Spring 5-31-2023

Increasing Independence with the Picture Exchange Communication System (PECS) for an Adult with Developmental and Intellectual Disabilities

Jessica Moore
Lindenwood University, jmoore@austl.org

Robbie Hanson
Lindenwood University, rhanson2@lindenwood.edu

Increasing Independence with the Picture Exchange Communication System (PECS) for an Adult with Developmental and Intellectual Disabilities

Jessica Moore

College of Education and Human Services, Lindenwood University

EDSBA 56000: Master's Thesis – Behavior Analysis

Dr. Robbie Hanson

Author Note

This thesis is submitted by the first author under the supervision of the faculty advisor to Lindenwood University as partial fulfillment of the requirements for an M.A. degree in Behavior Analysis.

Abstract

Numerous studies have evaluated the effectiveness of the Picture Exchange Communication System (PECS) among children diagnosed with autism spectrum disorder (ASD; Rosales & Marin-Avelino, 2022). However, there remains limited research that indicates the same effectiveness for adults (Rosales & Marin-Avelino, 2022). The purpose of the current study was to examine the use of Phase I of PECS to increase communication with an adult with ASD and developmental disabilities. Prior to intervention, the participant independently exchanged picture icons 0% of opportunities. Following intervention, the participant reached mastery criterion for independently exchanging picture icons across preferred items. Additional data showed that the participant actively engaged with items once received, providing support that icon exchanges corresponded to motivating operations. The results show preliminary evidence for the effectiveness of PECS for adults and for the adherence to the PECS protocol.

Keywords: picture exchange communication system, manding, communicative partner, physical prompter

Increasing Independence with the Picture Exchange Communication System (PECS) for an Adult with Developmental and Intellectual Disabilities

Approximately 30% of children who have diagnoses of autism spectrum disorder (ASD) and other developmental disabilities will not acquire vocal speech (Tager-Flusber & Kasari, 2013). Children who do not acquire vocal speech may present with a physical deficit or deficits in a generalized imitative repertoire. Children who display deficits in speaker behavior may have trouble developing social relationships, obtaining reinforcement (i.e., wants and needs), and reporting past events, among other issues (Battaglia & McDonald, 2015). Consequently, when vocal speech is not acquired, alternative modes of communication are necessary. The Picture Exchange Communication System (PECS) is an alternative communication modality that is typically implemented with non-vocal children. PECS was developed in 1985 and was first implemented with pre-school students diagnosed with ASD. Developers Andy Bondy and Lori Frost based PECS on B.F. Skinner's (1957) *Verbal Behavior*, and it consists of six phases: *how to communicate*, *distance and persistence*, *picture discrimination*, *sentence structure*, *responsive requesting*, and *commenting* (Bondy & Frost, 2021).

In Phase I of PECS the physical prompter fully assists the learner with exchanging one icon with a communicative partner. In Phase II, the learner utilizes a three-ring binder to store icons to travel to a communicative partner. In Phase III the learner is presented with multiple icons, in which the learner discriminates between items. In Phase IV, the learner constructs sentences using the "I want" icon and assembles the icon on a sentence strip alongside the preferred item. In Phase V, the learner uses icons to respond to the question, "What would you like?" or a similar phrase. In Phase VI, the learner uses a combination of icons to form sentences to answer "wh" questions (e.g., "What do you see?" or "What is it?"; Bondy & Frost, 2021).

Research has suggested that PECS is an effective approach to establish basic communication for non-vocal children diagnosed with ASD (Charlop-Christy et al., 2002; Rosales & Marin-Avelino, 2022; Treszl et al., 2021). Rosales and Marin-Avelino (2022) provided an overview of key research areas for PECS, including learner outcomes, interactions with peers as a communicative partner, training caregivers to implement PECS with integrity, and modifications for learners with multiple disabilities (Rosales & Marin-Avelino, 2022). In addition, Battaglia and McDonald (2015) conducted a review of the literature, in which they examined nine single-subject studies, evaluating the effects of PECS on maladaptive behaviors for children with ASD. The authors suggested caution due to the limited number of publications to date and lack of an extensive body of literature on functional relationships between PECS and the reduction of maladaptive behavior. Finally, a review of the literature was conducted by McCoy and McNaughton (2019) in which they examined seven published research articles that employed PECS training among education professionals (McCoy & McNaughton, 2019). The results demonstrated that educational professionals who were properly trained on PECS implementation, increased the quality of PECS implementation (i.e., implementing PECS with integrity) or increased the quantity of PECS teaching opportunities (i.e., providing the learner more opportunities to mand using picture icons; McCoy & McNaughton, 2019).

Although previous research is encouraging, there appears to be little research on the effectiveness of PECS overall within behavior-analytic journals. Barlow et al. (2013) conducted a study comparing the acquisition of exchange-based and signed mands among children with ASD. Specifically, the authors compared the efficiency of training picture exchanges (i.e., selection-based) and signs (topography-based) with three participants with severe language deficits (Barlow et al., 2013). The findings showed that each participant reached mastery

criterion (i.e., three consecutive sessions with 80% or more independent responses) for selection-based mands but none of the participants reached mastery criterion for topography-based mands (Barlow et al., 2013). Doherty et al. (2018) taught children with ASD to initiate mands to peers and to respond to peer mands using PECS. The results demonstrated that PECS was effective for teaching the participants to initiate and respond to peer mands. However, when generalization was probed, responding to peer mands did not occur (Doherty et al., 2018). Additionally, the results showed that most-to-least prompt fading, time delay prompt fading, and positive reinforcement were an effective treatment package for teaching these skills (Doherty et al., 2018). Kunnavatana et al. (2018) conducted a study on assessing mand modality preference when developing a functional communication training intervention. Specifically, the authors sought to reduce arbitrary selection of communication modalities by evaluating preference during acquisition (Kunnavatana et al., 2018). The results showed that each participant demonstrated a clear preference for one mand modality during choice probes and independent responding increased (Kunnavatana et al., 2018). Areas of future research suggested evaluating preference for other forms of communication and evaluating the caregiver's preference when selecting mand modalities (Kunnavatana et al., 2018). Landa and Hanley (2016) conducted a study that consisted of an evaluation of multiple-schedule variations to reduce high-rate requests with PECS. The results showed reductions in the rate of manding for both participants (Landa & Hanley, 2016). Marckel et al. (2013) conducted a preliminary analysis of teaching improvisation with PECS to children with autism. The study was successful in teaching two male participants how to request preferred items by using functions, colors, and shapes for icons that were not available. Treszel et al. (2021) conducted a study that explored evidence-based strategies to assist parents with helping their children generalize the use of PECS in the home environment.

One child and both parents were participants in this study (Treszel et al., 2021). The father was taught three different PECS skills using general case training (GCT) and behavioral skills training (BST) and the accuracy of the father's PECS implementation was assessed. The results showed that during baseline, the father implemented targeted PECS skills with low fidelity and successfully implemented all targeted PECS skills after receiving training (Treszel et al., 2021).

In addition to a lack of extensive research on the effectiveness of PECS in behavior-analytic publications, there is limited research that suggests PECS is an effective approach for adults. Ziomek and Rehfeldt (2008) conducted a study to investigate the acquisition, generalization, and emergence of untrained verbal operants for mands that were acquired using PECS among adults with severe developmental disabilities. The study concluded that PECS was an effective selection-based system for teaching adults to mand for preferred items in which one participant mastered PECS Phase I and the two remaining participants mastered Phases I-III of PECS (Ziomek & Rehfeldt, 2008). Hughes-Lika and Chiesa (2021) conducted a research review (i.e., five studies) on the use of PECS with adults. At the conclusion of the examination, the authors stated that although PECS could be an effective teaching method for non-vocal adults, they emphasized a lack of research for this population. Specifically, they noted that areas of future research should focus on the implementation of PECS with a wider range of intellectual disabilities and for those with other diagnoses such as seizure disorders (Hughes-Lika & Chiesa, 2021). Because there appears to be a lack of research on PECS overall in behavior-analytic journals in addition to a heavy emphasis on the use of PECS with children, more research on PECS with adults is warranted. Thus, the purpose of the current study was to examine the use of PECS to increase communication for an adult male with developmental and intellectual disabilities.

Method

Participant and Setting

One 28-year-old African American male was included in this study. The participant was non-vocal and was diagnosed with autism spectrum disorder (ASD), seizure disorder, and severe intellectual disability. At the time of the study, the participant was receiving ongoing behavior-analytic services from an adult day program, in which the study took place. The experimenter obtained informed consent from the participant's court appointed guardian in which informed consent documents were submitted to the participant's guardian via email outlining potential benefits to the participant, potential risks, and what the participant would be asked to do during the study. The participant's guardian was informed that compensation would not be given for participation and that they could exit the study at any time without penalty. Additionally, assent was assessed before each session by the participant's willingness to transition to the area in which sessions were held in the absence of maladaptive behavior (e.g., protest). Data collection occurred during the participant's regularly scheduled treatment hours, Monday through Friday, between the hours of 9:00 a.m. and 3:00 p.m. Additionally, Lindenwood University's institutional review board (IRB) approved all procedures before data collection began.

The participant began attending the day program part-time in July of 2022. Part-time program hours consisted of 2 days per week, for 3 hr per day. Starting in August 2022, the participant transitioned to full-time, which consisted of attending the day program 5 days per week, for 6 hr per day. During the participant's part-time attendance, a functional behavior assessment (FBA) was conducted which consisted of direct observations, antecedent behavior consequence (ABC) data collection, and a functional assessment interview (FAI) with the participant's individualized supportive living (ISL) staff. Standardized testing, criterion-

referenced, and curriculum-based assessments were not conducted during the FBA. During the FAI, the participant's ISL staff stated that he had not received applied behavior analysis (ABA) services for over 3 years. In addition, ISL staff reported what the participant's typical daily schedule consisted of prior to attending day program. ISL staff reported that the participant previously watched television and went to bed between the hours of 2:30 a.m. and 6:00 a.m. Upon waking, he was reported to not appear fatigued and proceeded to engage in daily routines (i.e., brushing teeth, eating breakfast, showering). Additionally, ISL staff reported that the participant had adapted a unique communication system that included gestures, facial expressions, and some vocal communication such as responding "yes" or "no" when asked if he wanted to participate in a scheduled activity.

The FBA results identified public masturbation, elopement, falling to the floor, and physical aggression as behaviors to decrease and speaker and listener behavior as behaviors to increase. Public masturbation was operationally defined as any attempt or instance of stimulating the penis for the purpose of experiencing sexual pleasure. Examples included stimulating genitals over or under clothing. Non-examples include briefly adjusting body parts. Additionally, the primary hypothesized function of public masturbation was identified as automatic positive reinforcement. Elopement was operationally defined as any attempt or instance of moving 3 ft away from the designated area outside of typical transition times or directives. Examples included walking to the swing area when scheduled to attend the daily living skills class. Non-examples included walking laps during gym. The primary hypothesized function of elopement was escape or avoidance of non-preferred tasks or staff with a secondary hypothesized function of access to tangibles (i.e., program swing, preferred activity, and preferred staff). Falling to the floor was operationally defined as any instance or attempt of collapsing from a standing or seated

position to lay on the ground or floor. Examples included falling out of the chair after being presented with a demand. Non-examples include tripping or stumbling over an object, resulting in a fall to the floor. The hypothesized function for falling to the floor was identified as attention from individuals in the environment and escape from a demand. Lastly, physical aggression was operationally defined as any attempt or instance of slamming another individual into or on a hard surface (i.e., wall, table, floor, door) or making forceful physical contact with another person using the body. Examples included pushing, leaning into, or shoving another person with force. Non-examples included giving a high-five to another person or locking fingers, while rocking back and forth with another person. The hypothesized function of physical aggression was identified as escape from aversive stimuli (i.e., loud environmental noise). Although skill assessments were not reported as being conducted during the FBA, during direct observations, it was noted that the participant displayed pre-attending skills (i.e., making eye contact, responding to name, sitting in seat, discriminating between two stimuli).

Once the FBA was finalized, a modified selection-based system to mand in the day program setting was targeted for skill acquisition. The selection-based system implemented to teach mands consisted of a three-ring binder that contained picture icons (e.g., preferred leisure tasks, restroom, yes, no, listen to music). Other communication modalities (i.e., sign-language) were reported to not be feasible to implement due the lack of fluency and knowledge of how to teach and understand sign language among the participant's verbal community. Thus, the participant was reported to have a limited sign repertoire, emitting signs such as "more", "bathroom", "finish", "help", and "thank you".

During the first two weeks of the selection-based system, the participant continued to require model and verbal prompts to exchange an icon to mand for items with program staff.

After 2 weeks of implementation, additional contingencies were implemented for the participant to gain access to preferred items. For example, after the participant completed a brief task (e.g., assembling a 10-piece puzzle), direct support staff delivered praise (e.g., "Great job completing your puzzle, you earned a break"), opened the participant's picture binder containing an array of picture icons, followed by the delivery of an instruction such as, "What would you like?" The participant was reported to scan the icons with his eyes and then point to a physical object (e.g., iPad), which was located approximately 2 ft away from the participant's seat. Overall, staff reported utilizing least-to-most prompting during teaching, but the participant was reported to continue to require prompts to exchange an icon (see Figure 1).

Apparatus and Materials

Boardmaker 7 software was used to create picture icons (Boardmaker, 2023). Additionally, the PECS training manual was used to model the intervention after (see Table 1) and the PECS Phase I, trial-by-trial datasheet was used for data collection (see Appendix A). Each datasheet consisted of the date, trial data corresponding to pick up, reach, and release, the icon exchanged, and if an open hand was used by the communicative partner. Catalyst Data Finch software was used to conduct and record the results from the preference assessment (see Appendix B). Other materials used in the study were a stopwatch, laminator, laminator sheets, soft and hard Velcro, scissors, PECS icons, datasheets, and an ink pen.

Dependent Variables and Response Definitions

The primary dependent variable was the percentage of independence for PECS Phase I exchanges. An independent response (+) was defined as picking up the icon, reaching toward the communicative partner (i.e., trainer one), and releasing the icon into the communicative partner's open hand without assistance (Bondy & Frost, 2001). A full physical (FP) prompt was defined as

delivering full physical assistance (i.e., hand-over-hand) for the participant to emit a response. A partial physical (PP) prompt was defined as the physical prompter delivering partial physical assistance (i.e., guiding the elbow) for the participant to emit a response. The secondary dependent variable was the duration of stimulus engagement following an icon exchange. Duration data were collected on the participant's engagement with the stimulus received after exchanging the picture icon (see Appendix C).

Procedure

Pre-experimental Condition

Preference Assessment. Prior to implementing Phase I of PECS, a paired choice preference assessment was conducted to determine item(s) the participant preferred. Stimuli were presented sequentially, in pairs, in a randomized order. The participant was allotted 5 s to engage in an approach response to the stimuli per trial. Once an approach response was initiated, the response was recorded in the Catalyst application and the participant gained access to that item for 60 s. After the 60 s duration, the item was removed, and two new stimuli were presented. Presentation of stimuli were contingent on which items Catalyst paired together. Additionally, a preference assessment was conducted at the start of each data collection day and picture icons of the top three approached stimuli were created.

General Procedure

Once materials were created, the environment was structured with the participant and two trainers. Trainer one, the communicative partner, sat 2 ft in front of the participant. Trainer two, the physical prompter, sat next to the participant. At the start of each trial, the highest preferred item identified from the preference assessment was placed 1 ft in front of the participant on the table and an icon corresponding to the item was placed on the table, directly in front of the

participant and next to the item. Trials were conducted 10 times per day, 5 program days per week, for three consecutive weeks.

Experimental Conditions

Baseline. This condition assessed the percentage of independent PECS Phase I exchanges prior to intervention. During this condition, the highest preferred item identified during the preference assessment was placed on the table in front of the participant with the corresponding icon placed on the table and positioned directly in front of the participant and next to the item. If the participant reached for the item, he was allowed to engage with the item for 10 s and the trial was then terminated. If the participant independently exchanged the icon, the item would have been delivered immediately to the participant and the trial was terminated, however this never happened. If the participant did not reach for the item or the icon, the second and third highest preferred items identified during the preference assessment were placed in front of the participant as described above. If the participant still did not reach for the item or the icon, a new preference assessment was conducted. No prompts were delivered during baseline.

Intervention. This condition was designed to target the following sequence: pick up, reach, and release. The presentation of stimuli was contingent on top to least preferred items identified during the preference assessment. If the participant did not reach for an item, presentation of the second and third highest preferred stimuli identified from the preference assessment were presented. Each trainer (i.e., communicative partner, physical prompter), waited for the participant to reach for the item (i.e., preferred item determined through preference assessment). The corresponding picture icon was placed on the table in front of the participant and next to the item. Once the participant reached for the item, the physical prompter immediately provided physical assistance at a 0 s delay to ensure the participant picked up the

picture, reached to the communicative partner, and released the picture into the communicative partner's open hand (Bondy & Frost, 2001). Once the participant placed the picture in the communicative partner's open hand, the communicative partner delivered the corresponding item within half of a second. Additionally, the communicative partner paired social praise with the reinforcer (e.g., "Way to go!", "You've requested iPad!").

Prompts were systematically faded using a progressive time delay (PTD) procedure (Cooper et al., 2020). A 0 s delay was implemented immediately after presentation of the icon, in which the physical prompter delivered a full physical prompt to emit a correct response. The 0 s delay procedure was implemented across all trials, for five consecutive program days. At the conclusion of the fifth program day, a 2 s delay was implemented, which consisted of the physical prompter delivering a partial physical prompt 2 s after the presentation of the icon. Following the same sequence as the 0 s delay procedure, the 2 s delay was implemented across all sessions, for five consecutive program days. On the first trial of the third week of this intervention, a 3 s delay procedure was implemented.

Experimental Design

This study employed a multiple baseline design across preferred items. Three baselines were concurrently established, and the intervention was sequentially introduced across each preferred item (Kennedy, 2005). Specifically, this design was appropriate due to the irreversibility of the intervention once it was introduced.

Interobserver Agreement and Treatment Integrity

Interobserver agreement (IOA) data were collected across 33% of sessions by a secondary observer. IOA was calculated by dividing the number of agreements by the sum of agreements and disagreements and multiplying by 100 to obtain a percentage (Kennedy, 2005).

IOA averaged 100% across sessions. Treatment integrity (TI) was measured by a secondary observer who assessed if materials needed for the intervention were available, if the implementer delivered prompts correctly, delivered the reinforcer within 0-3 s, and if the implementer scored the data collection appropriately (e.g., scoring a prompt if a prompt was required, scoring an independent if a prompt was not required; see Appendix D). TI was calculated by dividing the number of correctly implemented trials by the total number of trials and multiplying by 100 to obtain a percentage. TI averaged 100% across observed sessions.

Social Validity

Social validity was measured by emailing a questionnaire to the participant's stakeholders (i.e., direct support staff) after the completion of the study and the questionnaire included a section for additional comments (see Appendix E).

Results

Figure 2 shows the results for percentage of independence for icon exchanges across conditions. During baseline, the participant exchanged icons independently 0% of opportunities across all preferred items. During intervention, the participant exchanged the icon for the iPad with an average of 70% independence (range, 40%-100%). In addition, during intervention, the participant exchanged the icon for playing cards with an average of 60% independence (range, 20%-100%), and the participant exchanged the icon for the shark bite game with an average of 70% independence (range, 40%-100%). Furthermore, the participant engaged with the iPad and shark bite game 100% of opportunities following icon exchanges and the participant engaged with the playing cards an average of 95% (range, 90%-100%) following icon exchanges (see Figure 3). The social validity survey results showed that direct support staff scored a 4 (*agree*) for questions one and three, a 3 (*neutral*) for question two, and a 5 (*strongly agree*) for question

four. Additional comments stated, “The incorporation of PECS has been tremendously beneficial to my client. At the home, we are using PECS and are constantly updating them to better understand his needs.”

Discussion

Previous research has shown the effectiveness of PECS to increase communication among children. However, research on the use of PECS with adults is limited and warrants further investigation. Therefore, the purpose of the current study was to examine the use of PECS Phase I to increase manding for a non-vocal adult male with developmental and intellectual disabilities. Prior to this study, the participant engaged in utterances and exchanged picture icons with assistance (i.e., gestural, verbal, positional prompts) from direct support staff. Following intervention, the participant independently exchanged picture icons across three preferred items (i.e., iPad, playing cards, shark bite game). The results of this study suggest that PECS may be an effective selection-based system for strengthening communication skills for the adult population. Additionally, selection-based systems are commonly utilized in the special education setting. However, it is unclear if these systems are implemented with integrity or if they are in alignment with the PECS protocol. The results of the current study show some preliminary evidence for adherence to the PECS protocol, as the modified selection-based communication system used prior to the study was not effective in increasing communication for the participant.

Although the results are encouraging, there are several limitations that future research should address. First, it’s possible that acquisition for exchanging icons for the playing cards and the shark bite game was influenced by the acquisition for exchanging the icon for iPad. Skill acquisition for the shark bite game icon was achieved quickly and it cannot be determined if

acquisition would have been similar if previous acquisition for icon exchanges for other preferred items had not occurred first. However, carryover effects to other preferred items may be advantageous in a clinical setting, as the practitioner may not need to teach each individual picture exchange.

Second, only Phase I of PECS was targeted, and the other phases were not implemented. Therefore, it is unclear if skill acquisition would have been acquired for the other phases (i.e., Phases II-VI). Future research should examine implementation of all phases of PECS with adults. Next, only one participant was included. Therefore, future research should target multiple participants. Fourth, only three preferred items were used in the current study and generalization and maintenance data were not collected. Thus, it is not clear if independent icon exchanges would occur for other preferred items. However, the preferred items were targeted based on what the participant selected during preference assessments and data showed that the participant actively engaged with preferred items after exchanging the icon. Finally, although some previous research has shown reductions in maladaptive behavior following PECS implementation, the current study did not examine this variable, so future research should examine this. Despite limitations, overall, the current study demonstrates preliminary evidence of the effectiveness of Phase I of PECS for an adult with intellectual and developmental disabilities. Given the lengthy history of the participant requiring assistance with communication, any increases in independent communication can be considered an important contribution.

References

Barlow, K. E., Tiger, J. H., Slocum, S. K., & Miller, S. J. (2013). Comparing acquisition of exchange-based and signed mands with children with autism. *The Analysis of Verbal Behavior*, *29*(1), 59–69. https://doi.org/10.1007/bf03393124

Battaglia, D., & McDonald, M. (2015). Effects of the picture exchange communication system (PECS) on maladaptive behavior in children with autism spectrum disorders (ASD): A review of the literature. *Journal of the America Academy of Special Education Professionals*, 8-20.

Bondy, A., & Frost, L. (2021, December 3). *Picture exchange communication system (PECS)®*. Pyramid Educational Consultants. https://pecsusa.com/pecs/

Charlop-Christy, M. H., Carpenter, M., Le, L., LeBlanc, L. A., & Kellet, K. (2002). Using the picture exchange communication system (PECS) with children with autism: Assessment of PECS acquisition, speech, social-communicative behavior, and problem behavior. *Journal of Applied Behavior Analysis*, *35*(3), 213-231. https://doi.org/10.1901/jaba.2002.35-213

Cooper, J, O., Heron, T, E., & Heward, W, L. (2020). *Applied behavior analysis* (3rd ed.). Pearson Education.

Doherty, A., Bracken, M., & Gormley, L. (2018). Teaching children with autism to initiate and respond to peer mands using picture exchange communication system (PECS). *Behavior Analysis in Practice*, *11*(4), 279–288. https://doi.org/10.1007/s40617-018-00311-8

Hughes-Lika, J., & Chiesa, M. (2020). The picture exchange communication system and adults lacking functional communication: A research review. *European Journal of Behavior Analysis*, *22*(1), 40–58. https://doi.org/10.1080/15021149.2020.1815507

Kennedy, C. H. (2005). *Single-case designs for educational research*. Pearson.

Kunnavatana, S. S., Wolfe, K., & Aguilar, A. N. (2018). Assessing mand topography preference when developing a functional communication training intervention. *Behavior Modification, 42*(3), 364-381. https://doi.org/10.1177/0145445517751437

Landa, R., & Hanley, G. P. (2016). An evaluation of multiple-schedule variations to reduce high-rate requests in the picture exchange communication system. *Journal of Applied Behavior Analysis*, *49*(2), 388–393. https://doi.org/10.1002/jaba.285

Marckel, J. M., Neef, N. A., & Ferreri, S. J. (2013). A preliminary analysis of teaching improvisation with the picture exchange communication system to children with autism. *Journal of Applied Behavior Analysis*, *39*(1), 109-115. https://doi.org/10.1901/jaba.2006.131-04

Mayer-Johnson, Inc. (2002). *Boardmaker*.

McCoy, A., & McNaughton, D. (2019). Training education professionals to use the picture exchange communication system: A review of the literature. *Behavior Analysis in Practice*, *12*(3), 667–676. https://doi.org/10.1007/s40617-018-00296-4

Rosales, R., & Marin-Avelino, Y. (2022). The picture exchange communication system. In J. B. Leaf, J. H. Cihon, J. L. Ferguson, & M. J. Weiss (Eds.), *Handbook of applied behavior analysis interventions for autism: Intergrading research into practice* (pp. 361–374). Springer Cham.

Skinner, B. F. (1957). *Verbal behavior*. Appleton-Century-Crofts.

Tager-Flusberg, H., & Kasari, C. (2013). Minimally verbal school-aged children with autism spectrum disorder: The neglected end of the spectrum. *Autism Research*, *6*(6), 468–478. https://doi.org/10.1002/aur.1329

Treszl, A., Koudys, J., & O'Neill, P. (2021). Evaluating the effects of picture exchange communication system ® mediator training via telehealth using behavioral skills training and general case training. *Behavioral Interventions*, *37*(2), 290–305. https://doi.org/10.1002/bin.1835

Ziomek, M. M., & Rehfeldt, R. A. (2008). Investigating the acquisition, generalization, and emergence of untrained verbal operants for mands acquired using the picture exchange communication system in adults with severe developmental disabilities. *The Analysis of Verbal Behavior*, *24*(1), 15–30. https://doi.org/10.1007/bf03393054

Table 1

PECS Phase I Implementation Procedures

Step	Description
The structured training environment	The learner and two trainers are in the same setting. Trainer one, the communicative partner, remains in front of the learner and trainer two, the physical prompter, remains behind the learner.
Communicative partner's responsibilities	Entice the learner, reinforce the leaner's exchange within ½ of a second, pair social praise with tangible reinforcement, deliver open hand prompt in a timely manner.
Physical prompter's responsibilities	Wait for the learner's initiation, deliver physical prompts to the learner to exchange the picture icon, and systematically fade prompts.
Teaching the physical assisted exchange	The practitioner arranges the training environment by providing one picture at a time, positioning the communicative partner appropriately, and enticing the learner with the reinforcer. The communicative partner opens their hand, the learner reaches towards the desired item, in which the physical partner redirects the learner by providing a full physical prompt.

Figure 1

Percentage of Independent Icon Exchanges Prior to Current Study

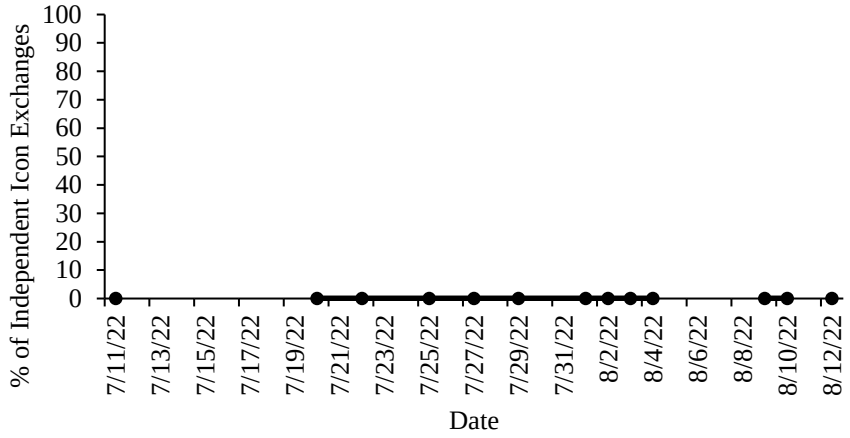


Figure 2

Percentage of Independence for PECS Phase I Icon Exchanges

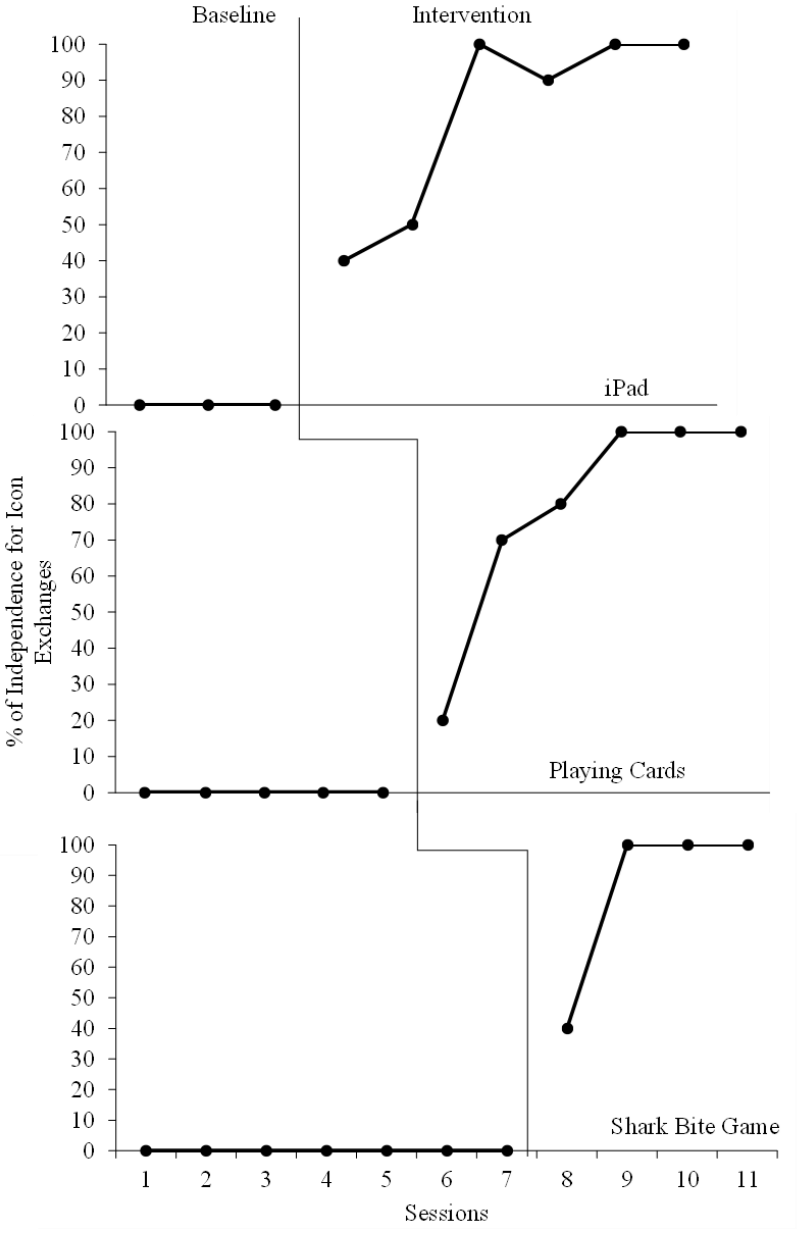
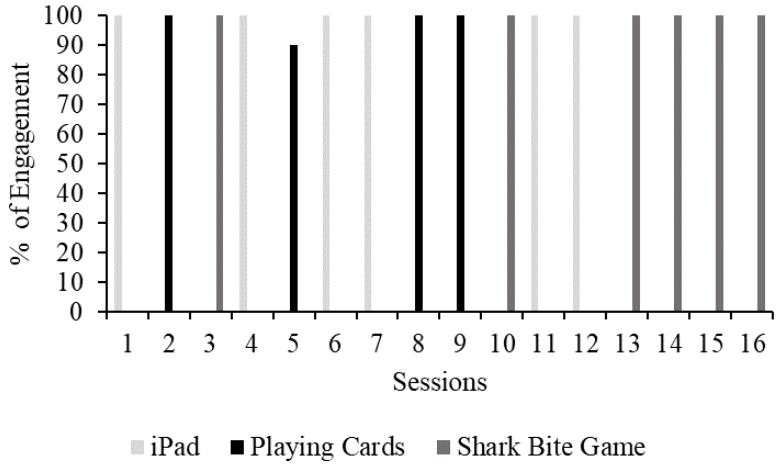


Figure 3

Percentage of Engagement with Preferred Item After Icon Exchanges



Appendix A

PECS Phase I©

Student:

Staff Initials	Date	Activity	Item	Pick-Up	Reach	Release	Open Hand
				FP PP +	FP PP +	FP PP +	YES No
				FP PP +	FP PP +	FP PP +	YES No
				FP PP +	FP PP +	FP PP +	YES No
				FP PP +	FP PP +	FP PP +	YES No
				FP PP +	FP PP +	FP PP +	YES No
				FP PP +	FP PP +	FP PP +	YES No
				FP PP +	FP PP +	FP PP +	YES No
				FP PP +	FP PP +	FP PP +	YES No
				FP PP +	FP PP +	FP PP +	YES No
				FP PP +	FP PP +	FP PP +	YES No
				FP PP +	FP PP +	FP PP +	YES No
				FP PP +	FP PP +	FP PP +	YES No
				FP PP +	FP PP +	FP PP +	YES No
				FP PP +	FP PP +	FP PP +	YES No
				FP PP +	FP PP +	FP PP +	YES No
				FP PP +	FP PP +	FP PP +	YES No
				FP PP +	FP PP +	FP PP +	YES No
				FP PP +	FP PP +	FP PP +	YES No
				FP PP +	FP PP +	FP PP +	YES No
				FP PP +	FP PP +	FP PP +	YES No
				FP PP +	FP PP +	FP PP +	YES No
				FP PP +	FP PP +	FP PP +	YES No
				FP PP +	FP PP +	FP PP +	YES No
				FP PP +	FP PP +	FP PP +	YES No
				FP PP +	FP PP +	FP PP +	YES No
				FP PP +	FP PP +	FP PP +	YES No
				FP PP +	FP PP +	FP PP +	YES No
				FP PP +	FP PP +	FP PP +	YES No
				FP PP +	FP PP +	FP PP +	YES No
				FP PP +	FP PP +	FP PP +	YES No
				FP PP +	FP PP +	FP PP +	YES No
				FP PP +	FP PP +	FP PP +	YES No
				FP PP +	FP PP +	FP PP +	YES No
				FP PP +	FP PP +	FP PP +	YES No
				FP PP +	FP PP +	FP PP +	YES No
				FP PP +	FP PP +	FP PP +	YES No
				FP PP +	FP PP +	FP PP +	YES No
				FP PP +	FP PP +	FP PP +	YES No
				FP PP +	FP PP +	FP PP +	YES No
				FP PP +	FP PP +	FP PP +	YES No

FP= Full Physical Prompt	**PP** = Partial Physical Prompt	**+** = Independent
YES = The open hand is still visible	NO = The open hand has been faded	

Appendix B

Student Name: _____

Paired Stimulus Preference Assessment (8-Item)

This assessment is based upon the procedures described by Fisher et. al., 1992.

Assessment Start Date: _____
Assessment End Date: _____

Stimulus Number	Stimulus Name	Number of Times Each Stimulus was Approached
1		
2		
3		
4		
5		
6		
7		
8		

Directions: Record the student's selection by circling the appropriate number on the data sheet. Record "NR" for no response.

Trial	Left position	Right position	Notes
1	1	2	
2	3	4	
3	5	6	
4	7	8	
5	2	3	
6	4	5	
7	6	7	
8	8	1	
9	1	3	
10	2	4	
11	3	5	
12	4	6	
13	5	7	
14	6	8	
15	7	1	
16	8	2	
17	1	4	
18	3	6	
19	5	8	
20	7	2	
21	2	5	
22	4	7	
23	6	1	
24	8	3	
25	1	5	
26	2	6	
27	3	7	
28	4	8	

Trial	Left position	Right position	Notes
29	1	7	
30	2	8	
31	4	1	
32	6	3	
33	8	5	
34	2	7	
35	5	2	
36	7	4	
37	1	6	
38	3	8	
39	5	1	
40	6	2	
41	7	3	
42	8	4	
43	2	1	
44	4	3	
45	6	5	
46	8	7	
47	3	2	
48	5	4	
49	7	6	
50	1	8	
51	3	1	
52	4	2	
53	5	3	
54	6	4	
55	7	5	
56	8	6	

Appendix C

Date: _____
Client Initials: _____
Implementer: _____

Instructions: List the picture icon in the left column and record if the client engaged with the stimulus after exchanging the icon.

Picture icon	Did client engage with stimulus during the session?
1.	Yes, No
2.	Yes, No
3.	Yes, No
4.	Yes, No
5.	Yes, No
6.	Yes, No
7.	Yes, No
8.	Yes, No
9.	Yes, No
10.	Yes, No

Appendix D

Staff name: _____	Date: _____		
Integrity Check for:	Client: _____		
Necessary materials are available?	Yes	No	No opportunity
Implementer recorded the appropriate response (i.e., Prompted, Independent) for pick-up, reach, and release sequence?	Yes	No	No opportunity
Reinforcer delivered within 0-3 seconds?	Yes	No	No opportunity
Desired number of trials were implemented?	Yes	No	No opportunity
Full physical prompts were systematically faded?	Yes	No	No opportunity

Staff score (# of yes/total number of opportunities): _____

Observer signature: _____

Notes:

_____
_____
_____
_____
_____
_____

Verbal feedback has been provided Yes No

Written feedback has been provided Yes No Staff signature:

_____

Appendix E

1 – strongly disagree 2 – disagree 3 – neutral 4 – agree 5 – strongly agree

Since the PECS intervention, I have observed a reduction in maladaptive behavior.
1 2 3 4 5

My client mands independently using PECS.

1 2 3 4 5

PECS intervention has increased my client's functional communication.

1 2 3 4 5

This study was socially significant and valid for my client.

1 2 3 4 5

Additional
Comments:_____
_____
_____
_____