

AN EXPERIMENTAL ANALYSIS OF OPPORTUNITY AND COMMUNICATION RESPONSE
FORM IN A CHILD WITH AUTISM AND HEARING IMPAIRMENTS

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An alternating treatment design was used to systematically evaluate the communication response forms, picture exchange communication system (PECS) or sign language, selection for a child with pervasive developmental disorder-not otherwise specified, profound hearing loss, and cochlear implants. The child had a limited pool of high preference items and very few functional skills. Key factors for this child included a structured environment that created a verbal community and contingent access to high preference items. No preference in communication response form was observed. The child successfully used four response forms to communicate: gestures, PECS, sign language, and vocalization. The results are discussed in terms of decision making factors in the selection of response forms.

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INTRODUCTION

One of the central diagnostic criteria in the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (American Psychiatric Association, 1994) for autism is impairment in communication. According to the American Psychiatric Association (2000), speech deficits are common to children with autism and speech is not easily learned by children with autism. Peeters and Gillberg (1999) estimate that approximately 50% of children diagnosed with autism will remain functionally mute in adulthood.

Communication is an essential skill needed in every day living. It is how we express wants and needs, how we learn, and one of the ways we develop social skills.

Researchers have suggested that communication deficits may contribute to or cause behaviors such as aggression, self-stimulation, and self-injury in individuals with autism (e.g., Koegel & Koegel, 1995). Research also exists that suggests there is a reduction in the problem behavior of nonverbal individuals with autism who acquire appropriate ways to communicate (e.g., Carr & Durand, 1985; Day, Horner, & O'Neill, 1994; Frea, Koegel, & Koegel, 1993). Various communication response forms have been taught to children with autism, including but not limited to: sign language, electronic devices, picture communication systems, picture boards, plastic symbols, written words, and line drawings. Two alternative response forms that have been widely used to teach nonverbal children with autism to communicate are sign language (e.g., Bonvillian & Nelson, 1976; Carr, Binkoff, Kologinsky, & Eddy, 1978; Carr & Kologinsky, 1983; Salvin, Routh, Foster, & Lovejoy, 1977; Sundberg & Sundberg, 1990) and the Picture Exchange Communication System (e.g., PECS, Bondy & Frost, 2002). Sign language has been used to teach verbal behavior under control of various stimulus conditions such as,

requesting for preferred items, conversation, and describing remote events (Sundberg & Partington, 1998). PECS (Bondy & Frost, 2002) is also used to teach communication skills to children with autism. PECS involves the exchange of picture symbols to request, describe, and converse. Both options, PECS and sign, are widely used, and to some degree, are supported by scientific evidence (e.g., Carr & Dores, 1981; Charlop-Christy, Carpenter, Le, LeBlanc, & Kellet, 2002; Ganz & Simpson, 2004; Koita & Sonoyama, 2004; Kravits, Kamps, Kemmerer, & Potucek 2002; Layton & Watson, 1995; Malandraki & Okalidou, 2007; Tincani, Crozier, & Alazetta, 2006; Yoder & Layton, 1989).

The parents of the participant in the present study were attempting to decide whether to use PECS only, sign only, or both PECS and sign as communication response forms for their profoundly deaf child with cochlear implants and pervasive development disorder--not otherwise specified (PDD-NOS). Their child received services from an independent speech pathologist, a behavior analyst, an occupational therapist, public school teachers, a public school speech pathologist, and a public school autism specialist. Each of these individuals had varying opinions as to which response form or forms were best for the child. The parents did not know what to do. This is a situation that parents of other children with similar diagnoses often find themselves facing. Which communication response form is best for a specific nonverbal child with autism? There is a shortage of empirically based research that answers this question. Both sign language and PECS have been successful in teaching individuals with autism to communicate, but the decision-making process of which response form to use is often based on the individualized preferences, knowledge, and teaching skills of the child's

family, teachers, and interventionists, not necessarily on empirically based evidence (Shafer, 1993).

Scholars who have reviewed research on communication interventions for children with autism suggest that gestural and visual response forms of teaching communication to children with autism using augmentative and alternative communication systems have been successful in children with autism with extremely limited communication skills (Goldstein, 2002). Two studies were identified that specifically compared response forms. In an unpublished dissertation, Anderson (2002) compared sign language and PECS acquisition in six children between the ages of 1-year 11-month old and 4-year 11-month old with an autism spectrum disorder. Three of the participants used no speech, and the other three used less than four words. Children with fewer than ten identified preferences were excluded from the study. The study used an alternating treatment, multiple baseline probe design to research differences in rates of acquisition, maintenance, behavior of participants, spontaneous use, generalization, eye contact, vocalization, and prerequisite skills that may be related to performance in each response form training method. All sessions took place in the autism research laboratory of a university. Anderson assessed the children prior to intervention in multiple areas including: severity of autism, communication skills, daily living skills, socialization skills, and motor skills. Each participant also was administered vocal imitation, motor imitation, social/play, and joint attention assessments prior to baseline. Preferred items were determined using a paired preference assessment. Anderson measured behaviors associated with rapport: tantrumming, positive affect, self-stimulation, avoidance, aggression, and self-injury; and communication skills:

looking, object gazing, reaching, leading, pointing, seeking, vocalizing, sign language attempted, sign language correct, PECS attempted, and PECS correct. All participants mastered more items during the PECS training than in sign training. According to Anderson three of the participants preferred sign and three preferred PECS. Preference was determined by comparing the correct use and maintenance at post-treatment. Anderson found that fine and gross motor imitation skills were not predictive of the child performing better with sign language than PECS. One of the children who did not perform well in the sign language training had among the highest fine and gross motor skills.

In 2004, Tincani published a research article in which he used an alternating treatment design to determine which of two response form training methods, PECS or sign language, was the most optimal method to use to teach mands to two children with autism. The participants in this study were 5-year 10-month old and 6-year 8-month old and were able to imitate some words with prompting. All sessions were in a classroom in the participants' public school. Tincani used a paired stimulus preference assessment to determine a list of 10 to 12 preferred items per participant. He also performed a motor imitation assessment with each participant prior to baseline but did no other assessments. He measured motor imitation, mands using PECS or sign, and word vocalizations. Tincani found one child was more successful using sign language and the other student was more successful using PECS. Based on assessment data, he postulated that it may depend upon the child's level of motor imitation skills and, that in addition to the augmentative response form (sign or PECS), it was also important to

monitor and factor in the occurrence of vocalizations when making decisions regarding response form selection.

The purpose of the present study was also to compare the effectiveness of sign language and PECS training on the acquisition of requests for a profoundly deaf child with cochlear implants and pervasive development disorder--not otherwise specified (PDD-NOS). This study is a partial replication of Tincani (2004), borrowing features of Anderson (2002), and incorporating the literature on the systematic assessment of preferences (e.g., Mason, McGee, Farmer-Dougan, & Risley, 1989; Pace, Ivancic, Edwards, Iwata, & Page, 1985). The following extensions were included in the present study: a) a much younger child (3-year old as opposed to 6- and 7-year old), b) a child with profoundly impaired hearing and autism (as opposed to a single diagnosis), c) a child with fewer functional and academic skills, d) a child with a limited pool of high preference items, and e) the setting was the child's home environment (as opposed to the school).

Similar to Anderson (2002) and Tincani (2004), this study employs an alternating treatment design. This design has become an increasingly useful method of evaluating controversial and critical outcomes in autism treatments (Kay & Vyse, 2005).

Communication response forms are both controversial and critical. Systematic design of treatment procedure implementation allow interventionists to analyze and identify the most functional and parsimonious approach to help the child (Etzel & LeBlanc, 1979). Single subject research methodology allows systematic evaluation of treatment effects for a particular child (Horner, Carr, Halle, McGee, Odom, & Wolery, 2005). In autism, with the wide range of presenting symptoms in children labeled as autistic,

individualization is of the utmost importance as what works for one child with autism may not work for another child with autism (Anderson & Romanczyk, 1999).

Furthermore, this kind of research allows the intervention team to comfortably and objectively evaluate procedures to determine what treatment is in the child's best interests at any given point in time which is crucial to obtaining support from the child's parents and other stakeholders (Kay & Vyse, 2005). It was our hope to systematically analyze conditions in order to provide the family with information to increase this child's communication.

METHOD

Participants

The participant, Luke, was a 3-year, 8-month old profoundly deaf male with a diagnosis of pervasive development disorder—not otherwise specified (PDD-NOS). Luke was born ten weeks premature and had emergency bowel surgery when he was one week old. He developed sepsis and peritonitis and was administered eight different antibiotics to stop these infections, but none worked. To save his life, he was administered Gentomycin, a very powerful antibiotic. A possible side effect of Gentomycin is hearing loss, and the participant was diagnosed with profound hearing loss at 7-month old. At 15-month old, the participant received bilateral cochlear implants which allow him to hear all but a few high pitched sounds. The parents received training in how to use the cochlear implants and his private speech therapist specializes in children with cochlear implants. He sees her weekly. Luke attends public school 3½ hours each week day and sees the public school's speech therapist two times per week. In addition, the public school district provides two hours of applied behavior analysis therapy each week in his home. He also attends private occupational therapy weekly.

The school district provided sign language training 2 times per month for his parents when Luke was 2-year old, and this lasted for approximately 2 years. When the experiment started, if physically prompted, he would sign "eat" and "thank you", and nothing else. He quit signing "eat" during the first month of the experiment. His private speech therapist started teaching him to use picture communication at 3-year 4-month old. When the experiment started, he did not use picture communication at home,

although the pictures were available. He did use it occasionally at school if he was prompted. His primary method of communication at home and school was gesturing, but more often than not, he was either provided events or they were openly made available to him.

Luke's attention span was short. He engaged in activities for 10 to 30 seconds before moving on to something else. His mother spent most of her time trying to keep him engaged or following him from place to place to be sure he did not get hurt when he was awake. Toddler gates were used to restrict him to his bedroom and the family room. A chime was installed on the front door to alert them if anyone opened the door, because the participant had previously opened the door and run into the street. In short, Luke had a limited number of skills. He appeared to have no imitative skills, no conventional communication skills, no self-care skills, and no pre-academic skills.

Luke's mother also participated in the generalization assessments conducted throughout the study. She was a middle age homemaker who was actively involved in all aspects of Luke's daily life. Informed consent was obtained, and the informational letter is included in Appendix A.

Setting and Materials

All sessions were conducted in the participant's bedroom/playroom at home which was 11' by 14'. At the onset of the experiment, the participant's bedroom contained a chest of drawers, a door chest, a baby bed, a twin bed, a LEGO® table, a train table, approximately 6 open bins for toy storage, and multiple other toys on the floor around the room. The toys in the bins and on the floor consisted of approximately 60 toy sets (e.g., train set, bucket of LEGOs®, shopping cart with food items),

comprising over one thousand items (e.g., train cars, blocks, figurines, cars, balls, LEGOs®, pretend food, books). The PECS book was a 10" by 11" dark red 1" thick vinyl binder with Velcro strips on the front. (See Appendix B for picture.) The pictures used for the PECS training were pictures of the actual preferred items taken with a digital camera, downloaded, printed and laminated for use in this experiment. The pictures were approximately 2" by 2" squares. The items used were a blue fleece 50" by 60" blanket, a yellow fleece 50" by 60" blanket, a small handheld fan with lights, a small bottle of bubble solution with a wand, two small slinkies with eyeballs on the end, and a wooden ring stacker. (All items were shown to be high preference during the preference assessment described later.) The items were placed in various sizes of transparent plastic containers with opaque lids beginning in baseline 2 and continuing throughout the rest of the experiment.

Experimental Design

The study used an alternating treatments design (Barlow & Hayes, 1979) with three different baseline phases, two PECS and sign training phases with a reversal phase. The experimental phases were: Baseline 1. Open Access and Item Exchange Training; Baseline 2. Arrange Opportunities; Baseline 3. Separate High Preference Availability; Communication Training: PECS "Yellow", Sign "Blue"; Baseline 3; and Communication Training: PECS "Blue", Sign "Yellow".

General Procedures

Stimulus Preference Assessment: Sensory Preferences

This process began with the use of a preference assessment based on various sensory qualities as described in research conducted by Mason, McGee, Farmer-Dougan, and Risley, 1989. The items used in the assessment included two stimuli from each of the following categories: a) olfactory, b) gustatory, c) visual, d) tactile, e) thermal, f) vestibular, g) auditory, and h) social. These stimuli were chosen by the experimenter based upon the mother's indication of items the child liked, the experimenter's experience playing with the child, suggestions from the Mason et al. (1988) research, and ease of acquisition and presentation. The experimenter presented single item trials of five stimuli from different sensory categories. Each item was alternated randomly among other stimuli for 3 to 5 trials. If the participant failed to approach an item within 5s of its display, then the experimenter picked up the item and manipulated it to give the participant a model response. The item was then re-presented after 5s. If there was still no attempt by the participant to pick up or play with the item, the response to the item was scored neutral. The experimenter then used physical guidance with the participant to assist the participant in picking up or playing with the item. If the participant refused, threw the item down, or knocked the item away, the response was scored as avoid.

Multiple Stimulus Preference Assessment Without Replacement

The next step in the stimulus preference assessment was to take the information learned in the sensory preference assessment and find 10 to 12 stimuli to use in a multiple stimulus preference assessment without replacement (MSWO) (DeLeon &

Iwata, 1996). Twelve stimuli were selected and the MSWO was conducted using only six stimuli per trial, because the experimenter was concerned that the participant did not have the skills necessary to make meaningful choices given a large number of options.

Motor Imitation Assessment

The experimenter attempted to assess the motor imitation skills of the participant using a list of 27 hand, arm, and finger movements similar to those used in sign language (Sundberg & Partington, 1998; Tincani, 2004). The experimenter gave the vocal instruction, "Do this," while modeling the movement. During all trials, the participant either did not perform the movement or would move away from the experimenter and access other items available in his playroom.

Baseline 1. Open Access and Item Exchange Training

The experimenter and the participant played with the stimuli that had been chosen based on the sensory preference assessment, the short stimulus preference assessment and the experimenter's and mother's experience with the participant. The experimenter taught the participant to share items by saying, "your turn" and giving the item to the participant for a short time and then by saying, "My turn" and taking the item from the participant and manipulating it for a short time. The PECS book, which the participant occasionally used, was available for him to use but was not a requirement for playing with an item. During all but the first session of this phase, the experimenter spent approximately 40 minutes with the participant playing with the preferred items and other toys in his room, teaching him to share, and working on his

attending skills; and the mother spent the last 10 minutes of the session playing with the participant.

Baseline 2. Arrange Opportunities

In this phase, the participant's bedroom was rearranged so that the majority of toys were removed from the room and the remainder put in clear plastic containers with lids. This included all stimuli that were used in the experiment. The containers with the items used for the experiment were lined up in random order on the floor to the experimenter's left. The experimenter sat on the floor with the participant and told the participant to "Pick one" or "Choose one." This was the cue for the participant to pick a container. The participant was required to touch, bring, or point to a container to obtain the item in the container. The mother was given these same instructions to use during her 10 minute session with the participant. When the participant touched, brought, or pointed to the container, the experimenter removed the lid from the container, gave the participant access to the item for 10 to 30 seconds. Depending upon the item, the experimenter may have required the participant to take turns (e.g., manipulating blanket, stacking rings, and holding fan).

Baseline 3. Separate High Preference Availability

The stimulus selected with the most frequency was a blue fleece blanket. A yellow blanket of similar material and size was purchased and added in baseline 3 to facilitate an alternating treatment analysis of response form. During this phase the experimenter used the blue blanket during the first 5 minutes of each 10 minute session and the yellow blanket during the second 5 minutes and alternated in this manner until the entire 40 minute session was completed. During the mother's 10

minute session, the mother used the blue blanket during the first 5 minutes of the 10 minute session and the yellow blanket during the second 5 minutes. After 4 sessions in this phase, a new PECS book was added and the PECS book used at school and home was removed. A picture of the new PECS book is in Appendix B. To facilitate PECS training, the new PECS book only had pictures of items used during the sessions. All other procedures remained the same as in the previous phase.

Communication Training Procedures

PECS training. The PECS book was placed on the floor in the middle of the plastic containers. The experimenter said, "Pick one." During the first session, if the participant picked the container with the yellow/blue blanket, the experimenter held up the PECS book with only the picture of the yellow/blue blanket on the front of the book. The experimenter modeled taking the picture off of the book, said, "yellow/blue blanket," and opened the container with the item for the participant. In subsequent sessions, Luke was prompted to touch the picture, pull the picture off of the book, and then hand the picture to the experimenter. As soon as Luke pulled the picture off of the book, the experimenter opened her hand to receive the picture. The experimenter said, "yellow/blue blanket" and opened the container. In the final training session, the pictures of all of the items located on the floor were placed on the front of the PECS book and placed on the floor in the middle of the containers. The procedures were the same as those in the previous sessions. A copy of the PECS Checklist for procedural integrity training is in Appendix C.

Sign training. During the first training session, the experimenter sat on the floor opposite the participant and said, "Pick one." The experimenter made the sign for

whichever blanket Luke chose, said the name of the item, opened the container, and gave the item to the participant.

In the next session, the same procedure was followed except the participant was required to make the sign for the blanket or an approximation of the sign before access to the blanket was given. The experimenter would physically guide the participant to make the correct sign if the participant did an approximation and the participant would receive access to the blanket. If he picked the container with bubbles or any other item, no sign was required. Appendix D contains a copy of the Sign Checklist for procedural integrity training.

Communication Training: PECS "Yellow", Sign "Blue"

In this phase, PECS and sign training was begun for one stimulus. The yellow blanket was used for PECS training and the blue blanket was used for sign training. A picture of the yellow blanket used in the PECS training is in Appendix B. The new PECS book was available for both PECS and sign training sessions, but the pictures of the blue blanket and yellow blanket were removed or added from/to the front of the book depending upon what was being trained. The sign used for the blue blanket was the American Sign Language sign for "sky", because it was easy for the participant to do and because it was not similar to any other sign that was being taught at school or home. The sky sign is made by making an arc with the right hand and arm starting at mid-chest and ending at the top of the right shoulder, the right hand is open. (See Appendix C for a picture of "sky".) In this phase, the first 5 minutes of each 10 minute session was the blue blanket and sign training was taught. In the second 5 minutes of the 10 minute session the yellow blanket was used and PECS was taught. The mother's

generalization assessment session used the same availability protocol, but no training occurred.

Baseline 3

In this phase, the participant was only required to gesture (touch, point, or bring) to the container to obtain the yellow blanket or to use sign language to obtain the blue blanket. The procedures were the same as in "Baseline 3. Separate High Preference Availability." This phase lasted for four sessions.

Communication Training: PECS "Blue", Sign "Yellow"

The procedures in this phase required PECS for the blue blanket and sign for the yellow blanket. The sign used for the yellow blanket was the American Sign Language sign for "sun". This sign is made by opening the right hand and forming a "C" with the thumb and index finger, the other fingers of the right hand are side by side with the index finger and help to form the "C". (See Appendix C for a picture of the sign "sun". See Appendix B for a picture of the blue blanket used in the PECS book.) PECS training for the blue blanket was identical to that used for the yellow blanket. All other procedures were the same as in the PECS and sign training phase.

Dependent Variables and Data Collection

The first 10 minutes of each session with the experimenter was videotaped and scored by the experimenter. The 10 minutes with the mother at the end of each session was also videotaped and scored by the experimenter. Frequency of responses was used to measure all dependent variables.

Several different responses were measured. The entire observation code and data sheets are in Appendix D and brief descriptions of all measures are in Table 1.

Communicative gestures which consisted of all non-vocal gestures (touches, points, signs, brings, and picture exchange) directed to an item were measured. Vocalization approximations and correct production of a word(s) emitted by the child were also measured. The PECS communication measures were: PECS corrects, PECS approximates, PECS prompted, and PECS unprompted. The sign language measures were: sign corrects, sign approximates, sign prompted, and sign unprompted. The other measures were related to rapport: approach to the teacher/mother by the child and protests by the child.

Interobserver Agreement

The primary observer was the experimenter and the secondary observer was a graduate student. Prior to the beginning of the interobserver agreement checks, the experimenter reviewed the dependent variable definitions with the secondary observer. In addition, the experimenter and secondary observer reviewed several of the videotapes and the secondary observer asked questions about the definitions. The secondary observer picked 30% of the sessions in each phase and scored the videotape. Total agreement was used to calculate interobserver agreement and the mean interobserver agreement for all phases was 92.48% (range 0.00% to 100%). Table 2 shows interobserver agreement by phase.

RESULTS

Stimulus Preference Assessment: Sensory Preferences

In this assessment, Luke demonstrated his preferences by either pushing away the item, leaving the item, or by manipulating the item. He pushed away olfactory items. He ate and drank the gustatory items, but the mother requested that no food or drink be used as reinforcers for the experiment. He played with items with lights, but showed a clear preference for items with intermittent rather than continuous shining lights. He chose a satin material over a burlap material to manipulate. He preferred cold over heat and preferred music that was not loud.

Multiple Stimulus Preference Assessment Without Replacement

Based on his sensory preferences from the previous phase, 12 toys and other items were selected by the experimenter to use in this assessment. Again, at the request of the mother, no food or drink was used. His identified preferences during assessment were for a fleece blanket, bubbles, spinning lights, slinky, and stacking rings or blocks.

Motor Imitation Assessment

Luke would not imitate any of the hand, arm, or finger movements modeled by the experimenter.

Analysis of Response Forms and Stimuli

In Figure 1, there are three graphs representing: 1) total communicative gestures with the experimenter by phase, 2) responses to two stimuli (yellow and blue blanket) by phase, and 3) responses by PECS, sign, or vocals in each phase. The abscissa in all graphs shows the order in which the sessions were conducted, and the

ordinate is the number of responses per session. The trend of total communicative gestures over all phases was upward. There was a brief decline in baseline 2 when the items were placed in containers and were harder to access.

The second graph shows Luke did not play with the blue blanket in baseline 1 when he had open access to any toys in his room, but in baseline 2 when his room was arranged with limited access to toys, he chose the blue blanket. (The yellow blanket was not available until baseline 3.) During the rest of the phases, he chose the yellow blanket more often than the blue blanket.

In the third graph, Luke used PECS more than sign language or vocals to communicate. However, the graph shows that Luke uses the form of communication the most that is required for him to obtain the yellow blanket. In the first communication phase, PECS was required to obtain the yellow blanket and in the second communication phase, sign language was required to obtain the yellow blanket. The vocals in the second communication were approximations of the word "yellow".

Analysis of Responses to Stimuli

The graphs in Figure 2 represent the number of different stimuli requested in each phase, the number of communicative gestures for the blue blanket, and the number of communicative gestures for the yellow blanket. Generally the number of different items requested during the phases remained the same.

Luke's communicative gestures for the blue blanket were generally stable throughout all phases. The graph for communicative gestures for the yellow blanket shows a slight upward trend during the last phase. Overall, a comparison of the graphs

for the blue and yellow blanket show more communicative gestures for the yellow blanket.

Analysis of Prompted, Unprompted, Approximations, and Corrects

The top graph in Figure 3 shows prompted and unprompted PECS and sign responses by phase. The bottom graph shows approximations and correct PECS and sign responses by phase. The top graph shows that Luke never made unprompted signs but did perform PECS unprompted. He only made signs when he was prompted by the experimenter. The bottom graph shows that Luke made PECS correct more often than sign.

Analysis of Rapport Indicators

The graph in Figure 4 shows the approaches and protests of the participant with the experimenter during sessions. Approaches to the experimenter increased during the experiment even though more and more demands were placed upon the child to access the preferred items. Protests increased in baseline 3 and then decreased in the first phase of communication training and declined slightly overall. Protests in the early phases of the experiment were much more aggressive than those in later phases. Initially the child would scream, bite, scratch, and/or pinch when he was upset, but aggression decreased and his protests consisted of making disgruntled sounds, putting his shirt in his mouth, and occasionally flapping his arms.

Figure 5 Analysis of Responses in the Presence of Mother

In Figure 5, the three graphs show the participant's interaction with his mother during the experiment. The top graph shows the total communicative gestures with his mother over all phases. The second graph shows the responses of the participant by

objects over phases, and the third graph shows the mother's rapport with the participant during the experiment via measures of approaches and protests. Overall, in the top graph the total communicative gestures with his mother remained stable during all phases. The second graph shows that the responses for the blue blanket and yellow blanket remained stable over all phases and there was not a distinct preference for one blanket over the other.

The bottom graph shows that the approaches of the participant to the mother increased slightly over the phases and the protests remained fairly stable. During the experiment the only instruction the mother was given was before baseline 2 began, and those instructions were to give Luke access to the items in the container only when he touched, pointed, or brought the container to her. She was never instructed to use PECS or sign language with the child during any of the phases. However, she did not stick to the protocol in all sessions. She often would require the child to sign "open" to open the container and give the item to the child. She would also require the child to sign "finish" to indicate he was finished playing with the item. During the later phases when the mother realized the experimenter was using PECS and/or sign with the child, the mother began to sign "sky blanket" or "sun blanket" and require the child to model it to obtain the item. She also signed the names of some of the other items but did not require the child to model the signs to obtain the items. At times, she would entice Luke to come play with an item by taking the lid off of the container and allowing him to play with it without following the protocol.

DISCUSSION

This study demonstrated that for this specific participant a structured environment that created opportunities to communicate and contingent access to a high preference item were the key factors to success rather than the superiority of a particular response form. Essentially, during the initial baseline, there was no reason for Luke to communicate when he could readily access items. If he was required to communicate to get access to an item, he would find something else in his room that did not require communication. When access required a communicative act; however, he communicated. This study also clearly demonstrates that a reinforcer is essential when teaching a child to request. Luke was able to communicate using any response form, PECS, sign, and/or vocals, to obtain the yellow blanket, the high preference item. It was also important that the requirements for obtaining the item remain supportive (utilizing shaping and prompt fading) and consistent (initiations and attempts were always reinforced); so that he would not become frustrated and retreat. This may have been one of the reasons that the rapport indicators (increases in approach, low protests) were favorable during training.

In the present study and Anderson's (2002) study, the participants were of similar ages and either had no speech or spoke few words. Participants in both studies were diagnosed on the autism spectrum. Both studies conducted preference assessments, motor imitation assessments, and used an alternating treatment design. Anderson did measure some rapport indicators similar to the present study and also measured PECS, sign and vocalizing.

There are several differences between the two studies. All of Anderson's participants had no hearing loss and were required to have at least ten preference items (food and objects) to participate in the study. In the present study, the participant had profound hearing loss and a much more limited pool of high preference items (only six objects; food and drink were not used at the parents' request.). Anderson also did initial assessments of the severity of autism, communication skills, daily living skills, socialization skills, and motor skills. Then immediately prior to baseline, she assessed vocal imitation skills, play/social skills, and joint attention skills. The experimental design in Anderson included a multiple baseline probe design, and there was also a post-treatment assessment period in Anderson, neither of which is in the present study. All of Anderson's sessions took place in an autism research laboratory and not in the participants' homes. The baseline in the Anderson study was 2 to 10 weeks long. Sign training in the Anderson study used a protocol similar to PECS training instead of the protocol designed by Sundberg and Partington (1998) utilized by Tincani (2004).

Tincani (2004) was similar to the present study in several ways. Both studies used preference assessments, motor imitation assessments, and an alternating treatment design. The present study and Tincani used the Sundberg and Partington (1998) protocol for training sign language and the Bondy and Frost (2002) protocol for training PECS. Both studies measured PECS, sign, and vocalizations.

One of the differences between the present study and Tincani's (2004) study is that Luke was younger than either participant in the Tincani study. Luke also had a profound hearing impairment which the other participants did not have. In addition, his

skill levels were much lower than the participants in the Tincani study. The pool of reinforcers for Luke was also much smaller and all sessions were conducted in his bedroom/playroom at home. Luke never performed a sign with the physical dexterity of a fluent signer. This may be a function of his limited motor imitation skills. The present study included measures of rapport, such as approach and protest, but no data on these measures were presented in Tincani.

A further procedural extension in the present study was the use of a sensory preference assessment. Although caregivers, teachers, and therapists often think they know what items a participant likes; research by Mason et al. (1989) showed this to be inaccurate or lacking certain items that appealed to the participant's sensory preferences. The sensory preference assessment can assist the caregiver, teacher, therapist, or researcher in finding high preference items that might have never been considered (Mason et al., 1989). For example, warming preferred items in a microwave or chilling the same items in a freezer may make an item become even more preferred by the individual.

Additionally, the present study used environmental arrangements and reinforcer opportunity arrangements. Environmental arrangements are a critical aspect of promoting communication (Bates, 1976; Hart, 1985; Haring, Neetz, Lovinger, Peck, & Semmel, 1987, Kaiser, 2000). Children learn the importance of language when they learn what it can do. They learn this in an environment that requires them to communicate. When these opportunities to communicate are arranged in the environment, there also needs to be a teacher/parent present that knows how to respond to their communication effort by using shaping and prompt fading and by

being consistent in reinforcing any communication attempts (Kaiser, 2000). If the child always has access to everything that he/she needs or wants, then the child never needs to learn to communicate. In addition, if the child is never certain what the requirements are for communicating to obtain an item he/she needs or wants, the child becomes frustrated and may eventually quit attempting to communicate. Depending upon where training sessions are held, environmental arrangements and opportunity arrangements may or may not be needed. In this study, an environment requiring communication from the child was accomplished by rearranging the bedroom/playroom of excess toys and other items, putting the remaining toys and high preference items in containers, using shaping and prompt fading to assist the child, and consistently rewarding the child's attempts to communicate. Many of the skills that an individual with autism needs to learn are difficult for them and high preference items are needed to reinforce occurrence of these difficult responses; so it is not only important that the reinforcers be high preference but it is also important that there be limited access to them (Hart & Rogers-Warren, 1978; Kaiser, 2000). However, it is also hard to find reinforcers for many children with autism spectrum disorders (Dunlap & Koegel, 1980; Dunlap & Egel, 1982; Delmolino & Harris, 2004). In some cases the child is willing to respond for one or two items, but other children appear not to have items that consistently function as reinforcers. Reinforcers can be found for any child, but for some children it can be a long and laborious process to identify these items. Therefore, when a high preference item is identified it is important that the effects of open and limited access be evaluated. This was accomplished in the present study by placing the

items in containers and only making them available upon display of required responses as was done during the sessions of this study.

The last procedural difference in the present study was the addition of generalization sessions with the participant's mother. Luke appeared to enjoy this one-on-one time with his mother and it helped the research team to evaluate whether or not the response forms were generalizing to Luke's caregiver. Luke did use unprompted PECS several times in several different sessions, and he did initiate approximates of the signs for the blankets to some degree so he was using skills taught in the experimenter's sessions to communicate with his mother. His mother, however, although trained to use the procedures by other interventionists prior to this study, did not receive training by the experimenter during the course of this study.

Although the present study replicates and extends Anderson (2002) and Tincani (2004) and provides us with a clearer picture of variables influencing communication and response forms, there are several qualifiers when considering the results. The findings here would need to be replicated with children with similar characteristics. It could be that other participant skills and characteristics would produce results similar to Anderson or Tincani. Second, there were a limited number of communication opportunities. Sundberg and Partington (1998) recommend thousands of training trials and Bondy and Frost (2002) recommend at least 30 to 40 trials per day, neither of which was done in this study. Luke's acquisition of PECS and sign language might have been better if the number of communication opportunities had been at the suggested levels. Third, there was no second trainer to sit behind Luke and make physical prompts during sign language training. The experimenter did block Luke's inaccurate

approximations of sign and physically prompt him to make the correct sign, but it might have been more optimal to do this from behind the participant rather than from in front of the participant. Future research should try to identify more precisely the skills needed by the individual to learn PECS and sign language, determine the optimal number of communication opportunities needed for each teaching method, and compare the efficiency of training sign language using one versus two trainers. Finally, more research should be performed to determine if either PECS or sign language help a particular individual to develop vocal communications. In this study, with this child, it appeared that the vocalizations were more influenced by the high preference item than by PECS or sign language, but that is not definitive. The ultimate communication response form in our society is vocal, and it is important to know everything we can about the variables that influence the acquisition of vocalization in individuals with autism.

A question may arise as to whether this type of comparison was useful and whether or not an alternating treatment design was helpful in this analysis. Why was a scientific study necessary if the answer was that neither communication response form was superior to the other with this particular child? As was the case with this child, decisions regarding response form are “emotionally charged.” Advocates and proponents of various forms are adamant, and parents and teachers are often confused. It has been suggested that for a particular form to be successfully used, the child may need to have certain prerequisites, the trainer needs to have certain competencies, certain procedures need to be used in the training, high preference reinforcers are needed, and the environment needs to be arranged for communication opportunities.

However, the more empirical evidence we have, both demonstrations and comparisons, the more we are able to tease out what variables are critical for parents and practitioners to consider.

In conclusion, the present study like Anderson (2002) and Tincani (2004) suggests that alternating treatment designs are a practical, efficient, objective, and parsimonious method to use to identify critical variables and to decide favorable treatment options. The present study conducted a systematic analysis using a single subject design to evaluate the approaches to communication training for this particular child at this particular time. The parents now have a scientific validation of approaches that work for Luke and can present this information to other professionals interested in helping Luke. This is a general approach that can be implemented by practitioners and used to determine the favorable treatment approaches for their clients.

Table 1

Definitions of Dependent Variable

Dependent Variable	Definition
Approach	Anytime the child moves toward the teacher/mother within 1 foot proximity.
Protest	Spoken sounds or non-vocal communication (pictures/gestures/sign) directed to another indicating break, displeasure, or discomfort, puts shirt in mouth and screams or makes grunting sound, stops activity, which begin onset of protest. Offset of protest occurs when 4s have passed with none of the protest behaviors except when the child is holding his breath between cries or engaging in inaudible screaming.
Communicative Gesture	Non-vocal gestures (touches, brings, points, signs, picture exchange, prompt to touch) directed to an item.
Vocalization	Sounds emitted by child that is word approximations or actual word. ONSET occurs when first sound is produced; OFFSET occurs when 1 second pauses following emission of last sound.
PECS Corrects	Child removes picture of item from front of PECS book and puts it in hand of the teacher/parent with no assistance.
PECS Approximations	Child performs one or more parts of removing the picture of the item from the front of the PECS book and handing it to the teacher/parent.
PECS Prompted	Teacher/mother assists the child in identifying, removing, or placing the picture in the teacher/mother's hand.
PECS Unprompted	Teacher/mother gives the child no assistance in identifying, removing, and placing the picture in the hand of the mother/teacher.
Sign Corrects	Child physically uses their fingers, hand, and/or arm to make the sign for the item with no assistance.
Sign Approximations	Child performs any physical movement of fingers, hand, or arm when sign is required to obtain item.
Sign Prompted	Teacher/mother assist the child in the physical movement of fingers, hand, and/or arm to make the sign required or teacher/mother make the correct sign before the child makes the sign.
Sign Unprompted	Teacher/mother provides no assistance to the child to physically move his fingers, hand, and/or arm to make the sign required and the teacher/mother do not make the correct sign before the child makes the sign.

Table 2

Interobserver Agreement by Phase

Dependent Variable	Baseline 1 Open Access	Baseline 2 Arrange Opportunities	Baseline 3 Separate High Preference Availability (Yellow and Blue Blankets)	Communication Training: PECS "Yellow" Sign "Blue"	Baseline 3	Communication Training: PECS "Blue" Sign "Yellow"
Approach	66.67%	66.67%	87.50%	80.00%	92.86%	73.68%
Protest	33.33	33.33	100.00	95.00	88.80	100.00
Communicative Gesture	0.00	85.71	85.71	94.29	86.67	100.00
Vocalization Approx. /Corrects	100.00	100.00	100.00	66.67	100.00	80.00
PECS Approx. Prompted	100.00	100.00	100.00	100.00	100.00	100.00
PECS Approx. Unprompted	100.00	100.00	100.00	100.00	100.00	100.00
PECS Corrects Prompted	100.00	100.00	100.00	100.00	100.00	100.00
PECS Corrects Unprompted	100.00	100.00	100.00	100.00	100.00	66.67
Sign Approx. Prompted	100.00	100.00	100.00	100.00	100.00	75.00
Sign Approx. Unprompted	100.00	100.00	100.00	100.00	100.00	100.00
Sign Corrects Prompted	100.00	100.00	100.00	100.00	100.00	100.00
Sign Corrects Unprompted	100.00	100.00	100.00	100.00	100.00	100.00

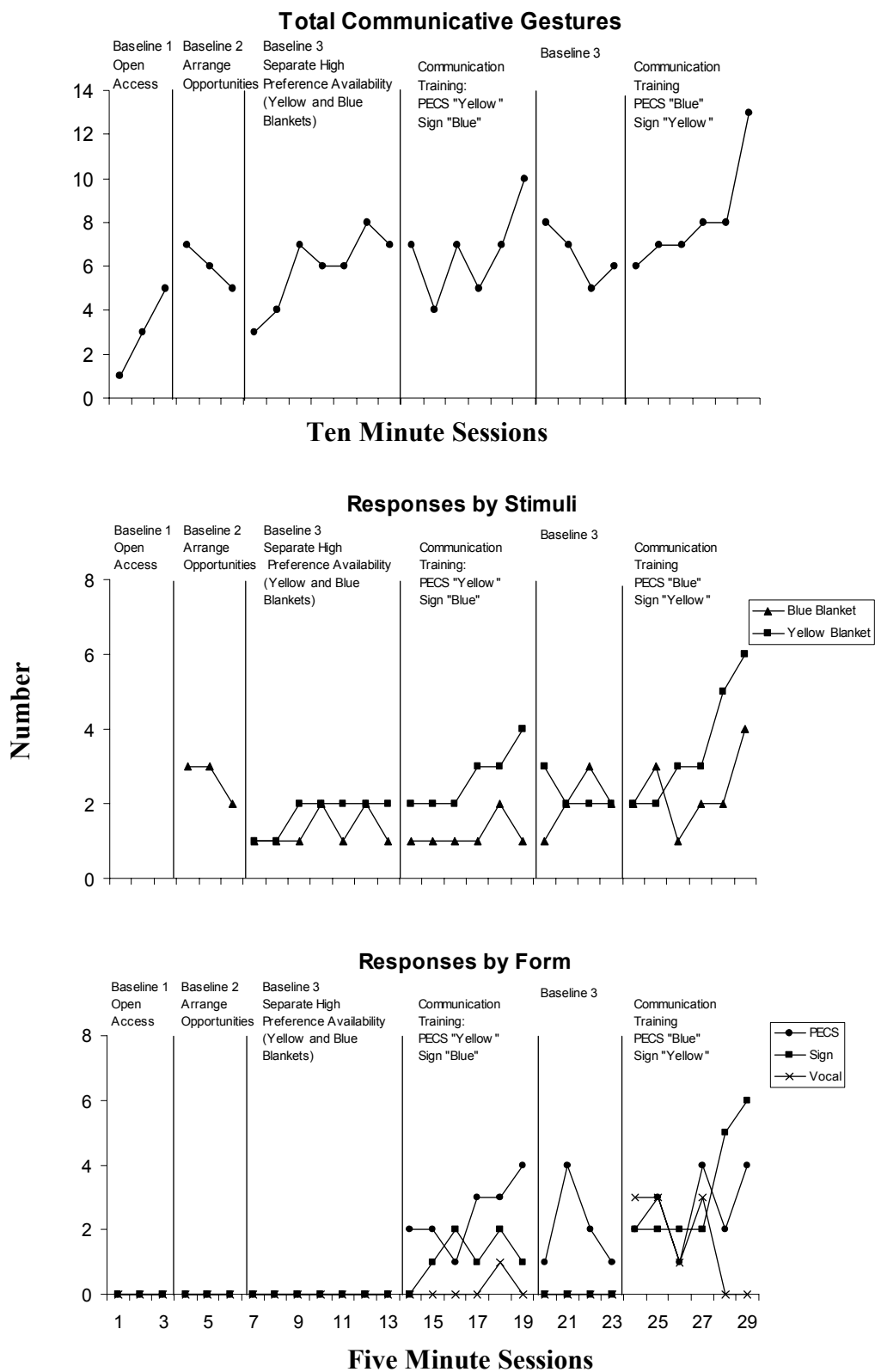


Figure 1. Analysis of response forms and stimuli.

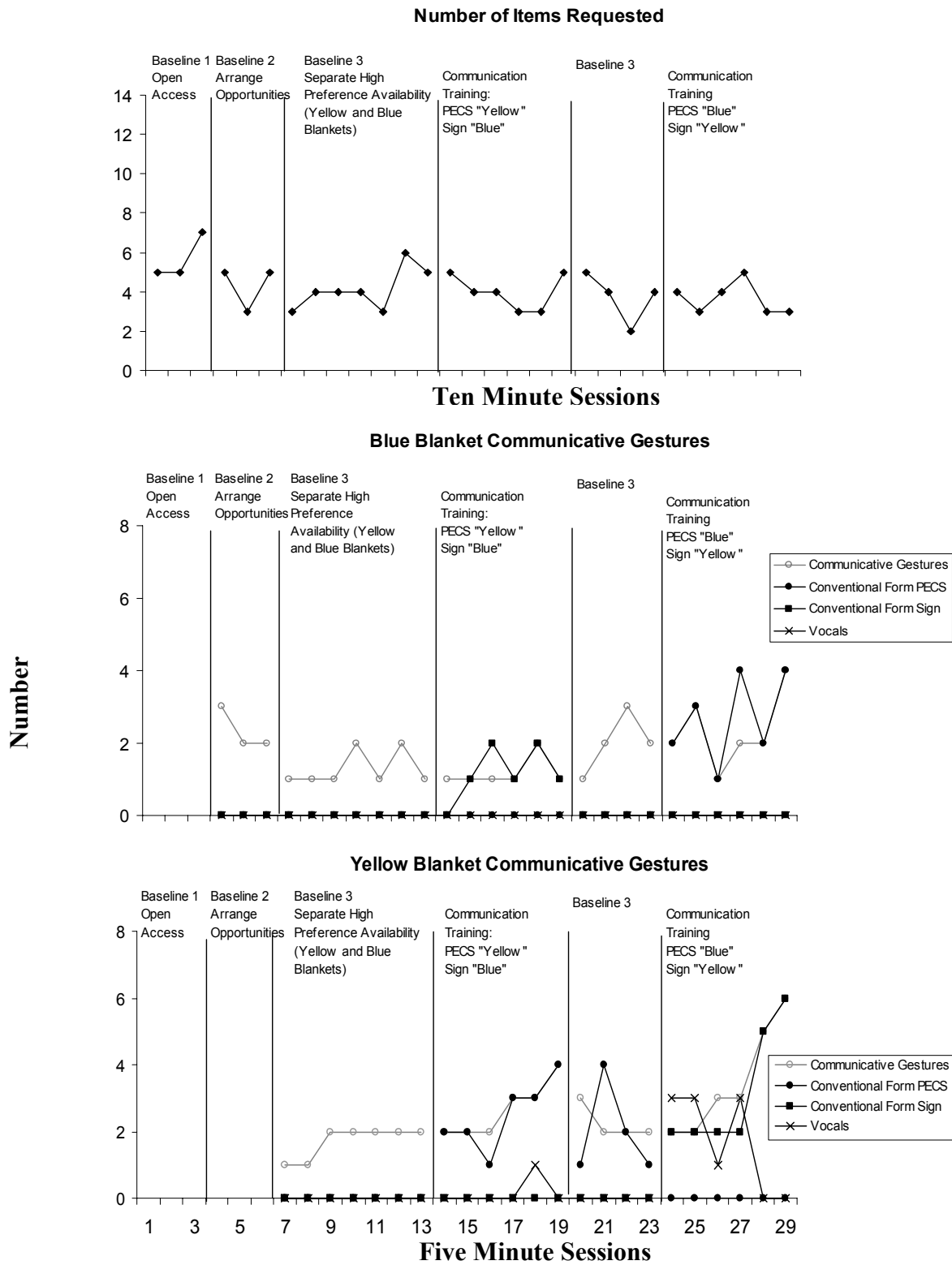


Figure 2. Analysis of responses to stimuli.

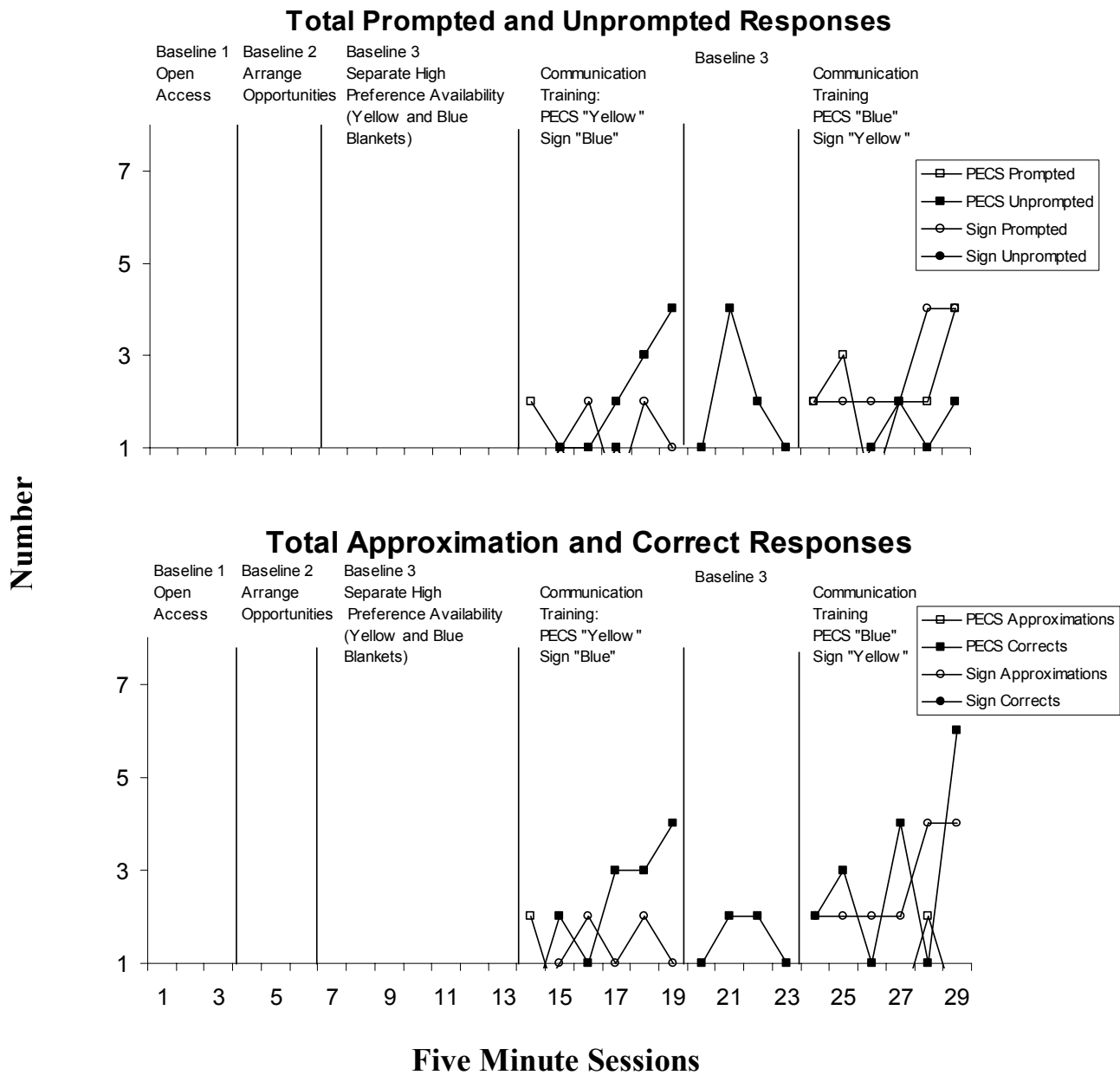


Figure 3. Analysis of prompted, unprompted, approximations, and corrects.

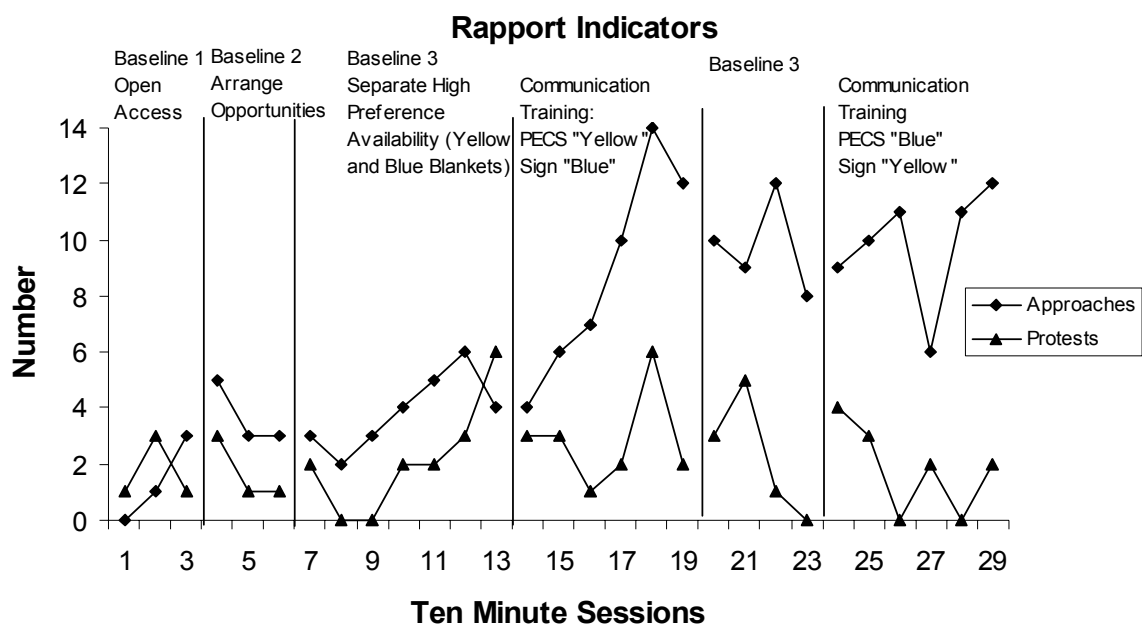
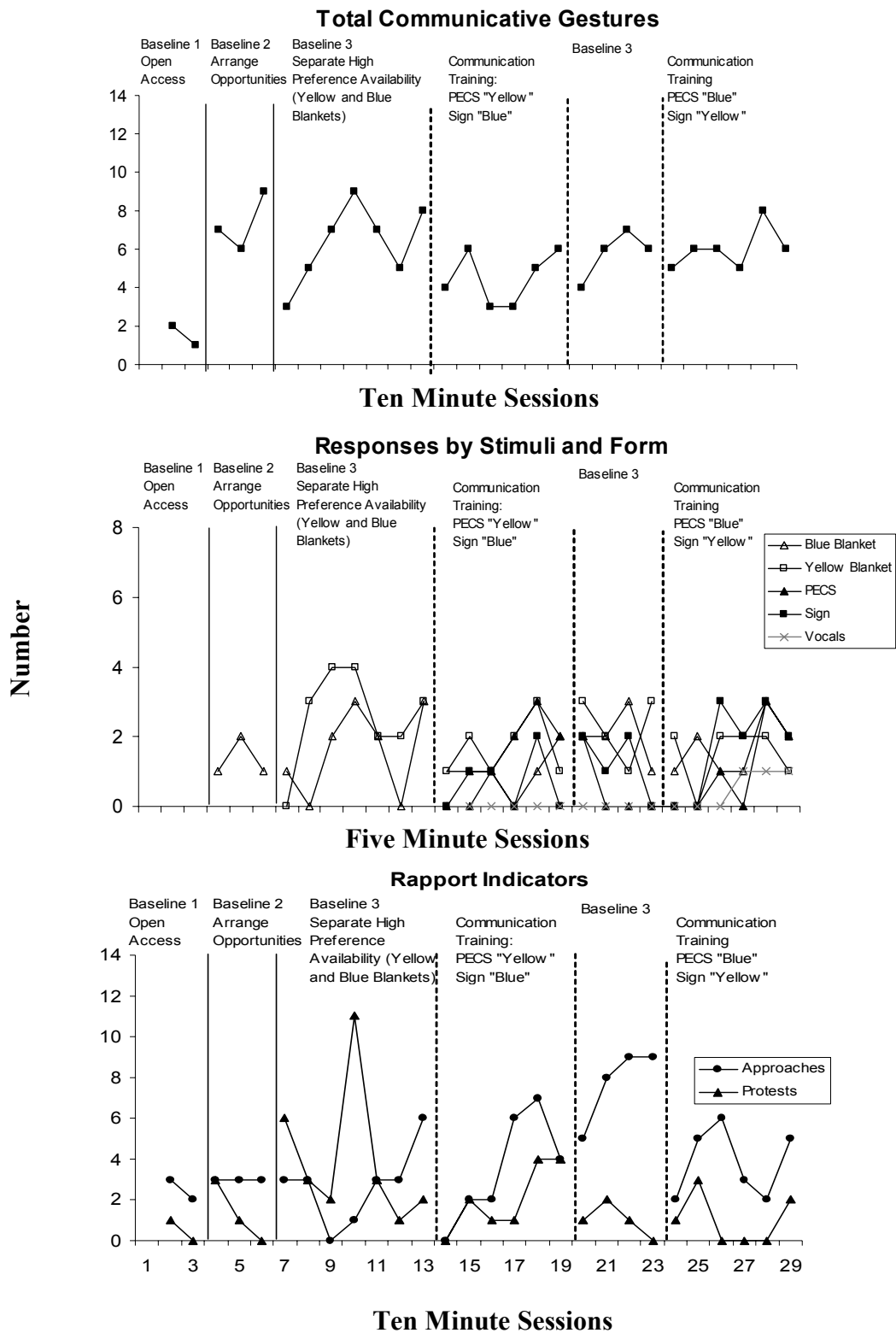


Figure 4. Analysis of rapport indicators.



APPENDIX A
INFORMED CONSENT LETTER

University of North Texas Institutional Review Board

Informed Consent Form

Before agreeing to your child's participation in this research study, it is important that you read and understand the following explanation of the purpose and benefits of the study and how it will be conducted.

Title of Study: A Method for the Empirical Validation of Treatment Options

Principal Investigator: Donna Dempsey, a graduate student in the University of North Texas (UNT) Department of Behavior Analysis.

Purpose of the Study:

You are being asked to allow your child to participate in a research study which involves an attempt to develop a procedure that can be used to assess the effectiveness and desirability of different applied behavior analysis methods in teaching a specific child with autism or autism spectrum disorders.

Study Procedures:

First, with your consent, I will review and take into consideration all assessments of the child and all Individualized Education Plans developed for your child by their public school (if applicable). Based on this information and information from you, one target goal for your child will be selected to help us evaluate procedures. I will review the treatment options in experimental and clinical published literature. Then I will review the options with you. We will determine methods to evaluate what is the most appropriate treatment for your child. As the parent, you have final approval for any treatment. Finally, I will develop and implement a procedure.

For example, your child may need to learn to identify objects, draw, write, match pictures, follow directions, describe events, etc. We will select a meaningful skill that will allow us to assess how your child learns best. Depending on the difficulty and complexity, this will take 2 to 6 hours per week of your child's time for 10 to 30 weeks.

Foreseeable Risks:

In the event that your child becomes upset, frustrated, or exhibits any other similar behavior, the session will stop immediately. You will be immediately notified. The faculty advisor will be consulted and the procedures will be modified.

Benefits to the Subjects or Others:

The goal of the procedure is to identify the most appropriate treatment for your child for one specific target goal and also to develop a method that can be used in the future to identify the most appropriate treatment for your child for other specific target goals. This study will may also benefit applied behavior analysis by extending research in the area of developing a procedure to assess effectiveness of different teaching methods.

Procedures for Maintaining Confidentiality of Research Records:

The signed consent forms will be kept in a locked file cabinet in the office of Dr. Shahla Ala'i Rosales. Your child will be assigned a pseudonym for research purposes. All research records will use the pseudonym to refer to your child. Any publication of the results of this research will use the pseudonym to refer to your child. Research records will be kept in a file cabinet in Dr. Ala'i Rosales' office. There will be times when the principal investigator has the data and other information in her possession so that she may record, analyze, graph, and compose her thesis. During those times the data will be kept in a locked desk at her home. All data and information kept on a computer will be password protected.

Questions about the Study:

If you have any questions about the study, you may contact Donna Dempsey, or the faculty advisor, Dr. Shahla Ala'i Rosales, UNT Department of Behavior Analysis.

Review for the Protection of Participants:

This research study has been reviewed and approved by the UNT Institutional Review Board (IRB). The UNT IRB can be contacted with any questions regarding the rights of research subjects.

Research Participants' Rights:

Your signature below indicates that you have read or have had read to you all of the above and that you confirm all of the following:

- Donna Dempsey and Dr. Shahla Ala'i Rosales have explained the study to you and answered all of your questions. You have been told the possible benefits and the potential risks and/or discomforts of the study.
- You understand that you do not have to allow your child to take part in this study, and your refusal to allow your child to participate or your decision to withdraw him/her from the study will involve no penalty or loss of rights or benefits. The study personnel may choose to stop your child's participation at any time.
- You understand why the study is being conducted and how it will be performed.

- You understand your rights as the parent/guardian of a research participant and you voluntarily consent to your child's participation in this study.
- You have been told you will receive a copy of this form.

Printed Name of Parent or Guardian

Signature of Parent or Guardian

Date

For the Principal Investigator or Designee:

I certify that I have reviewed the contents of this form with the parent or guardian signing above. I have explained the possible benefits and the potential risks and/or discomforts of the study. It is my opinion that the parent or guardian understood the explanation.

Signature of Principal Investigator or Designee

Date

APPENDIX B
PICTURE OF PECS BOOK

Picture of PECS Book



APPENDIX C

PROCEDURAL INTEGRITY CHECKLIST FOR PECS

Date_____

Observer_____

Donna

Mom

PECS Checklist

1. Environment is arranged correctly with therapist sitting in front of child, containers with items lined up along the side of therapist/Mom, and PECS book in the middle of the containers?	Y	N	NA
2. Therapist/Mom waits for child to pull the picture of the item off of the PECS book and bring it to her.	Y	N	NA
3. Therapist/Mom opens her hand as the child reaches with picture.	Y	N	NA
4. Therapist/Mom holds up picture symbol and says the name of the item.	Y	N	NA
5. Therapist/Mom gives immediate access to the item.	Y	N	NA

APPENDIX D

PROCEDURAL INTEGRITY CHECKLIST FOR SIGN

Date_____

Observer_____

Donna

Mom

Sign Checklist

1. Environment is arranged correctly with therapist/Mom sitting in front of child, containers with items lined up along the side of therapist, and PECS book in between the containers?	Y	N	NA
2. Therapist/Mom waits for child to touch container or bring container to her.	Y	N	NA
3. If child does not sign the name of the item, therapist/Mom signs the iconic name of the item (physical model) and provides a vocal model.	Y	N	NA
4. If child does not correctly sign the iconic name of the item with physical and vocal models, therapist/Mom physically prompts the child to sign the iconic name.	Y	N	NA
5. Therapist/Mom gives immediate access to the item.	Y	N	NA

APPENDIX E
SIGNS FOR "SKY" AND "SUN"

American Sign Language Sign for "Sun"



American Sign Language Sign for "Sky"



APPENDIX F

OBSERVATION CODE AND DATA SHEETS

OBSERVATION CODE

Approach

Anytime the child moves toward the teacher/mother within 1 foot proximity.

Examples include but are not limited to: Moving toward the teacher within 1 foot proximity and touching box that hold a toy or touching a toy not in a box, child is already in 3 foot proximity to parent and then moves within 1 foot to touch box holding a toy or to touch a toy.

Non-examples include but are not limited to: child moving toward the teacher within 3 feet proximity and passing teacher to go to the window; child passes by the parent on his way to run out the door.

Protest

Spoken sounds or non-vocal communication (pictures/gestures/sign) directed to another indicating break, displeasure, or discomfort, puts shirt in mouth and screams or makes grunting sound, stops activity, which begins onset of protest. Offset of protest occurs when 4s have passed with none of the protest behaviors except when the child is holding his breath between cries or engaging in inaudible screaming.

Examples include but are not limited to: screaming, pinching, crying, pushing or slapping toys away; arching back and lying on floor, grabbing mom's arms and squeezing them, putting t-shirt in mouth and making grunting or screaming noise, or when he puts toys back in container within 5s of receiving it, indicating that he does not want to play with it.

Non-examples include but are not limited to: Child falls and cries, child hits his head and cries.

Communicative Gesture

Non-vocal gestures (touches, brings, points, signs, picture, prompt to touch) directed to an item.

Examples include but are not limited to: child touches container, brings container to teacher, points at container, mom prompts child to touch a container, signs for item, pulls picture of item off of PECS book.

Non-examples include but are not limited to: child opens container himself, child grabs a container and runs away from the teacher, child screams.

Vocalization—Approximations/Corrects

Sounds emitted by child that are word approximations or corrects of item. ONSET occurs when first sound is produced; score OFFSET when 1 second pause occurs following emission of last sound: OFFSET also occurs if word is produced in following vocals.

Examples include but are not limited to: “buh” for blanket or bubbles when child is handing teacher container with blanket or bubbles inside; “ren” for ring when child is touching container with wooden ring toy.

Non-examples include but are not limited to: “f” for fan when child is touching container with bubbles inside; “buh” when child is standing at the window; “ma” when child is opening the door.

PECS

Corrects

Child removes picture of item from front of PECS book and puts it in hand of the teacher/parent with no assistance.

Examples include but are not limited to: removing picture of yellow blanket from the front of the PECS book when no other pictures are on the front of the book and places the picture in the hand of the teacher, removing picture of fan from front of the PECS book with other pictures of other items on the front of the book.

Non-examples include but are not limited to: child removes picture of blue blanket from the front of the PECS book but does not put the picture in the hand of the teacher, child points to the picture of the item on the PECS book but does not remove it and put it in mother’s hand.

Approximates

Child performs one or more parts of removing the picture of the item from the front of the PECS book and handing it to the teacher/parent.

Examples include but are not limited to: child points to the picture of the item on the front of the PECS book but does not remove it and place it in the teacher’s hand, child removes the picture of the item from the front of the PECS book and places the picture on top of the container that the bubbles are in.

Non-examples include but are not limited to: child picks up the PECS book and hands it to mother but does not point to or remove the picture of any item.

Prompted

Teacher/mother assists the child in identifying, removing, or placing the picture in the teacher/mother's hand.

Examples include but are not limited to: teacher points to the picture of the item on the front of the PECS book for the child to remove, teacher uses hand over hand guidance to assist the child in removing the picture of the item from the front of the book, mother assists child in putting the picture in her hand.

Non-examples include but are not limited to: mother identifies the picture on the book, removes the picture, and holds the picture in her hand; teacher removes the picture from the book, holds it up, and then gives the child the item.

Unprompted

Teacher/mother gives the child no assistance in identifying, removing, and placing the picture in the hand of the mother/teacher.

Examples include but are not limited to: child independently identifies the picture of the item on the book; child independently removes the item from the book.

Non-examples include but are not limited to: child independently removes the picture from the book that mother is pointing to, child puts picture of item in mother's hand after mother removes the picture from the book.

Sign**Corrects**

Child physically uses their fingers, hand, and/or arm to make the sign for the item with no assistance.

Examples include but are not limited to: child signs "sky" for the blue blanket, child signs "sun" for the yellow blanket.

Non-examples include but are not limited to: child signs "no" for the yellow blanket, child signs "blanket" for the yellow blanket.

Approximates

Child performs any physical movement of fingers, hand, or arm when sign is required to obtain item.

Examples include but are not limited to: child only completes a portion of the sign for "sky" for the blue blanket, child raises hand but does not sign

"sun" for the yellow blanket, child moves arm but does not sign "sky" for the blue blanket.

Non-examples include but are not limited to: child raises his leg but no other physical movement when sign for "sky" is required, child touches box but does not make any physical gestures when sign for "sky" or "sun" is required.

Prompted

Teacher/mother assist the child in the physical movement of fingers, hand, and/or arm to make the sign required or teacher/mother make the correct sign before the child makes the sign.

Examples include but are not limited to: Child raises hand but does not properly form the "c" for the sun sign so mother helps child to form the "c" with this hand and fingers, child moves arm parallel to the floor to make "sky" sign so teacher takes child's arm and physically prompts him to move his arm at a right angle to the floor, teacher/mother makes the correct sign and then child makes the correct sign.

Non-examples include but are not limited to: Child makes sign for "sun" with no assistance from teacher/mother and before teacher/mother model the sign when the child wants the yellow blanket.

Unprompted

Teacher/mother provides no assistance to the child to physically move his fingers, hand, and/or arm to make the sign required and the teacher/mother do not make the correct sign before the child makes the sign.

Examples include but are not limited to: Child makes sign for "sun" with no assistance from teacher to get the yellow blanket and teacher does not make the sign for "sun" before child does.

Non-examples include but are not limited to: Child makes sign for "sky" no assistance from mother to get blue blanket after mother makes sign for "sky".

DATA SHEET

Donna

Mom

Item	Count	Total
Approach		
Protests		
Communicative Gestures		
Vocals- Approximations/Corrects		
Corrects prompted PECS		
Corrects unprompted PECS		
Approx. prompted PECS		
Approx. unprompted PECS		
Corrects prompted sign		
Corrects unprompted sign		
Approx. prompted sign		
Approx. unprompted sign		

Date

Observer

Time Started

Time Ended

DATA SHEET

Donna

Mom

Item	Count	Total
Blanket (blue)		
Bubbles		
Slinky		
Fan		
Rings		
Blanket (yellow)		
Small Blocks		
Large Blocks		
Music toy		
Bead toy		

Date

Observer

Time started

Time stopped

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