expertise. Doing so may facilitate the acquisition of skills and behaviors that improve communication skills through independent appropriate means for meeting students' personal needs and desires. This article systematically provides a variation of the Picture Exchange Communication System (PECS) including materials, resources, and methodology necessary to implement similar pictorial augmentative and alternative communication systems.

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Introduction

The Picture Exchange Communication System (PECS) is a picture-based augmentative communication program frequently used with individuals with autism spectrum disorders (ASD) and others who are nonverbal (Frost & Bondy, 2002). The system requires the student to give the trainer a picture in exchange for a preferred item (e.g., food item, toy). According to the PECS manual, training takes place over six phases. Students are taught to make exchanges with a wide variety

of single line drawings (Phase 1); to generalize the picture exchange across a variety of trainers and further distances (Phase 2); to discriminate among several drawings and corresponding pictures with preferred items (Phase 3); to make requests in the form of sentences (Phase 4); to answer a variety of questions, including “What do you want?” (Phase 5); and to expand on previous skills (Phase 6). These phases are summarized in more detail in Figure 1.

Figure 1. Summary of PECS Phases.

Phase	Summary
Reinforcer Assessment	The child is offered a variety of items (e.g., toys or food) to determine which he or she chooses most often. A reinforcer assessment may be repeated frequently in case the child’s preferences change.
1 Picture Exchange	The student is taught to hand a picture to an adult in exchange for a desired item. Initially, a second trainer provides physical prompts from behind the child, but these prompts are quickly faded. During this and following phases, the adult verbally models the pictures the child hands to him or her.
2 Increasing Distance	The child learns to locate his or her communication picture, remove a picture from it, and walk to the appropriate communicative partner (e.g., the one who has the preferred items). The child generalized the basic picture exchange across further distances and a variety of communicative partners. Two trainers are still required in this phase.
3 Picture Discrimination	The child is taught to discriminate between a variety of pictures and to correspond pictures with preferred items. Error correction procedures are incorporated. Beginning with Phase 3, only one trainer is required.
4 Sentences	The child learns to form complete sentences, including a sentence starter (i.e., “I want” picture) picture and a picture of a preferred item. This is taught using backward chaining. The adult verbally models the entire sentence.

Phase	Summary
5 Questions	The child is taught to respond to questions, such as “what do you want?” This question is introduced after the child is frequently initiating requests to prevent prompt dependency (i.e., to prevent the child from waiting for the question before making any requests and encourage spontaneity). Next, the child may be taught to answer additional questions, such as, “what do you hear?” and, “what do you see?”
6 and Beyond Expansion	The child is taught to comment, form a variety of sentences, use attributes (e.g., color, size, shape), incorporate verbs, use numbers, and answer yes/no answers.

(Frost & Bondy, 2002)

Recently, several research articles have been published in support of the use of the Picture Exchange Communication System (PECS) with children with autism spectrum disorders (ASD). These studies have demonstrated rapid acquisition of a functional communication system (Ganz & Simpson, 2004; Kravits, Kamps, Kemmerer, & Potucek, 2002; Magiati & Howlin, 2003; Schwartz, Garfinkle, & Bauer, 1998); increased speech (Charlop-Christy, Carpenter, Le, LeBlanc, & Kellet, 2002; Ganz & Simpson; Kravits, Kamps, Kemmerer, & Potucek); decreased problem behaviors (Charlop-Christy, et al; Frea, Arnold, Vittimberga, & Koegel, 2001); and improved social interactions (Charlop-Christy, et al). In addition, Tincani (2004) compared the use of PECS with children with ASD with manual sign language and has found that PECS resulted in more independent requesting. These research articles are summarized in Figure 2.

Figure 2. Published research involving PECS.

Authors(s)	Summary
Bondy & Frost (1994)	Eighty-five preschool children in a statewide program for children with autism were taught to use PECS. Over 95% learned make requests using at least 2 pictures. Seventy-six percent of the children who had used PECS began using speech as a result.
Schwartz, Garfinkle, & Bauer (1998)	Thirty-one children with autism and developmental delays in an integrated preschool were taught to use PECS. On average, within 14 months of beginning PECS training, they independently used a functional communication system (range 3-28 mo.).
Schwartz, Garfinkle, & Bauer (1998)	Eighteen children with autism and developmental delays in an integrated preschool were taught to use PECS. Forty-four percent of the participants developed speech as a result of PECS training. All of the participants generalized the use of PECS across a variety of times and settings.
Frea, Arnold, Vittimberga, & Koegel (2001)	One boy with autism was taught to use PECS in a preschool classroom. As a result, aggression decreased.
Charlop-Christy, Carpenter, Le, LeBlanc, & Kellet (2002)	Three school-aged children with autism were taught to use PECS in a clinical setting. The participants mastered PECS quickly, improved problem behaviors and social skills, and increased speech skills as a result. (Available online: http://seab.envmed.rochester.edu/jaba/articles/2002/jaba-35-03-0213.pdf)
Kravits, Kamps, Kemmerer, & Potucek (2002)	A six-year-old girl was taught to use PECS with peers in her general education kindergarten classroom and at home. Spontaneous use of pictures and verbalizations increased as a result.
Magiati & Howlin (2003)	Thirty-four children were taught to use PECS. Participants increased their frequency of communicating using PECS, increased the amount of vocabulary used, and improved their overall levels of communication.
Ganz & Simpson (2004)	Three school-aged participants with autism and related disorders were taught to use PECS in general and special education settings. Participants quickly learned PECS and increased speech skills.

Authors(s)	Summary
Tincani (2004)	Two school-aged children with ASD were taught PECS and sign language. One participant produced more independent requests as a result of sign language training, while the other produced more independent requests with PECS. Sign language training resulted in more verbalizations than PECS training.

PECS was chosen for the child in this article, Elise, because of a number of attributes of the program and Elise's characteristics. First, Elise had previously been exposed to sign language. That is, her teachers had tried to teach her some basic manual signs, however, Elise was unable to produce the signs. Additionally, she had characteristics of autism. PECS was originally designed for individuals with autism and has a number of features that ensure ease of use for such individuals: (a) it is based on pictures or other concrete visuals, which may be easier for children with autism to comprehend than verbal or sign language; (b) the pictures used in PECS may be easier for individuals in the community to understand than manual signs or poorly articulated speech; (c) PECS does not require prerequisite skills, such as attending or sitting; (d) it requires a social approach to communicate, a deficit in ASD, while other methods of teaching communication skills may begin by teaching responding to verbal commands; and (e) requesting is the first skill taught in PECS, which may increase the motivation of children with ASD to participate, compared to systems that focus on labeling items as an initial lesson (Bondy & Frost, 1998; Miranda & Erickson, 2000).

The current case study was initially undertaken as part of a study involving three children with autism to investigate the impact of PECS on speech skills. However, when one participant, Elise, was unable to master

PECS according to the PECS protocol (Frost & Bondy, 2002), the authors decided to investigate variations to PECS to provide Elise with a method of communicating desired items. The purpose of this article is to describe variations on PECS that were implemented with Elise and to provide the reader with resources necessary to implement similar pictorial augmentative and alternative communication systems.

Method

Participant and Setting

When this case study began, Elise was 5 years, 1 month old. The most recent educational assessment was conducted when she was 4 years, 7 months, which resulted in an educational label of "significant global developmental delays." Assessment tools included the *Childhood Autism Rating Scale (CARS;* Schopler, Reichler, & Renner, 1988), on which she had scored in the "severe autism" range, and the *Gilliam Autism Rating Scale (GARS;* Gilliam, 1995), on which she received a borderline score for the likelihood of autism. The examiners noted that these scores were consistent with "significant cognitive impairment." While implementing training with Elise, the authors of this article noted several characteristics of ASD. In particular, she rarely made eye contact with the trainers and rarely initiated social interactions, preferring to play independently. In fact, her parents

had converted a large storage closet under the stairs into a play area where Elise could play undisturbed. This area contained a number of cause-and-effect toys, such as boxes with buttons and switches that played music and lit up. Occasionally, Elise did climb onto the laps of very familiar individuals such as her mother and home trainer, Corbin-Newsome. Approximately four months following the completion of this study, Elise was diagnosed with autism.

On the *Psychoeducational Profile-Revised (PEP-R*; Schopler, Reichler, Bashford, Lansing, & Marcus, 1990), Elise received a developmental score of 9 months, with subcategories of cognitive performance in the 0-8 month range and cognitive verbal in the 0-15 month range. Elise engaged in few functional activities and had few self-help skills. She was not able to perform any age-appropriate pre-academic activities, such as matching by color, stacking blocks, or coloring. For example, her home trainer had presented tasks that involved sorting two colors of blocks and stacking them by color and Elise was unable to do so. She appeared to have age-appropriate gross motor skills, though they had not been formally assessed.

On the *Developmental Assessment of Young Children (DAYC*; Voress & Maddox, 1998), Elise scored in the “severe delay” range on the general development quotient, with subscores of 8 months in communication and 4 months in social-emotional development. The authors of the current study observed that Elise had no recognizable speech, which included few vocalizations (mainly vowel sounds) and communicated primarily by crying and reaching for desired items. Though she had received some training for manual sign language, she used no recognizable signs. Corbin-Newsome, Elise’s home trainer, chose PECS as a communication sys-

tem for Elise and asked Ganz to implement the system and train Elise’s family to use it with her because it was determined that Elise needed a method of communicating that did not rely on speech, that provided concrete symbols (e.g., pictures or items versus written or spoken words), and that would require her to initiate communication with adults.

The study was conducted in her home, primarily in a small therapy room and in the kitchen. Three of the authors, Ganz, Corbin-Newsome, and Bourgeois, implemented communication training each week, for approximately 6 sessions of 10 trials each week, over the course of three months. Each session took approximately 15 to 20 minutes.

Materials

Materials used in this case study included a variety of foods and toys that Elise preferred. These included string cheese, bread, juice, milk, candy, raisins, dried cherries, cereal, bananas, pretzels, cookies, an outdoor child’s swing, a toy piano, bubbles, a light up miniature fan, shiny ribbon, a toy drum, balloons, and keys. Pictures of some of these items can be found in Figure 3. Additionally, color photos and line drawings of the items were used. The line drawings and the photos were approximately 2” x 2”. A number of vendors produce materials helpful for those implementing augmentative and assistive communication systems. A list of vendors with their websites is provided in Figure 3.

Figure 3. Where to get materials for use with pictorial AAC systems.

Vendor/Company	Web Address	Materials
Pyramid Educational Consultants (Home of the Picture Exchange Communication System)	http://www.pecs.com/	Velcro, line drawings and software to produce them, training sessions for the Picture Exchange Communication System (PECS), books, communication binders
Mayer-Johnson	http://www.mayer-johnson.com/	Software to produce line drawings (Boardmaker™), voice output communication aids (VOCAs), books, assistive technology devices
Autism Society of North Carolina bookstore	http://www.autismsociety-nc.org/html/bookstore.html	Software to produce pictures, books
do2learn	http://www.dotolearn.com/	Free line drawings that can be used in communication systems

To determine Elise's preferences, Elise's mother and her home therapist (the third author) were asked for a list of foods and toys the Elise preferred. Elise was offered a variety of these items to determine which she chose most often. That is, several items were placed on a table in front of Elise, approximately five at a time. As she took an item, a tally mark was made on a list of the items and that item was replaced on the table after it was consumed or Elise played with it for about 10 seconds (Frost & Bondy, 2002).

Measurement Methods

A trial was defined as beginning when the communicative partner began enticing Elise with a preferred item (e.g., holding a toy

within three feet and within Elise's sight, offering a bite of a preferred snack) or when Elise spontaneously took a picture out of the communication book, touched a box containing a preferred item, or picked up the box to make a request. The trial ended five seconds after Elise completed the exchange. Data were collected at every training session. Observers collected data on Elise's proficiency relative to the PECS phase criteria, as described in the *Procedures* section below. For each trial, observers recorded whether Elise performed the desired response independently (score of +) or with prompting (e.g., any verbal, gestural, physical, or corrective assistance given to facilitate the exchange). Percentages of proficiency were calculated for

each session by summing the total + scores, divided by the total number of trials in that session, and multiplying the calculated number by 100.

Procedures

Initially, the authors intended to teach Elise to use PECS following the PECS protocol as stated in the manual (Frost & Bondy, 2002). However, Elise did not make progress in Phase 1, thus the authors decided to make alterations to the typical protocol to teach Elise a method for communicating basic desires. Three of the authors, Ganz, Corbin-Newsome, and Bourgeois, served as Elise’s trainers. Elise’s training included reinforcer assessment, baseline, and four training phases: Phase 1: Basic picture exchange, Phase 1A: Touch clear box containing preferred item inside to make a request, Phase

1B: Lift clear box to make a request, Phase 3: Discrimination training (i.e., teaching the child to distinguish between two or more pictures and match them to the corresponding items). These phases are summarized in Figure 4. While the PECS protocol includes many more phases (Frost & Bondy, 2002), only modifications of Phases 1 and 3 were implemented with Elise. The authors chose to implement these phases to give Elise, at a minimum, a method of communicating desires at close proximity to an adult. Phase 2 of PECS, generalizing across distance, was not included because of the difficulty Elise had and the length of time it took to teach Elise a basic communication system. The authors prioritized discrimination training, Phase 3, to allow Elise to communicate basic desires given a few choices.

Figure 4. Phases implemented in the current case study.

Phase	Summary
Reinforcer Assessment	Elise’s mother and home therapist (the third author) provided a list of foods and toys the Elise preferred. Elise was offered a variety of these items (e.g., toys or food) to determine which she chose most often. This phase followed PECS protocol (Frost & Bondy, 2002).
1 Picture Exchange	The trainers attempted to train Elise to hand a line drawing to an adult in exchange for a desired item. A second trainer provided physical prompts from behind Elise. During this and following phases, the trainer verbally modeled the pictures Elise handed to her.
1A Touch Box	One trainer. A duplicate of each item was placed in a small, clear plastic box and placed in front of Elise. When she touched the box within 10 seconds of it being put on the table, she was given the item and the trainer verbally labeled it.
1B Pick Up Box	Phase 1B procedures were the same as Phase 1A, except a photograph of the item was attached to the box and Elise was required to pick up the box.

Phase	Summary
3M Discrimination with Boxes (modified)	Phase 3MA: two boxes: one with a preferred item and one with a non-preferred item Elise. When Elise picked up a box with a preferred item, she was given the item. Phase 3MB: two boxes containing preferred items were placed on the table. Correspondence checks and error correction procedures were conducted (Frost & Bondy, 2002).
3B Discrimination with Photographs	Same as Phase 3MB, with the boxes removed, leaving only the photographs.

Baseline was conducted for eight sessions. A trainer sat in front of Elise holding a preferred item (e.g., cereal, toy piano). A line drawing was placed on the table in front of Elise. Observers recorded whether Elise independently picked up the picture and handed it to the trainer (+) or not. If she simply reached for the item without taking the picture, it was given to her to play with for approximately 10 seconds. Food items were given a small amount at a time so they were quickly consumed. If Elise did not reach for the item before the 10-trial session was over, the trainers switched to another item and picture until one was found that Elise would reach for. Baseline was recorded for eight sessions.

Phase 1 of training followed PECS protocol (Frost & Bondy, 2002). Two trainers sat with Elise, one in front across a small table (first trainer), and one directly behind her (second trainer). The first trainer held a preferred item and a line drawing representing the item was placed on the table in front of Elise. When Elise indicated she wanted an item, usually by reaching for it, the second trainer physically prompted her to pick up the picture and hand it to the first trainer. The first trainer immediately accepted the picture, handed Elise the item, and verbally labeled

the item. During this phase, the trainers attempted to fade out prompts using backward chaining, first attempting to fade prompts from the last step of the exchange. For example, the first step to be removed was the physical prompt for Elise to let go of the picture, then the trainer attempted to fade the physical prompt for Elise to reach across the table with the picture, until all of the steps were faded. As is clear in Figure 5 below, Elise rarely made independent picture exchanges, thus prompts were not faded and this Phase was discontinued. Thirty-three sessions of Phase 1 were implemented.

Phase 1A was conducted with a single trainer and varied from PECS protocol because Elise was unable to master Phase 1 as written in the PECS manual (Frost & Bondy, 2002). In this phase, a duplicate of each item was placed in a small, clear plastic box. The actual items were added to entice Elise to reach for the boxes. The trainer sat in front of Elise across a table holding a preferred item. The plastic box was placed in front of Elise. When she touched the box within 10 seconds of it being put on the table (+), she was given the item and the trainer verbally labeled it. If she did not touch the box within 10 seconds, a

new item was offered. Seventeen sessions of Phase 1A were implemented.

Phase 1B. Once Elise demonstrated proficiency in Phase 1A, making independent requests for 80% of the trials for several consecutive sessions, Phase 1B was introduced. Phase 1B was similar to Phase 1A, except a photograph of the item was attached to the box and Elise was required to pick up the box before she received the item. Phase 1B was also similar to PECS Phase 1 as outlined in the PECS manual (Frost & Bondy, 2002), however, the box with the actual item was still included, instead of only the picture, to interest Elise in picking up the pictures. Twenty-five sessions of Phase 1B were implemented.

Phase 3M was a variation on PECS protocol (Frost & Bondy, 2002). Again, PECS protocol typically requires only a picture, while, in this experiment, the pictures remained attached to boxes containing Elise's preferred items. In Phase 3MA, Elise was taught to discriminate between a variety of photos attached to boxes and to correspond these with preferred items. Materials were prepared as in Phase 1B; however, two boxes were introduced, one with a preferred item and one with an item Elise did not like. When Elise picked up a box with an item she was known to prefer (+), she was given the item. She was not given an item if she picked up the box containing the non-preferred item. In Phase 3MB, two boxes containing preferred items were placed on the table. When she picked up a box, both items were offered to determine if she chose the same item as the one she had indicated by lifting the box. When she reached for the corresponding item (+), the trainer gave it to her. Error correction procedures are incorporated when Elise reached for the incorrect box. These procedures followed PECS protocol (Frost &

Bondy, 2002). The error correction procedure involved four steps: modeling the correct response, prompting the correct response, providing a "switch" to distract Elise (e.g., briefly covering the pictures or boxes, prompting a different response, such as clapping her hands), and repeating the presentation of desired items. Six sessions of Phase 3M were implemented.

Phase 3B followed PECS protocol (Frost & Bondy, 2002) using the photographs previously attached to the boxes. Procedures were the same as in Phase 3MB. Eight sessions of Phase 3B were implemented.

Results

Reliability

Observer agreement was calculated using a point-by-point agreement ratio, by dividing the number of agreements by the total number of agreements plus disagreements, multiplied by 100 (Kazdin, 1982). An agreement occurred when both observers independently recorded the same score on an item. Observer agreement was assessed using two independent observers on 31% of all sessions of PECS training and averaged 100% agreement.

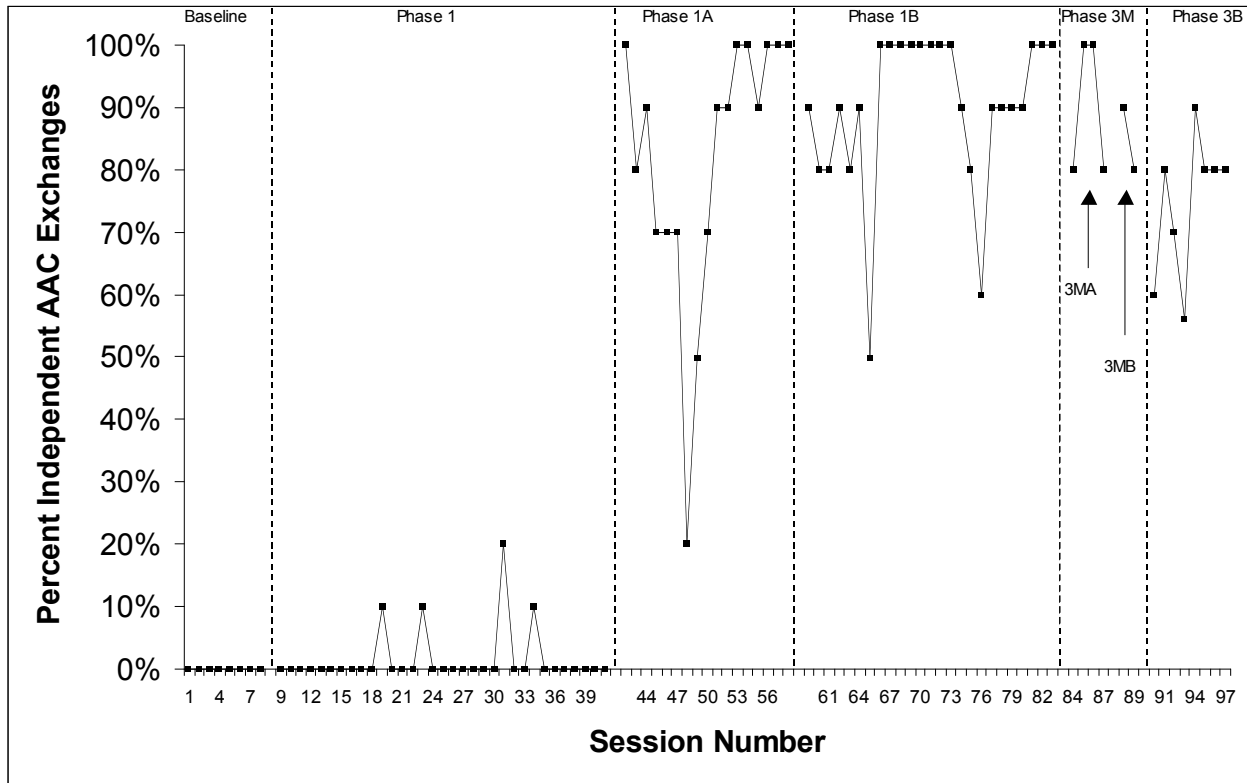
Analysis of Data

The results of this case study are illustrated in Figure 5. Following the procedures outlined in the PECS protocol (Frost & Bondy, 2002), Elise was unable to make picture exchanges independently in Phase 1. Elise performed no more than 20% of trials independently within any session. This led to the implementation of Phase 1A. Elise obtained proficiency in Phase 1A, achieving independent requests for 80% or more of the trials during the last seven consecutive sessions. Similarly, in Phase 1B Elise met the

80% criterion for the final seven consecutive sessions. Phase 3M was mastered within six sessions, all of which were about the 80% criterion. Finally, Elise mastered Phase 3B, the

last four sessions of which were at or above the 80% criterion.

Figure 5. Results of case study: Elise.



Conclusion

Designing an effective communication system for students with ASD involves using a multifaceted approach that incorporates a variety of effective-practice strategies and techniques. Related to Elise’s variable needs, it became obvious that without individualized modification, PECS alone would not provide her with an effective means for communication. In this case study, the trainers introduced additional phases that incorporated a hierarchy of visuals allowing for more authentic representation of desired reinforcement. While similar to PECS protocol, actual items

were incorporated to entice Elise to reach for and pick up the attached pictures and additional phases were added to teach Elise to exchange pictures more gradually than following typical PECS protocol (Frost & Bondy, 2002). In doing so, the authors were able to design a more effective communication system that promoted the acquisition of skills necessary to bridge the communication barrier previously experienced. Elise, like other children with ASD and developmental delays, needed a particularly concrete method of learning to use her communication system, as well as an exceptionally gradual, step-by-step process. This process began by capitalizing

on Elise's natural tendency to grab preferred items. Such a method may be appropriate for others with ASD and/or significant developmental delays. At the completion of this study, Elise was able to communicate desires when given a choice of two in a controlled training setting within her home; however, she was far from being a spontaneous, independent communicator. Future training for Elise, and for similar children, would begin by generalizing her communication skills to a variety of communicative partners (e.g., teachers, grandparents, brother), a wider variety of items and activities (e.g., swinging, favorite movies), and across a variety of settings (e.g., restaurants, school).

Authors' Notes

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