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Assessing the Effectiveness of a Picture Exchange Communication System on Increasing Manding and Vocal Speech in Identical Twin Adults with Autism

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ASSESSING THE EFFECTIVENESS OF A PICTURE EXCHANGE COMMUNICATION SYSTEM ON INCREASING MANDING AND VOCAL SPEECH IN IDENTICAL TWIN ADULTS WITH AUTISM

by

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This study examined the effectiveness of a Picture Exchange Communication System (PECS) on increasing manding (i.e., making requests) and spontaneous vocalizations. Participants were a set of identical twin adult women, both with a diagnosis of autism. The main dependent variable was the number of mands emitted by the participants while utilizing PECS. During each phase of training, participants had to meet a specific criterion before receiving a preferred item. Once the participants met the criterion for each phase of PECS training, a new phase began. Spontaneous vocalizations were tracked during each phase of training to determine if, as previous studies have shown in children, spontaneous vocalizations increase during Phase IV of PECS training. Additionally, the percentage of sessions that were terminated as a result of aggressive responding were also tracked.

A multiple-baseline across participant design was used in this research, with the training phases being implemented at different times for the two participants. Participants were assessed on their overall manding abilities (pointing, nodding, signing) as well as their use of pictures prior to the start of baseline. During baseline the participants averaged 0% use of pictures to mand for desired items. After PECS training

was completed, the use of pictures to mand for desired items averaged 96.63% for participant 1 and 98.26% for participant 2. Two weeks, four weeks, and six weeks after training was completed, probe sessions were conducted to ensure that the participants had maintained their ability to communicate using PECS, and the participants averaged 100% usage of pictures to mand for desired items during the probe sessions. These results suggest that PECS, which has previously proven useful in teaching children with autism to mand, is also effective with adults. In contrast to previous findings with children, however, many of whom began to spontaneously verbalize during PECS training, the two adult participants in the present study did not verbalize. Participant 1 showed an overall decrease in the percentage of sessions terminated due to aggressive responding throughout training. Further research to examine the value of PECS training in teaching manding with adults, and to examine whether such training can generate vocalizations, is warranted.

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CHAPTER 1

INTRODUCTION

The most frequently cited prevalence rate for children with Autism Spectrum Disorder (ASD) in the United States is approximately 1 in 88 (CDC, 2012). Little research has been done in the United States to investigate the true prevalence of ASD in adults, but there has been some research in England. The results of this research indicated that the estimated prevalence rate of autism in English adults was nearly identical to the estimated prevalence rate of autism in children in the United States (Brugha et al., 2011). Assuming that the English prevalence rates generalize to the prevalence rates of autism in adults in the United States, then approximately 1% of adults in the United States have autism. Given the data cited above, we can assume that at any given time there are actually more adults in the United States with autism than there are children with autism.

Interestingly, adults with autism are underrepresented relative to children both with respect to receiving behavioral therapy and in serving as participants in published research. With regard to the former, Ganz (2007) estimated the average per capita cost of behavior therapies for people with autism of various ages. His results are as follows: Ages 3–7 years, $32,501; 8–12, $4,033; 13–17, $3,479; 18–22, $1,235; and 22 and over, $0. These data suggest that almost no adults with autism receive behavioral therapy.

With regard to adults with autism being underrepresented in research, Edwards, Watkins, Lotfizadeh, and Poling (2011) reviewed 146 articles published from 2009 on in four prominent journals in the field of autism. All of those articles described treatments intended to somehow directly benefit participants. The purpose of the review was to provide an estimate of the distribution of ages of participants in intervention research involving people with autism. The results are not surprising: for the 2,063 participants whose ages were reported, the mean was 6.89 years. Only five (1.7%) of the participants were 20 years of age or older. The results of this study indicate that researchers show much less interest in adults with autism than in younger people with the disorder.

Both children and adults with autism face challenges regarding learning, communication, and social skills, but for the purpose of this paper, only the development of effective communication strategies and speech will be examined. Many children with autism experience difficulties in learning speech (American Psychiatric Association, 2000). A variety of strategies have been used to teach children with autism to communicate in other ways, including through the use of manual communication, American Sign Language, Voice Output Communication Aides, and the Picture Exchange System (PECS). PECS was developed by Frost and Bondy over a number of years, beginning in the late 1980s. They worked in a statewide public school program serving students with autism, and developed PECS while initially focusing on building essential skills in very young children (Bondy & Frost, 1993, 1994). The PECS protocol and training system are based on the analysis of language (i.e., verbal behavior) offered by Skinner (1957) in his book, *Verbal Behavior.*

The PECS training sequence begins by addressing simple requests, or mands, and then moves through a series of steps involving generalization, picture discrimination, simple sentence construction, vocabulary building via attributes and other qualifiers, responding to requests by others, and commenting, or tacting (Bondy, 2012). More specifically, PECS comprises six training phases. Phase I teaches the physical exchange of a picture for a preferred reinforcer. Phase II gradually separates the trainee from the pictures so that, by the end of the phase, the trainee can reliably pick up a picture from across the room and deliver it to a variety of trainers, as well as across activities and locations, in order to introduce generalization. Phase III introduces picture-discrimination skills, beginning with one preferred and one non-preferred item pictured. Error correction strategies are utilized to correct any mistakes. Upon continued success, the array of pictures is gradually increased until the trainee can accurately identify all pictures. In Phase IV, sentence strips are introduced (such as "I want" or "I need") and are presented before the picture. The trainer reads the sentence strip to the trainee, and then pauses briefly before describing the picture. The pause is to facilitate speech or other vocalizations from the trainee. If any vocalizations are emitted, a larger amount of the reinforcer is delivered to reinforce the vocalizations. In Phase V, descriptive vocabulary is introduced, such as "red" versus "blue" ball. In the final phase, the trainee learns to spontaneously emit comments on interesting stimuli in their environment.

There has been a steady growth of PECs-related research over the years (see Bondy, 2012). Bondy and his colleagues began publishing descriptions of PECS in the early 1990s, and publications by other authors showing the effectiveness of PECs appeared soon thereafter, with the first being written by Schwartz, Garfinkle, and Bauer

(1998). The rate of PECS-related publications held steadily for several years but rose sharply during the past few years, with nearly 40 publications appearing in the last three years. There has also been an increase in literature reviews, with at least six published since 2009 (Bondy, 2012). In all, more than 100 publications dealing with PECS have appeared, and more than 60 of them involve case studies or other data-based work. In a review of published single-subject design studies, Hart and Banda (2010) noted, "In summary, PECS may increase manding, social communicative behavior, and speech and decrease problem behaviors" (p. 486). Another review, by Tien (2008), concluded, "Taken as a whole, therefore, results of the studies reviewed provide evidence for the effectiveness of PECS; specifically, PECS is effective in enhancing functional communication skills of individuals with ASD. Therefore, PECS is recommended as an evidence-based intervention for this purpose" (p. 74).

Unsurprisingly, children were the participants in almost all of the PECS intervention studies. There are however, a few exceptions. Recently, Conklin and Mayer (2011) used PECS to benefit three adult participants with developmental disabilities and very weak communication skills. Results indicated that each participant was able to learn and utilize PECS, and in addition showed a decrease in non-treated and inappropriate target behaviors. Ziomek and Rehfeldt (2008) used three adults with varying developmental disabilities to assess the effects of PECS training on increasing manding as well as its effects on untrained tacts and intraverbals. Their results indicated that PECS may be a viable alternative communication system for adults with severe developmental disabilities who have limited imitative repertoires.

Chambers and Rehfeldt (2003) investigated whether PECS training or manual sign language would be more effective in increasing the ability of four adults with developmental disabilities to mand for objects. Although some of the participants met the criterion for manding for objects via manual sign, most of them showed greater generalization with PECS, and also manded for more reinforcing objects when using PECS. Stoner, Beck, and Hickey (2006) examined the effectiveness of PECS on five nonverbal adults with cognitive impairments. Results indicated that only three of the five participants could functionally use their PECS systems at the conclusion of the study.

Overall, the results of these studies suggest that PECS is valuable in improving communication in most adults with developmental disabilities and severely restricted communication. None of the studies, however, evaluated the effectiveness of PECS in adults with autism. Given that difficulty in communicating is a defining feature of autism, such research is clearly needed.

Prior research has indicated that children often emit more vocalizations during Phase IV (Overcash & Horton, 2010; Schwartz, Garfinkle, & Bauer, 1998; Tincani, Crozier, & Alazetta, 2006) of PECS training, in which the trainer begins to pair pictures of preferred items with sentence strips, such as “I want” or “I need,” and PECS training often is useful in establishing vocal speech (Bondy & Frost, 1994). No published research has examined whether adults with autism develop vocal speech during PECS training.

The current study examined whether two adult participants with a diagnosis of autism since early childhood could be trained to reliably use PECS to mand for (i.e., request) items. The study also ascertained whether the participants emitted more

vocalizations during Phase IV of PECs training than in prior conditions. Finally, the number of sessions that were terminated throughout the study due to problem behavior were tracked to determine if there was a decrease as a result of PECS training.

CHAPTER 2

METHODS

Participants

The participants for this study were identical twin 26-year-old women, both with a diagnosis of autism, as well as a diagnosis of Fetal Alcohol Syndrome. Both participants had some exposure to a form of picture exchange, however, neither of them had received PECS training, and neither of them used pictures to communicate functionally. Both participants were nonverbal. When they were toddlers, they both emitted some words ("kitty kitty," "hot dog," "mama"), but have since stopped emitting words. To communicate, at the beginning of the study the participants manded for items by pulling their mother's or father's hand to the desired items, or by engaging in behaviors such as physical aggression or self-injurious behaviors in order to obtain desired items.

The participants were receiving behavioral treatment services from the researcher through the local Community Mental Health unit before the study began. The participants' parents expressed to the researcher a desire to establish a better strategy for their daughters to communicate, and the researcher suggested that PECS might be appropriate. The parents agreed and the researcher offered to provide the necessary training and also asked the parents if its effects could be formally evaluated in a research study, which was described in an informed consent document (Appendix A). They

consented for this to occur. Due to the functioning level of the participants, they could not provide meaningful assent to participate.

Setting

The experiment took place in the family home of the participants. The majority of the sessions took place with the participants sitting at a kitchen table; however, the participants were able to move freely about the home and sessions were conducted where the participants were most comfortable (e.g., with them sitting on the couch or on kitchen bar stools). The equipment with which all sessions were video recorded was portable and the experimenters were easily able to transport the recorder if the participants moved during a session.

Recruitment

Experimental Task

The design and methods used in the experiment were similar to those used previously by Tincani et al. (2006) to examine the effects of PECS training on manding and vocalization in children. Because the treatment was intended to increase both manding and vocalizations in the participants, an assessment that measured both of these responses was used in order to establish an objective baseline. The assessment used was the Verbal Behavior Milestones Assessment and Placement Program (VB-MAPP, Sundberg, 2008). The VB-MAPP is based upon B.F. Skinner's analysis of verbal

behavior, developmental milestones, and field-tested data from typically developing children, children with autism, and children with other developmental disabilities.

There are five components to the VB-MAPP. The first section is the VB-MAPP Milestones Assessment, which is designed to provide a representative sample of a child's existing verbal and related skills. This section contains 170 measurable Milestones that are balanced across 16 skill areas, and across 3 developmental levels (0–18 months, 18–30 months, and 30–48 months). In the present study, the only skill areas that were assessed were Manding and Spontaneous Vocalizations. It should be noted that although the description of this assessment is written for and describes utilization with children, the assessment focuses on developmental age rather than chronological age, hence it is appropriate for low-functioning adults. VB-MAPP data for Participant 1 and for Participant 2 are shown in Figures 1 and 2, respectively.

After the participants' manding skills and spontaneous vocalizations were assessed, a preference assessment was conducted for each participant to isolate reinforcers to be used in training. First, the parents of the participants were asked to fill out a written questionnaire identifying foods, toys, beverages, or activities that are highly preferred (see Appendix B). Second, items were presented to both participants using a forced choice method (Paclawskyj & Vollmer, 1995). Based on the results of the written questionnaire, 10 items (edible and non-edible) were chosen for each participant to utilize for the preference assessment. All items were paired systematically with every other item in a random order to ensure completeness. Once an item was chosen, the participants were given approximately 30 seconds of access to the non-edible item or were able to consume the edible item. Finally, items were ranked based on the participants' selections.

Name:	Participant #1
Age:	26

	Date	Color	Tester
1st	5/23		LH
2nd	8/7		LH

	Mand	Tact	Listener	VP/MTS	Play	Social	Reading	Writing	LRFFC	IV	Group	Linguistics	Math
15													
14													
13													
12													
11													

	Mand	Tact	Listener	VP/MTS	Play	Social	Imitation	Echoic	LRFFC	IV	Group	Linguistics
10												
9												
8												
7												
6												

	Mand	Tact	Listener	VP/MTS	Social	Imitation	Echoic	Vocal
5								
4								
3								
2								
1								

Figure 1. VB-MAPP Results, Participant 1.

Name:	Participant #2
Age:	26

	Date	Color	Tester
1st	6/10		LH
2nd	8/7		LH

	Mand	Tact	Listener	VP/MTS	Play	Social	Reading	Writing	LRFFC	IV	Group	Linguistics	Math
15													
14													
13													
12													
11													

	Mand	Tact	Listener	VP/MTS	Play	Social	Imitation	Echoic	LRFFC	IV	Group	Linguistics
10												
9												
8												
7												
6												

	Mand	Tact	Listener	VP/MTS	Social	Imitation	Echoic	Vocal
5								
4								
3								
2								
1								

Figure 2. VB-MAPP Results, Participant 2.

For participant 1, the most frequently selected items were latex gloves, magazines, goldfish crackers, and Oreo cookies. For participant 2, the most frequently selected items were beads, goldfish crackers, Nutter Butter cookies, and licorice.

Once both participants were given a preference assessment, PECS training began. Only phases I through IV of PECS were trained. Training was provided by the researcher or by an assistant, both experienced in using the PECS system. Each week, an attempt was made to conduct four sessions with each participant, but this was not always possible due to participants' schedules. All sessions were video (and audio) recorded through the use of a high definition *Flip Mino* camera (Cisco Systems, San Jose CA) placed on the closest flat surface and directed at the trainer and participant. Video records were used to calculate inter-observer agreement for dependent variables and to assess intervention integrity. Each session provided at least 20 response opportunities during PECS training. In addition to the four sessions per week that were completed by the researcher or research assistant, both parents and other family members were trained on the PECS procedures and were asked to utilize the pictures when the participants manded for items outside of formal sessions. To train family members, the primary researcher modeled proper usage of the pictures when the participants manded for items, and family members were asked to follow the same procedure while the researcher observed and provided feedback. This training occurred at the beginning of each new phase of PECS training.

Family members were not asked to conduct formal sessions, but rather when appropriate to prompt the participants to utilize PECS, rather than other strategies, to mand for desired items, and to provide them when PECS was used appropriately. To increase the likelihood that PECS would be used consistently and appropriately, the

Picture Exchange Communication System (Bondy & Frost, 1994) was used to direct the use of PECS by family members, the researcher, and the research assistant. This book provides precise, step-by-step instructions for each phase of PECS. In addition, at least once each week either the researcher or the research assistant directly observed family members using PECS and provided feedback as necessary.

Method of Data Collection

A multiple-baseline across participants design was employed for this study to assess the effects of PECS training on increasing manding and spontaneous vocalizations.

The proper utilization of pictures for the purpose of manding for desired items during each phase of PECS training was remotely monitored via high definition *Flip Mino* brand software and scored using the Interval Recording data sheet for Manding (see Appendix C). Also, the number of spontaneous vocalizations during each session were scored using the Frequency Count for Spontaneous Vocalizations data sheet (see Appendix D). The video recorder was positioned approximately two feet from the participants, depending on which phase was bring trained (e.g., segments of Phase II require that the participants travel 15 feet or more to properly deliver the picture to the experimenter, so the camera was placed farther away during this phase). In cases such as this, the camera was moved by a research assistant and was no more than five feet from the participant. All sessions were recorded and stored digitally for the purposes of conducting inter-observer agreement.

Independent Variable

The independent variable in this study was introducing the Picture Exchange Communication System. As noted previously, the procedures that were followed for the training came directly from *Picture Exchange Communication System* (Bondy & Frost, 1994). The researchers scored the participants on their accuracy in utilizing PECS during training. There were three general phases during the study (baseline, intervention, and probe).

Dependent Variables

The primary dependent variable was the number of mands emitted by utilizing PECS in order to obtain a desired item. During formal sessions, the number of mands emitted using pictures was recorded by using an interval recording data sheet. Each response opportunity was counted as an interval, and the researcher indicated whether or not the correct response was emitted by circling "Y" for yes or "N" for no. The second dependent variable was the number of spontaneous vocalizations emitted during all phases of PECS training. This was recorded by using a frequency count, in which the researcher tallied how many spontaneous vocalizations were emitted during all phases of PECS training. The third dependent variable was the number of sessions that were terminated as a direct result of problem behavior exhibited by the participants.

Baseline

A list of preferred items was compiled for each participant from the written Preference Assessment from the parents as well as from the results of the Preference Assessment conducted by the experimenter. Ten preferred items for each participant were purchased and placed into a clear tote so that the participants were able to see the items. Pictures of the preferred items were laid out on the table one at a time and were within two feet of the participants. Trainers would ask, "What do you want?" and participants would indicate what they wanted by pointing, signing "please," or reaching for the items.

Intervention

Each participant was trained on the first four of the six phases of the Picture Exchange Communication System. The criterion for successful completion was different for each phase and included independently completing a request sequence for a desired item across multiple trainers and items, discrimination among up to five pictures, and traveling into different rooms to find the trainer to deliver the picture. No verbal prompts were delivered to the participants during training. If the participants reached for the item or did not complete the request sequence properly, the trainer conducted an error correction sequence in which the trainer physically prompted the participant to pick up the picture and place it in the trainer's hand, and the trial would start over. If the participants correctly followed the request sequence, the trainer would immediately deliver the requested item accompanied by verbal praise. Trials continued until the participants either voluntarily ended the session or until at least 20 trials were completed

in the session. During Phase IV of PECS training, the trainer would read the sentence strip that was created by the participants out loud. The trainer said, “I want” followed by the item being requested by the participants, and the trainer pointed to each picture while reading the strip. Once this was mastered, the trainer would read “I want” and then pause for 2–3 seconds before saying the item out loud. This step gave the participants the opportunity to attempt to vocalize the item themselves, as this phenomenon has occurred in previous studies with children.

Probe

Three probe sessions were conducted for each participant at two weeks, four weeks, and six weeks after training ended, respectively. The probe sessions were conducted in the same fashion that the previous sessions were conducted to determine whether or not the participants maintained their ability to mand utilizing pictures.

Duration of the Study

Sessions were conducted 3–4 times each week over the course of eight weeks. Sessions lasted from 25 minutes to 50 minutes. The number of trials completed depended on the training phase and the participant’s performance and varied from 12 to 96 across sessions.

Analysis of Data

For each participant, the number of independent mands completed correctly and incorrectly were charted for each session and performance is quantified as percentage of

possible responses that were performed corrected. Data were graphed and changes in performance across phases of the study were visually analyzed to determine the effects of the intervention.

Inter-Observer Agreement (IOA) and Procedural Integrity

Inter-observer agreement was calculated on 50% of the total trials, selected at random, across all conditions and participants. For the sessions that were used to determine IOA, two researchers independently collected data. The IOA for this experiment was calculated by using the formula [NUMBER OF AGREEMENTS /(NUMBER OF AGREEMENTS + NUMBER OF DISAGREEMENTS)] x 100. The resulting IOA was 97.5% (591/606 x 100).

Procedural integrity was evaluated by the primary researcher (the communicative partner) and the research assistant (the physical prompter) for 25% of total trials (303 trials), selected at random. The tool utilized was the PECS Implementer Skills Assessment (Frost and Bondy, 2002; see Appendix D). “Yes” responses on the checklist indicate compliance with experimental procedures. The primary researcher obtained a mean percentage of “Yes” responses for all conditions of 96.7% (147/152 total trials). The research assistant obtained a mean percentage of “Yes” responses for all conditions of 96.02% (145/151 of total trials).

CHAPTER 3

RESULTS

Figure 3 shows for each participant the percentage of manding opportunities during which an appropriate independent mand was emitted. Neither participant manded independently before PECS training was introduced. After PECS training was introduced, the participants' use of pictures to mand for items went from 0% in baseline to 97.45% during the intervention. During probe sessions, both participants maintained their ability to mand using pictures and did on 100% of occasions. Both participants showed a remarkable improvement in their ability to mand for desired items, but participant 2 showed a slightly higher improvement overall. The lowest compliance level during training for participant 2 was 83%, which occurred during the fifteenth session, when a new training phase had just begun. For participant 1, the lowest compliance level was the sixth session, at 40%. The participant was ill during this session.

Spontaneous vocalizations were monitored for both participants throughout this project. During baseline, both participants emitted a whining sound and laughter, but neither participant emitted any functional vocalizations during baseline. During PECS training, including phase IV, participants did not show any increase in spontaneous vocalizations as was hypothesized.

The percentage of sessions that were terminated due to aggressive responding were also monitored. Participant 1 showed a decrease in the number of sessions

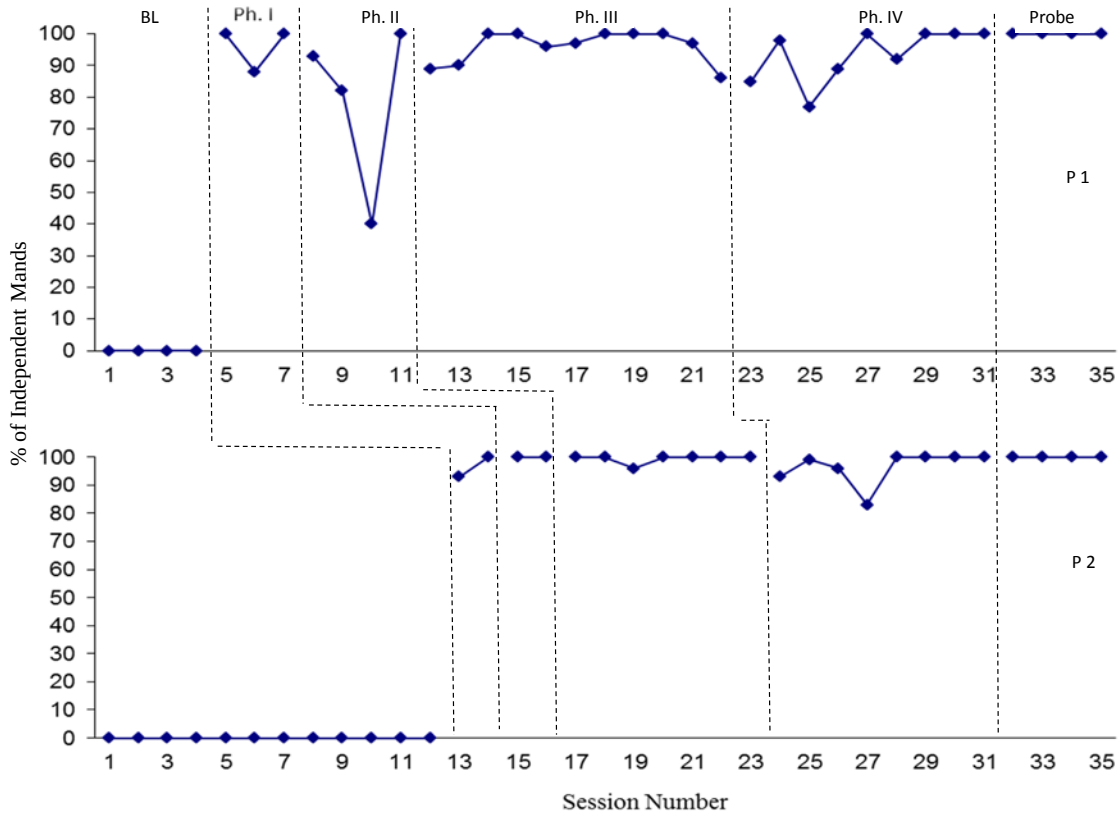

Figure 3. Independent Manding Results.

terminated due to aggressive responding, and participant 2 never had a session terminated due to aggressive responding. The level of spontaneous vocalizations before and during PECS training is shown in Figure 4. The percentage of sessions that were ended for each participant due to aggressive responding is shown in Figure 5.

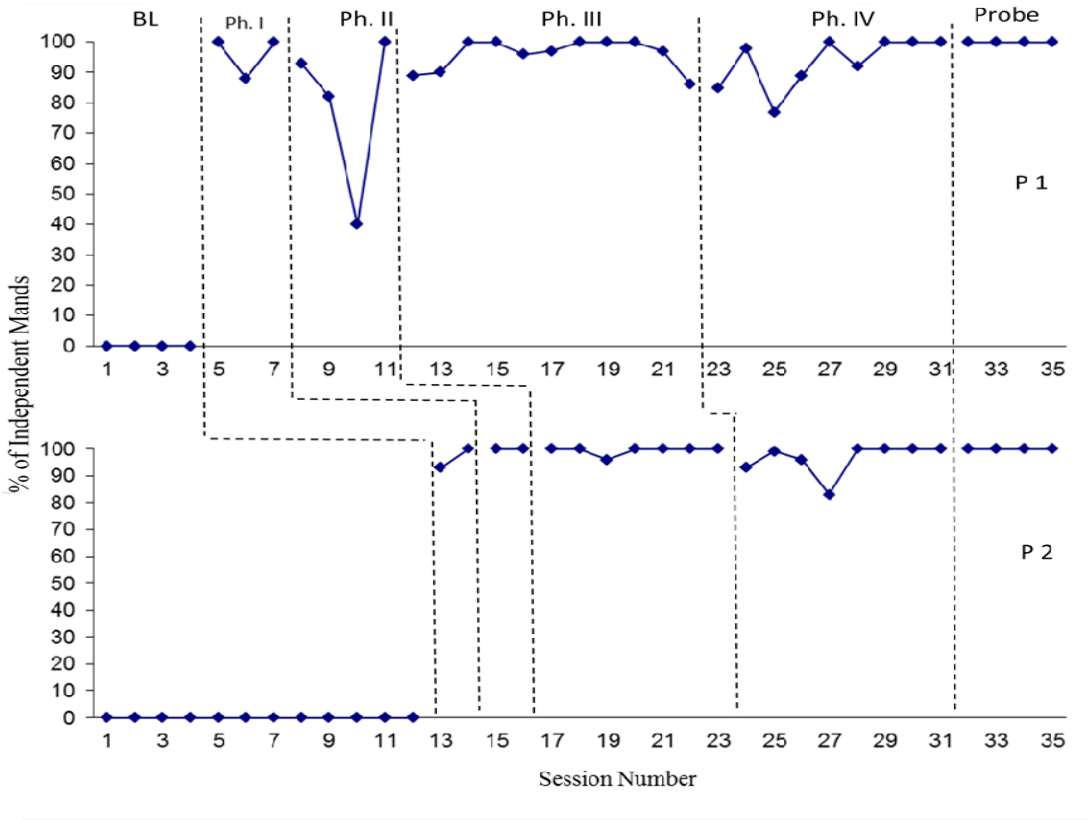

Figure 4. Spontaneous Vocalization Results.

Phases

Participant	1	2	3	4	Probe
1	33	25	17	22	0
2	0	0	0	0	0

% of sessions ended due to aggressive responding

Figure 5. Percentage of Sessions Ended due to Aggressive Responding.

CHAPTER 4

DISCUSSION

Training with the PECS system dramatically increased spontaneous manding by both participants. The effectiveness of PECS in teaching manding observed in the present study is consistent with the results of a large number of prior studies with children (see reviews by Bondy, 2012; Hart & Banda, 2010; Tien, 2008). These studies also found that many, although not all, children began to verbalize during Phase IV of PECS training. In contrast to this finding, in the present study neither participant evidenced an increase in spontaneous vocalizations during Phase IV training or at any other time. This may be attributed to the fact that neither participant emitted any functional vocal speech prior to the training. Children who demonstrated substantial verbal responding during Phase IV training emitted at least some vocal speech prior to training (Overcash & Horton, 2010; Schwartz et al., 1998; Tincani et al., 2006).

Training the participants in the present study to use PECS seemingly reduced the response effort required for them to obtain the items they desired, and perhaps for this reason they continued to use the PECS system, rather than the alternative behaviors used to obtain desired objects (leading parents by the hands, behaving aggressively) prior to PECS training. The percentage of sessions that were terminated by the researcher due to aggressive responding decreased for participant 1 throughout PECS training. Participant 2 never had a session terminated due to aggressive responding. These results indicate that

training a functional communication system resulted in less aggressive behaviors, perhaps due to the decrease in response effort for the participants. The results of the probe sessions indicate that both participants maintained their ability to utilize PECS to functionally communicate. Conducting the training in the home of the participants, allowing them to move about the home as they pleased during sessions, and requesting that the family conduct themselves just as they would when sessions were not being conducted probably increased the likelihood that the participants would continue to use PECS, as the majority of their time is spent in the home.

It should be noted that it is likely the participants already had some of the skills required to learn PECS prior to training; skills that children with autism and other disabilities do not yet possess. For example, in the Manding Results graph, participant 1 was successful in completing the first session of Phase I of PECS training with 100% compliance—however, she had not previously been formally trained in PECS. This would indicate that she had skills in her repertoire already that aided in her success (i.e., the researcher holding out their hand indicates to the participant to put the picture in it).

In a study by Tincani et al. (2006), which used procedures comparable to those of the present study but with school-aged children as participants, the results were similar to those of the present study in regards to the increase in manding observed after PECS training. Both participants in the study were able to generalize their manding skills to other trainers, as were the participants in the present study. The speed of skill acquisition differed slightly—for example, in the present study, both participants met the criterion for successfully completing Phase I of PECS within three sessions, whereas in the study conducted by Tincani et al, one of the participants required 11sessions before he met the

criterion for completion. In regards to vocal speech, as noted previously, the participants in the present study did not show any increase during PECS training. In the study by Tincani et al., one of the participants, who was somewhat vocal prior to PECS training, showed an appreciable increase in vocalizations during Phase IV training.

A study by Charlop-Christy, LeBlanc, and Kellet (2002) obtained similar results with three children with autism. All participants were able to functionally communicate after PECS training, and all participants showed an increase in vocal speech after Phase IV of training. After PECS training, participants in this study also showed a decrease in the number of disruptions that occurred in an academic setting. A significant difference between the Charlop-Christy et al. study and the present study is that neither participant in the present study exhibited vocal speech prior to the experiment and during the baseline phase, whereas all of the participants in the Charlop-Christy et al. study did so. Although further research is needed, it certainly appears that PECS training only engenders vocalizations during Phase IV (or elsewhere) in participants who exhibit some level of vocalizing prior to training.

As noted previously, far fewer studies of the effectiveness of PECS training have been conducted with adults with disabilities than in children with disabilities, and no published study has assessed the effectiveness of PECS in adults with autism. However, Ziomek and Rehfeldt (2008) conducted a study with three adults with varying developmental disabilities. Two of the three participants were able to master PECS training; this study did not formally examine the effects of such training on spontaneous vocalizations. Conkin and Mayer (2011) conducted a similar study with three adults with developmental disabilities. Results indicated that PECS was an effective tool to increase

manding; however, this study also did not address spontaneous vocalizations as a dependent variable. Chambers and Rehfeldt (2003) examined the effectiveness of PECS versus American Sign Language on increasing manding skills, and results indicated that, although both forms of communication were effective, more participants were able to generalize with PECS. Again, this study did not examine vocal speech as a variable and there is a clear need to ascertain the conditions under which PECS training generates speech in adults with autism and other developmental disabilities. There is similar need to further examine the value of the procedure for generating functional communication in adults of varying ages and with diverse diagnoses.

Nonetheless, the present findings and those of other studies with adults (Chambers & Rehfeldt, 2003 ; Conklin & Mayer 2011; Stoner et al., 2006; Ziomek & Rehfeldt, 2008) provide substantial evidence that PECS training is useful for developing appropriate communication, specifically, manding, in adults with autism and other developmental conditions. Given the effectiveness of early behavioral-analytic interventions in improving the behavior of people with autism, including their ability to communicate, (e.g., Eldevik et al., 2009; Howlin, Magiati, & Charman, 2009; Reichow & Wolery, 2009; Rogers & Vismara, 2008) it is unsurprising that far fewer studies have examined strategies for increasing functional communication in adults with autism than have done so with children with autism. As the participants in the present study illustrate, however, and survey results confirm (Shattuck et al., 2007), many people with autism have life-long behavioral challenges. It is reasonable to propose that the same kinds of treatments that benefit younger people with similar challenges will similarly benefit them, but distressingly few data to support the proposal. The present data are among

those that do provide such support and they are of value for that reason. They are also of value in documenting a modest, but significant, improvement in the quality of life of the participants and of the family members who love them.

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Appendix A

Consent Document

Western Michigan University
H.S.I.R.B.
Approved for use for one year from this date:

APR 15 2014

HSIRB Office

Consent Document
Department of Psychology: Applied Behavior Analysis
Dr. Alan Poling, Principal Investigator
Laura Hilton, Student Investigator
Assessing the Effectiveness of a Picture Exchange Communication System on Increasing Manding and Vocal Speech in Identical Twins with Autism

You are invited to participate in a study "Assessing the Effectiveness of a Picture Exchange Communication System on Increasing Manding and Vocal Speech in Identical Twins with Autism." This study is being conducted by Laura Hilton, a doctoral student in the Applied Behavior Analysis doctoral program at Western Michigan University, under the supervision of Dr. Alan Poling, her dissertation committee chair.

The following information is being provided for you to determine if you wish to have your two daughters participate in this study. In addition, you are free to decide not to participate in this research or to withdraw your daughters at anytime without affecting your relationship with the researchers or Western Michigan University.

The purpose of this study is to assess the effectiveness of a picture exchange communication system on increasing manding and vocalizations in adults with autism. If you decide to participate you will be asked to participate in a written questionnaire that identifies preferred items that would be used in the study with your daughters. In addition, you would also be asked to utilize the pictures that have been introduced up to that point with your daughters when formal sessions are not being run. Sessions will be video recorded, but you may have the video recorder turned off at any time if you wish to do so.

Please do not hesitate to ask questions about the study before participating or while the research is taking place. I will be happy to share the results with you at the completion of the study. Ensuring the confidentiality of data is the norm in research. Your name or the names of your daughters will not be used in the dissertation dissemination process; rather it will only be known to the researcher. Pseudonyms will be used for participants (i.e. Participant 1 and Participant 2) and general terms will be used in reporting results.

The video recordings that will be used during the data collection process will be destroyed once the data collection process has been completed and a written record is

Western Michigan University
H.S.I.R.B.
Approved for use for one year from this date:

APR 15 2014

HSIRB Office

produced. There are no other known risks/discomforts associated with participating in this study.

There are several expected benefits from participating in this study. They are: 1) the possibility that your daughters will learn a system in which to effectively communicate with others; 2) a better understanding of the effectiveness of picture exchange systems in adults with autism; and 3) being a part of research that is the first of its kind.

If you have any questions about this study, please contact Laura Hilton, the student investigator at (616) 304-3042 (cell) or via email at laura.c.hilton@wmich.edu. You may also contact the Chair, The Western Michigan University Human Subjects Institutional Review Board (269) 387-8293 or via email at hsirb@wmich.edu if any questions or issues arise during the course of the study.

This consent document has been approved for use by the researcher for one year by the Human Subjects Institutional Review Board (HSIRB) as indicated by the stamped date and signature of the board chair in the upper right corner. Do not participate in the study if the stamped date is older than one year.

A signed copy of this consent form will be given to you for your records.

_____ _____

Participant Date

Consent obtained by: _____

Interviewer/Student Investigator

_____

Date

Appendix B

Reinforcer Profile Assessment for Parents

Potential Reinforcer Profile

Child's Name: _____ Date: _____

Name of Reporter(s):

_____

Instructions: From each category, check **10** of the preferred items for your child. If items are not listed that are preferred by your child, please write those items next to "list other."

Visual Reinforcers

☐ T.V./movies

☐ Computer games

☐ Video games

☐ Wind-up toys

☐ Light-up toys

☐ Kaleidoscope

☐ Stickers

☐ Mirrors

☐ Books

☐ Toys with wheels

☐ Car or marble ramps

☐ Pop-up toys

☐ Balloons

☐ Beads

☐ Chalk & chalkboard

☐ Waterwheels

☐ Painting

☐ Viewfinder

☐ Snow globes

☐ Puppets

☐ Train with tracks

☐ Magna-doodle

☐ Puzzles

☐ Stamp & stamp pad

☐ Crayons/Markers

☐ Dress-up

☐ Pouring liquids

☐ Glow in the dark items

☐ Spinning Objects

☐ Bright Lights

☐ Shiny Objects

List other _____
List other _____

Auditory Reinforcers

☐ Music (tape/C.D.)

☐ Books with sound effects

☐ Whistles

☐ Toys that make noise

☐ Music box

☐ Clapping

☐ Singing songs

☐ Others people singing

☐ Party Blowers

☐ Clackers

☐ Whistles

☐ Nursery Rhymes

☐ Car sounds

☐ Beeps

☐ Sirens

☐ Musical instruments:

_____

_____

List other _____

List other _____

Therapists' tone of voice: (circle one) whisper yell high pitch low pitch

Tactile Reinforcers

☐ Stress ball

☐ Lotion

☐ Shave cream

☐ Play-doh

☐ Clay

☐ Putty

☐ Silly-string

☐ Sand play

☐ Water play

☐ Bubble wrap

☐ Pipe-cleaners/Wikki-stix

☐ Toys that are rubbery

☐ Koosh-ball

☐ Finger painting

☐ Bumble ball

☐ Vibrating pen

☐ Pom-poms

☐ Glitter

☐ Magnets

☐ Water balloons

☐ Bean bags

☐ Feathers

☐ Ball pit

☐ Fan

☐ Bubbles

☐ Crumpling/tearing paper

☐ Cold things

☐ Warm things

List other_____
List other_____

Physical Play/Movement Reinforcers

☐ Trampoline

☐ Bouncing on therapy ball

☐ Rolling on floor

☐ Spinning

☐ Sock-em Boppers

☐ Sit & spin

☐ Running

☐ Jumping/hopping

☐ Skipping

☐ Bicycle/tricycle

☐ Rocking chair

☐ Wagon rides

☐ Dancing

☐ Swinging

☐ Crawling through tunnel

☐ Hide & seek

☐ Skater/rolling blades

☐ Skate board

☐ Bowling

☐ Golf

☐ Air hockey

☐ Tug-o-war

☐ Rolling on stomach over large ball

☐ Climbing

☐ Scooter board

List other _____

List other_____

Social Reinforcers

☐ Adult attention

☐ Attention from other children

☐ Being left alone

☐ Hugs

☐ Private praise

☐ Being rocked

☐ OK sign

☐ High five

☐ Praise

☐ Public recognition

☐ Thumbs up sign

☐ Pats

☐ Smiles

☐ Eye contact

☐ Public praise

☐ Applause

☐ Tickles

☐ Shake hands

List other_____
List other _____

Edible Reinforcers

Instructions: List **10** potential edible reinforcers (food or drink items) in order of most preferred (1 =
most preferred, 10 = least preferred)

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

Appendix C

Interval Recording Data Sheet

Instructions: For each opportunity to respond, circle "Y" if the participant responded correctly or circle "N" if the participant responded inappropriately or did not respond.

Item:_________________

Date___	Date___	Date___	Date___	Date___	Date___	Date___	Date___	Date___	Date___	Date___
Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N
Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N
Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N
Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N
Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N
Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N
Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N

Item:_________________

Date___	Date___	Date___	Date___	Date___	Date___	Date___	Date___	Date___	Date___	Date___
Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N
Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N
Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N
Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N
Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N
Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N
Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N

Item:_________________

Date___	Date___	Date___	Date___	Date___	Date___	Date___	Date___	Date___	Date___	Date___
Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N
Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N
Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N
Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N
Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N
Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N
Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N

Item:_________________

Date___	Date___	Date___	Date___	Date___	Date___	Date___	Date___	Date___	Date___	Date___
Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N
Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N
Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N
Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N
Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N
Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N
Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N

Item:_________________

Date___	Date___	Date___	Date___	Date___	Date___	Date___	Date___	Date___	Date___	Date___
Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N
Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N
Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N
Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N
Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N
Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N
Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N

Appendix D

Spontaneous Vocalizations Data Sheet

Instructions: Mark a tally for each vocalization emitted. If the participants emit words approximations, write them below the tally boxes.

Date:_____	Date:_____	Date:_____	Date:_____	Date:_____

Words/Sounds emitted:

1._____	1._____	1._____	1._____	1._____
2._____	2._____	2._____	2._____	2._____
3._____	3._____	3._____	3._____	3._____
4._____	4._____	4._____	4._____	4._____
5._____	5._____	5._____	5._____	5._____
6._____	6._____	6._____	6._____	6._____
7._____	7._____	7._____	7._____	7._____
8._____	8._____	8._____	8._____	8._____
9._____	9._____	9._____	9._____	9._____
10._____	10._____	10._____	10._____	10._____

Date:_____	Date:_____	Date:_____	Date:_____	Date:_____

Words/Sounds emitted:

1._____	1._____	1._____	1._____	1._____
2._____	2._____	2._____	2._____	2._____
3._____	3._____	3._____	3._____	3._____
4._____	4._____	4._____	4._____	4._____
5._____	5._____	5._____	5._____	5._____
6._____	6._____	6._____	6._____	6._____
7._____	7._____	7._____	7._____	7._____
8._____	8._____	8._____	8._____	8._____
9._____	9._____	9._____	9._____	9._____
10._____	10._____	10._____	10._____	10._____

Appendix E

PECS Implementer Skills Assessment

PECS Implementer Skills Assessment©

Implementer:	
Reviewer:	
Review Date:	
Site:	

	Pass	Redo	Comments
General Issues:			
Plans for PECS training to occur across a range of activities			
Plans for a variety of trainers to participate			
Plans for student to request a variety of reinforcers			
Notes:			
Phase I Communicative Partner:			
• Arranges training environment effectively – pictures available one at a time, trainers positioned appropriately, control of reinforcers			
• No verbal prompting			
• Entices appropriately			
• Uses open hand prompt effectively- appropriate timing			
• Reinforces within ½ second and provides social praise			
• No insistence on speech			
• Returns picture (while student consumes/plays with R+)			
Notes:			

Phase I Physical Prompter:			
• Waits for student to initiate (reach for REINFORCER)			
• Physically guides to pick up, reach, release			
• Fades prompts effectively			
• Interrupts/prevents student's interfering behaviors			
• No social interaction with student			
Notes:			

Phase II Communicative Partner:			
• Plans for each student to have own communication book			
• Arranges training environment appropriately –pictures available one at a time, trainers positioned appropriately, control of reinforcers			
• Entices appropriately			
• Gradually increases distance between student and communicative partner			
• Teaches student to cross room to reach communicative partner			
• Gradually increases distance between student and communication book			
• Teaches student to cross room to reach communication book			
• Turns away from student-eliminates "body language" cues			
• Reinforces appropriately—new behavior within ½ second			

• Eliminates subtle trainer prompts (body orientation, eye contact, expectant look, etc.)			
• Does not insist on speech			
• Teaches student to travel from room to room			
Notes:			
Phase II Physical Prompter:			
• Waits for initiation			
• Prompts removal of picture from book if necessary			
• Physically guides student to trainer if necessary			
• Physically guides student to communication book if necessary			
• Does not interact socially with the student			
• Uses backstepping if necessary			
Notes:			
PHASE IIIA- high vs. distracter discrimination			
• Arranges effective training environment			
• Entices with both items			
• Socially reinforces as soon as student touches correct picture			
• Appropriate reinforcement with requested item			
• Uses a variety of distracter items and a variety of target pictures			

• Conducts error correction procedures correctly- high vs. non-desired ▪ Gives non-desired item ▪ Elicits negative response ▪ **Model** ▪ **Prompt** ▪ **Switch** ▪ **Repeat** • Second error correction if necessary			
• Moves pictures around on book (diagonal, vertical, horizontal)			
• No insistence on speech			
Notes:			
Phase IIIB multiple preferred discrimination			
Arranges effective training environment			
Entices with all items			
Conducts correspondence check			
• Conducts error correction procedures correctly- high vs. high with correspondence check • Prevents student from taking non-corresponding item ▪ Model picture of item reached for ▪ Elicits negative response ▪ **Model** ▪ **Prompt** ▪ **Switch** ▪ **Repeat** • Second error correction if necessary			

• Moves pictures around on book (diagonal, vertical, horizontal)			
• Teaches 3, 4, 5-way discrimination			
• Uses a variety of target pictures in the 2-, 3-, 4-, or 5-way mix			
• Teaches looking inside book			
• No insistence on speech			
Notes:			
Phase IV			
• Begins with "I want" already on sentence strip			
• Waits for initiation			
• Physically guides student to put R+ picture on strip and exchange strip			
• Fades physical guidance to put R+ picture on strip and exchange strip			
• Verbal praise + turns strip around and "reads" sentence			
• Teaches assembly of entire strip- backward chaining			
• Reinforces new behavior within ½ second			
• Appropriately reinforces with tangible item			
• Uses physical assistance to teach student to point while strip is being "read"			
• Uses delay (3-5 seconds) in "reading" strip			
• Differentially reinforces if student speaks			
• Avoids verbal prompting			
• Conducts error correction for incorrect picture sequence			

• Organizes communication book appropriately			
• Does not insist on or drill speech imitation/production			
Notes:			
Attributes:			
• Assesses current reinforcers for potential attributes			
• Teaches three-picture construction			
• Reinforces new behavior within ½ second			
• Teaches discrimination between attribute icons			
• Conducts correspondence check with attributes			
• Conducts error correction for attribute icons			
• Conducts error correction for incorrect picture sequence			
• Teaches variety of attributes within same class (several colors, variety of sizes)			
• Teaches multiple exemplars of each attribute (several "red" items)			
Notes:			

Appendix F

HSIRB Approval Form

Date: April 16, 2014

To: Alan Poling, Principal Investigator
Laura Hilton, Student Investigator for dissertation
Brian Hilton, Co-Principal Investigator

From: Amy Naugle, Ph.D., Chair

Re: HSIRB Project Number 14-04-16

This letter will serve as confirmation that your research project titled "Assessing the Effectiveness of a Picture Exchange Communication System on Increasing Manding and Vocal Speech in Identical Twin Adults with Autism" has been **approved** under the **expedited** category of review by the Human Subjects Institutional Review Board. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may now begin to implement the research as described in the application.

Please note: This research may **only** be conducted exactly in the form it was approved. You must seek specific board approval for any changes in this project (e.g., ***you must request a post approval change to enroll subjects beyond the number stated in your application under "Number of subjects you want to complete the study***)." Failure to obtain approval for changes will result in a protocol deviation. In addition, if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the HSIRB for consultation.

Reapproval of the project is required if it extends beyond the termination date stated below.

The Board wishes you success in the pursuit of your research goals.

Approval Termination: April 15, 2015

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