

**Evaluating the Effects of Picture Exchange Communication System® (PECS®) Mediator  
Training Via Telehealth Using Behavioural Skills Training and General Case Training**

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## Abstract

The Picture Exchange Communication System® (PECS®) is often used by children diagnosed with autism spectrum disorder (ASD) as a means of functional communication. Although there is extensive research indicating that PECS is an evidence-based intervention for children with ASD (e.g., Wong et al., 2015), little is known about how best to train parents to support their child's PECS use. Of those studies that do explore parent training approaches, few measure the caregiver's fidelity implementing PECS or explore whether parents generalize or maintain skills post-training. Similarly, little is known about how to train parents to implement PECS via telehealth. The purpose of the current study was to bridge the gap between PECS and telehealth research and to explore strategies to help parents support their child's PECS use at home. One father-mother dyad was recruited. The father was the primary training recipient (i.e., parent trainee). The mother participated in training sessions as the role play partner (i.e., surrogate parent). Researchers used behavioural skills training (BST) to teach target PECS skills and applied strategies of general case training (GCT) to actively program for generalized behaviour change. A multiple baseline design across skills was used to monitor the father's fidelity during mediator training sessions and a multiple probe design was embedded to monitor both the father's and mother's fidelity in the natural environment with their child. Results demonstrated that the parent trainee acquired PECS skills within the training setting. However, parents did not reliably demonstrate all of the PECS skills in the generalization setting during follow-up.

*Keywords:* autism, Picture Exchange Communication System, parent training, generalization, telehealth

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## **Evaluating the Effects of Picture Exchange Communication System® (PECS®) Mediator Training Via Telehealth Using Behavioural Skills Training and General Case Training Autism Spectrum Disorder**

The Diagnostic and Statistical Manual of Mental Disorders, 5<sup>th</sup> Edition, (DSM-5; American Psychiatric Association, 2013) specifies two domains for diagnosing autism spectrum disorder (ASD). The first domain is deficits in social communication and interaction. The second is restricted, repetitive patterns of behaviour, interests, or activities. Within the first domain, three diagnostic criteria are specified. The first criterion is deficits in social-emotional reciprocity, which is described as a lack of sharing interests or emotions and failure to initiate or reciprocate social interactions. The second is deficits in nonverbal communicative behaviours, which also pertains to social interactions and the inability to express or decode facial expressions, body language, and deficiencies in eye contact. The third criterion is deficits in developing, maintaining, and understanding relationships, which may include difficulties behaving suitably in different social contexts. Depending on the severity of ASD symptoms, individuals may have limited or no speech (Greenberg et al., 2012). Communication deficits have been identified in children as young as 12 months of age (Horovitz & Matson, 2010; Mody, et al., 2017). Approximately 33%–50% of children diagnosed with ASD remain mute and are unable to functionally speak (Horovitz & Matson, 2010). Due to these social communication deficits, it can be difficult for some individuals diagnosed with ASD to form meaningful relationships and experience a sense of belonging in the community.

### **Picture Exchange Communication System**

One of the most commonly used augmentative and alternative (AAC) systems is the Picture Exchange Communication System (PECS), which was developed by Bondy and Frost

(1994). There is an abundance of research supporting positive social and communicative outcomes associated with the use of PECS (e.g., Carre, et al., 2009; Flippin, et al., 2010). PECS research has shown some association with speech development and other significant benefits like reduced levels of aggression and frustration (e.g., Bondy & Frost, 1994). PECS allows individuals with communication deficits to initiate and engage in meaningful interactions (i.e., social approach, engagement, and reciprocity) with people in their environment (Bondy, 2001; Carre, et al., 2009; Charlop-Christy, et al., 2002). PECS training involves multiple phases that gradually teach users appropriate communicative behaviours (Frost & Bondy, 2006). PECS users are taught alternative communicative behaviours and those behaviours are differentially reinforced throughout several phases in PECS training. Initially, in Phase 1, PECS users give a communicative partner a single picture in exchange for a desired item or activity. This teaches PECS users to initiate social interaction to access preferred items/activities. The picture exchange mimics typical communicative interactions, during which the speaker's actions are reinforced by the behaviour of the listener. Phase 2 aims to strengthen communicative skills by increasing the distance between the PECS user and the communicative partner and the PECS binder. Increasing distance and persistence skills enhance the PECS user's ability to engage in and initiate communicative interactions. In Phase 3 picture discrimination is taught. Correspondence checks are conducted within this phase to ensure the user is accurately using the associated picture to request desired stimuli. To determine if the PECS user can properly discriminate between the various pictures, after accepting the picture, the communicative partner must present both items and only allow access if the PECS user selects the corresponding item. If the PECS user does not demonstrate correspondence between the exchanged picture and the item he/she reaches for, error correction procedures are implemented to facilitate picture

discrimination. Phase 4 introduces sentence structure by teaching the learner to arrange a sequence of pictures on a sentence strip. Phases 5 and 6 teach PECS users how to respond to simple questions and to use the system for communication purposes other than requesting.

### **PECS Mediator Training**

Training parents to implement PECS with their child promotes generalization of the PECS user's communication skills and increases the social validity of the functional communication system (Frost & Bondy, 2006). Although it is commonly reported that children receive AAC or PECS training in educational settings, and occasionally in the home environment, parents are rarely concurrently trained on how to implement these communication systems at home (Jurgens et al., 2012; Moorcroft et al., 2019). This oversight significantly limits parents' ability to support their child's communication and may lead to system abandonment (Moorcroft et al., 2019). In the literature, there are limited studies that focus on teaching parents how to implement PECS (e.g., Carson et al., 2012; Chaabane et al., 2009; Park et al., 2011). Studies that did include parent training in PECS implementation commonly used Behavioural Skills Training (BST; Alsayedhassan et al., 2016). BST involves a variety of components, including instructions, modelling, practice, and feedback (Miltenberger, 2008). Despite the use of BST in these studies, direct data related to the parent's accuracy implementing PECS, or their adherence to protocols when implementing PECS (i.e., treatment fidelity), were not shared. Rather, in much of the current PECS parent training literature, researchers measured the child's accuracy using PECS and neglected to measure the parent's treatment fidelity when supporting their child's PECS use.

For example, Chaabane and colleagues (2009) used a multiple baseline design across manding behaviours to investigate the effects of parent-implemented PECS training, and to

measure the child's accuracy of communicative exchanges using pictures that correlate with preferred items. To implement PECS, two mothers (30 and 45 years old) and their two children with ASD (5 and 6 years old) were trained by the experimenters using BST procedures. Both mothers had to achieve 90% accuracy implementing PECS for three consecutive sessions and were retrained if their performance scored below 80%. All training sessions, for both the mothers and children, were conducted in their homes and the duration of sessions ranged from 10 to 30 min. Results indicated that in comparison to baseline, both child participants had higher levels of accuracy for generalized requests (i.e., using novel pictures) following parent training. This study suggests that parents are capable of implementing PECS and suggests BST is an effective training method; however, experimenters did not specifically report the accuracy of mothers' performance or their adherence to PECS protocol (i.e., treatment fidelity) during the study. Further, no data were collected to determine if the mothers' maintained their skills following the study or if they generalized their PECS implementation skills to other settings.

Park and colleagues (2011) also conducted a parent training study using a changing criterion design to evaluate the effects of mothers implementing PECS with their children. Three child participants who were between 2–3 years of age, were diagnosed with ASD, and were recommended for an ACC but had no previous PECS training were included in the study. Mothers of the participants were between 33–35 years of age and had no previous training in how to implement PECS. Parent training sessions were roughly 60 min in duration, conducted at home, and without the child present. Experimenters provided mothers written instructions, modelled procedures, showed a video clip, and instructed the mothers to continue practicing procedures until they achieved 90% accuracy across three consecutive trials. Experimenters observed the mothers' performance and gave corrective feedback when necessary. However, the

mothers' specific level of adherence to PECS protocol (i.e., treatment fidelity) was not reported. Data were only collected and reported on the children's accuracy using PECS. Additionally, the mothers' treatment fidelity was not reported or monitored post-training. Park and colleagues (2011) failed to investigate whether mothers generalized or maintained PECS skills following the study. The lack of data collected on parent behaviour across parent training studies in the current literature is an omission this study is intended to address.

### **Generalization and Maintenance**

Generalization is demonstrated when a taught behaviour occurs in an untrained setting, with untrained stimuli, or a behaviour functionally related to a trained behaviour happens without direct training (Cooper et al., 2020). Effective generalization training facilitates the use of communicative behaviours across settings, stimuli, and communicative partners. As a result, these behaviours are more likely to occur throughout the PECS user's life. The PECS training protocol emphasizes the importance of contriving frequent communication opportunities, across various settings and events, to support generalized PECS use (Frost & Bondy, 2006). To this end, many studies have investigated PECS user's generalized PECS skills (e.g., measuring the child's stimulus generalization and discrimination skills [Chaabane et al., 2009], evaluating PECS user's skills across trained and untrained settings [Carson et al., 2012; Greenburg, et al., 2012], and PECS use across multiple communicative partners [Park et al., 2011]). Of these studies, results revealed that PECS user's generalized skills across stimuli (e.g., Chaabane et al., 2009), settings (e.g., Carson et al., 2012; Greenburg et al., 2012), and communicative partners (e.g., Park et al., 2011). However, other studies that investigated generalized PECS use reported that participants did not reliably demonstrate generalized behaviour change across settings (e.g., Greenburg, et al., 2012). Stokes and Baer (1977) declare that generalization does not naturally

occur as a consequence of behaviour change programming, rather it must be actively planned. Therefore, behavioural interventions must strategically incorporate approaches to facilitate generalized behaviour change. This tends to be overlooked or neglected in many published studies that involve training parents to teach and/or support PECS use (Alsayedhassan et al., 2016).

Similar gaps in the literature exist concerning the maintenance of PECS skills. Maintenance refers to the continuation of skills long-term or lasting behaviour change in the absence of the intervention (Cooper et al., 2020). Since parent behaviour is rarely measured in studies that train PECS implementation there is very little data reporting whether parents maintain high treatment fidelity after training. Often when maintenance of the parents' acquired skills is assessed, data are collected through indirect measures (i.e., parent report; Guðmundsdóttir et al., 2017; Heitzman-Powell et al., 2013). Some PECS studies monitor the maintenance of the PECS user's communication skills (e.g., Christy-Charlop et al., 2002; Jurgens et al., 2018; Park et al., 2011). However, the lack of data reporting or directly measuring parent's implementation skills post-training is a substantial gap in the current research.

### **General Case Training (GCT)**

GCT is an approach that actively programs for generalized behaviour change. GCT involves strategically incorporating a variety of stimuli and responses when training target behaviours related to a particular task or situation. For example, GCT methods have been utilized to teach staff and parents how to implement behavioural programming (e.g., Alaimo et al., 2017; Ducharme & Feldman, 1992; Ward-Horner & Sturmey, 2008), to teach staff how to conduct language and response chaining programs (e.g., Seiverlong et al., 2010), and to teach individuals how to use a variety of vending machines (e.g., Sprague & Horner, 1984). GCT is different than

other teaching strategies because it exposes learners to a range of variables (i.e., alternative settings, diverse stimuli, multiple people) while applying target skills (Chadsey-Rusch et al., 1993). The target skill must be taught in various ways and by using diverse stimuli to prepare the learner for all possible circumstances that could arise in their natural environment (Steere et al., 1989). For example, not every vending machine is alike as they vary in colour, size, and function and some are more technologically advanced than others. Horner and his colleagues (1982) recommend professionals adhere to the following criteria when using GCT: (a) define the range of situations the learners must demonstrate the target behaviour(s) within, (b) identify relevant variations in stimuli and responses, (c) select the order of examples that should be presented, and (d) decide what setting is best for a training environment.

Sprague and Horner (1984) conducted a study using a multiple baseline design across students, to compare single instance, multiple instances, and GCT procedures when teaching intellectually disabled students how to use vending machines. Six students participated in this study who were between 15–19 years of age and were recruited from special needs classrooms from two different high schools. Before the study, none of the participants had been formally taught how to use vending machines and could not distinguish or discriminate the value of different coins. Probe data were collected, and training sessions took place, in locations where students would commonly see vending machines (e.g., school hallways, community recreational centres, hospital lobby, laundromat, and in a lunchroom/cafeteria of a nearby public service building). In baseline, each student was presented with the same ten vending machines, given the appropriate amount of money, and instructed to buy the item allocated. Researchers graphed a single data point representing each students' ability to operate a vending machine, across all ten machines probed. During the single instance training, students were individually trained on how

to use a single vending machine. Training sessions were 30 min in duration, occurred at least four times a week, and consisted of 3-15 trials. During sessions, participants practiced purchasing different items in each trial. Experimenters used verbal and physical prompts during training and gave verbal praise immediately following correct responses. The multiple instance training procedures were the same as single instance training sessions; however, students were exposed to three vending machines that were functionally similar to each other. Training procedures were also replicated for the GCT sessions, but the training exemplars (i.e., vending machines) used in the training sampled the entire range of stimulus and response variations required to use a variety of machines. Results demonstrated almost no change in behaviour between baseline and single instance training. Following multiple instance training, some students demonstrated the ability to perform some steps correctly that were required to purchase items from a vending machine. However, none of the students' demonstrated the ability to correctly perform all of the steps required to purchase items across a variety of untrained machines until exposed to GCT. Following GCT sessions, all six students demonstrated the ability to perform all steps required to purchase items, across 10 untrained vending machines.

### **Combining BST and GCT**

Only one published study to-date has incorporated both BST and GCT to enhance language training. Seiverling and colleagues (2010) combined BST and GCT strategies when training three staff members to implement Natural Language Paradigm (NLP) teaching strategies. NLP is a less structured approach of discrete trial training designed to increase verbal behaviour by modelling a target vocalization and then providing reinforcement once the learner imitates the target response or emits a vocal approximation (Koegel et al., 1987). The three staff members were between 23–42 years of age and the child participants were between 40–49

months old. To assess if combining BST and GCT procedures was an effective approach to train staff to conduct NLP teaching, researchers used a multiple baseline across staff-child dyads. Seiverling and colleagues (2010) used components of BST (e.g., instructions, modelling, rehearsal, and feedback). During training sessions, staff were required to perform ten trials of NLP with a researcher simulating child responses. Six scripts were used throughout training sessions to incorporate GCT methods, as the researcher exhibited a range of child responses (e.g., maladaptive behaviour, inaccurate vocal approximations, no eye contact). Staff were exposed to the scripts in a similar sequence for the initial training session and then the sequence of scripts was varied throughout the training. All staff members achieved or exceeded a mastery criterion of 90% for at least three of the four training sessions. Results showed that all three staff members exhibited correct NLP procedures and maintained performance levels of 90% or higher. Despite positive results such as these, there is no current research utilizing GCT to enhance generalized behaviour change when instructing parents to implement communication training such as PECS.

### **Vicarious Learning**

Vicarious learning, sometimes described as observational learning, refers to attentively observing another individual's behaviours in an instructional or training setting and learning from those experiences without any hands-on or direct training (Myers, 2018). This perspective suggests that people can learn behaviour as a side-effect of observing and interacting with others. Research suggests that individuals can effectively be taught new behaviours by observing models, scoring or assessing behaviours observed, and subsequently can imitate target behaviours (Eid et al., 2017; Myers, 2018; Stegman, 2012). Eid and colleagues (2017) conducted a parent training study to teach parents how to implement NLP strategies with their child. The

purpose of this study was to investigate if parents could learn target skills by observing other parents being directly trained. Six parents participated in the study, creating three trainee-observer dyads. A therapist used BST components (i.e., instructions, models, rehearsal, feedback) to train parent trainees while the parent observers watched closely. Both trainees and observers were provided the same instructions. Parent observers were told to pay close attention and try to retain as much as of the training as possible. The results indicated that all three observer's performance increased after observing other parents receive BST training. However, only one observer achieved the mastery criterion by observational learning alone and did not require additional training. Therefore, the results of this study suggest the effectiveness of observational learning may fluctuate across learners. To-date, no studies have explored the impact of vicarious learning on parents' PECS implementation skills.

### **Telehealth**

The majority of studies previously described in this paper conducted training face-to-face, either in the participant's home or in a clinical/educational setting (e.g., Chaabane et al., 2009; Park et al., 2011; Seiverling et al., 2010; Sprague & Horner, 1984). Few studies have investigated the nature and outcomes of delivering training to parents virtually using a telehealth model (Parsons et al., 2017). Telehealth is a relatively modern practice that refers to the use of communication technologies to offer professional and therapeutic services to consumers virtually (Sutherland, et al., 2018). Sutherland and colleagues (2018) reviewed the telehealth literature and found only fourteen studies that involved parent training which also examined the participants' applications of behavioural interventions and assessments. Similar to the PECS literature, the majority of telehealth studies involving parent training directly measured child outcomes and neglected to directly measure parent behaviour (e.g., Vismara et al., 2013; Wacker et al., 2013).

Several studies that conducted parent training via telehealth used Likert rating scales to measure social validity or to score target parent behaviours as a fidelity tool (e.g., Vismara et al., 2013) instead of directly measuring parent behaviour.

Suess and colleagues (2014) were one of the few telehealth studies that directly measured child and parent behaviours. Suess and colleagues (2014) trained parent participants how to conduct a Functional Analysis (FA) and Functional Communication Training (FCT) treatment package using a multi-element design. Across participants, the modality of FCT was vocal mands (i.e., emitting 1-2 words) or gestures (i.e., pointing). Parents were trained virtually via telehealth and were provided an electronic manual that explained the purpose of the treatment package. Suess and colleagues (2014) did not train parents using all components of BST as they foresaw limitations modelling treatment procedures via telehealth. Therefore, the training relied on descriptive verbal instructions and timely feedback. Coached sessions occurred once a week, for 1 hour and involved the behaviour consultant instructing parents how to set up the environment and coaching them to implement FCT trials with their child. Once parents completed at least ten coached sessions, they were instructed to record approximately four independent sessions per week while implementing FCT with their child and to send the recordings to the behaviour consultant for feedback. The behaviour consultant collected treatment fidelity data on the parent's behaviour across coached and independent sessions during FCT trials using a task analysis (TA) specific to the child's treatment program. For each step of the TA, data were recorded as correct, incorrect, or not applicable. The TA served as a prompt for the behavioural consultant to know when to coach the parent to implement certain steps of the program, but the parent never saw the TA during treatment. Results from the study supported the use of telehealth to train parents to implement behavioural treatments. The average

percentage of steps implemented correctly by the three parents varied across treatment, but all of the parent's fidelity increased compared to baseline. Percentage of steps implemented correctly was similar across coached and independent sessions for all three parents throughout the study. This study is one of the few studies that collected direct treatment fidelity data on the parent's behaviour outside of training sessions; however, they did not specifically assess generalized skill use since the coaching sessions took place in the same room as the independent sessions (i.e., the participant's living room) and parents were trained with the child present during both types of sessions.

### **Gaps in PECS Research**

As mentioned previously, few studies that trained parents PECS implementation skills directly measured parent behaviour (e.g., Carson et al., 2012; Park et al., 2011). Although research suggests BST is an effective teaching strategy (e.g., Chaabane et al., 2009; Park et al., 2011) studies do not explicitly report parent treatment fidelity. Further, since generalization and maintenance of parent behaviour are often not reported, there is no empirical evidence that indicates BST results in generalized or maintained behaviour change in terms of parent's PECS implementation. Therefore, it is unknown if BST is the most effective method to train PECS implementation skills (Rosales et al., 2009). Although GCT has been used to enhance skill generalization (i.e., Alaimo et al., 2017; Ducharme & Feldman, 1992; Seiverling et al., 2010) the use of PECS and GCT together has not been explored in relation to parent training in PECS. Further, within the current research literature, there has not been a telehealth study that conducts parent training on PECS implementation skills. Given the need to expand effective services to rural and remote communities, and the recent concern of the COVID-19 global pandemic, telehealth interventions that train parents to effectively implement PECS, and to generalize their

PECS teaching skills beyond the training setting, are essential. This study attempts to bridge the gaps within the telehealth and PECS literature by exploring the effects of a telehealth intervention, using BST and GCT procedures, on parent PECS training skills, as well as child PECS use.

### **Research Questions**

The purpose of this research was to determine:

1. Does the combination of BST and GCT delivered through a telehealth format effectively improve parents' PECS implementation skills (i.e., result in high treatment fidelity) in the training environment?
2. Does this training strategy facilitate parent PECS implementation skills in the natural environment with their child (i.e., produce generalized behaviour change)?
3. Does participation in this training improve PECS implementation skills (i.e., result in vicarious learning) for a parent who does not directly engage in PECS practice or receive direct instruction and feedback?
4. Does improved parent PECS treatment fidelity influence child PECS accuracy?

### **Methods**

#### **Participants**

One parent dyad and their child were recruited for this study. Child participant inclusion criteria were as follows: (a) diagnosis of ASD, (b) already using PECS to communicate, and (c) no history of engaging in significant challenging behaviour (e.g., property destruction, extreme tantrums, self-injury, aggression, disruptive behaviour). Current PECS users were recruited as it is not uncommon for children to be trained to use PECS, while their parents are not (Moorcroft et al., 2019) and the purpose of this study was to explore parents' response to training as opposed to

child PECS outcomes. Similarly, children with severe challenging behaviours were excluded because exploring effective training methods to teach PECS implementation was the primary focus, as opposed to the use of PECS to reduce the occurrence of challenging behaviour. Parent participant inclusion criteria were as follows: (a) parents had not previously received formal PECS training (i.e., hands-on PECS coaching, online PECS modules, official PECS training/workshops), (b) both parents were available for training sessions at least twice a week (45 min–60 min per session), (c) parents had access to a secure and password-protected internet source, and (d) parents understood spoken and written instructions in English. Participants were recruited from an ABA service provider near Brantford, Ontario who had several clients using PECS and whose parents had not yet received training in PECS. Information about the study was distributed to families who met the inclusion criteria through the ABA service provider. Only one family expressed interest in participating.

The father (Jeffrey, age 39) and mother (Kate, age 35) were both Caucasian and had university education. Parents had not received any formal or community-based training in PECS before this study. Kate had been present for speech and language therapy sessions when her child was first introduced to PECS, but sessions primarily involved the Speech and Language Pathologist (SLP) working with the child; parent training was not a component of these sessions. Jeffrey participated in this study as the *parent trainee*. During training sessions, he received all components of the training (i.e., instructions, modelling, practice, and feedback). Kate participated in this study as the *surrogate parent*. During training sessions, she followed a script and played the role of the child in a variety of scenarios for Jeffrey to practice implementing target PECS skills. Kate did not receive any direct training or feedback on her behaviour throughout the study.

The child participant, Noah, was a 4-year-old male diagnosed with ASD. Noah was introduced to PECS by his SLP approximately two years before the study. Noah also began receiving Applied Behaviour Analysis (ABA) services, at a community provider which included PECS training, approximately six months before the study. However, Noah's ABA services were disrupted due to the COVID-19 pandemic. As such, Noah had only received approximately three months of ABA before the start of the study. Due to the restrictions imposed by COVID-19 and physical distancing recommendations, it was not possible to directly assess Noah's communication skills to determine his current PECS phase. Therefore, researchers obtained consent from Noah's parents to contact Noah's ABA team to obtain information regarding his PECS use. Noah's ABA supervisor has been a Board Certified Behaviour Analyst (BCBA) since 2018 and is a member of the Ontario College of Teachers (OCT) since 1993. She has over twenty years' experience working with children with complex communication needs and has attended the official PECS training created by Dr. Andy Bondy and Ms. Frost (the creators of PECS) provided by Pyramid Educational Consultants. She reported that Noah was using PECS Phase 4 when enrolled in services. However, direct data collected by the ABA team indicated that he had a limited selection of reinforcers, and although he demonstrated early PECS skills (i.e., picture exchange Phase 1, persistent communication Phase 2), he made frequent picture discrimination (i.e., Phase 3a/b), and sentence structure (Phase 4) errors. As such, the ABA team advised the researchers to teach the family Phase 3B PECS skills as the child was a persistent communicator but would benefit from additional picture discrimination training. Further, if the parents learned Phase 3B skills it would give them the tools required to help expand Noah's vocabulary and would ensure his communication system kept up with his interests.

## **Setting and Materials**

All research activities (i.e., participant recruitment meetings, ABA team consultation, research sessions) were conducted virtually using a secure, video-conferencing platform (i.e., Lifesize®). Training sessions with the parents usually took place in the family's kitchen at the table. However, a couple of sessions took place downstairs in their basement (i.e., rec-room). Sessions designed to assess parent generalization were conducted in the natural environment in a variety of rooms within the family's home (i.e., dining room table, living room, child's bedroom) as chosen by the family.

For each training session, parents were instructed to have an assortment of toys and food items (i.e., 5 -10), a PECS binder with pictures that matched the array of practice materials, written instructions (Jeffrey), and the session outline (Kate). Written instructions were provided in the form of a treatment fidelity checklist. Items on the treatment fidelity checklist were associated with the specific skill being taught that session (e.g., setting up a communication opportunity, discrimination training, error correction; Appendix A). Parents downloaded Lifesize software and called the researcher's extension number to meet virtually every session.

## **Experimental Design**

A multiple baseline design across behaviours (i.e., PECS skills) was used to monitor the impact of the PECS mediator training on Jeffrey's behaviour (described below). Three different PECS skills were taught to Jeffrey and his treatment fidelity implementing each skill was directly monitored. A multiple probe design was used to monitor the effects of the PECS mediator training on Jeffrey's treatment fidelity implementing target PECS skills across environments with his child (i.e., generalized behaviour change). A multiple probe design was also used to

monitor the effects of the PECS mediator training on Kate's treatment fidelity and Noah's PECS accuracy in the natural environment.

### **Primary Dependent Variables**

#### ***Parent Trainee Treatment Fidelity***

The primary dependent variable was Jeffery's accuracy of PECS Phase 3B implementation (i.e., treatment fidelity) during sessions across settings: (a) training environment, and (b) natural environment.

***Training Environment.*** Observers collected data from session recordings using the *Parent Treatment Fidelity Checklist* (Appendix A). A correct response was scored "+" for each target behaviour Jeffrey performed accurately. An incorrect response was scored "-" for each target behaviour Jeffrey performed inaccurately. If Jeffrey was not required to demonstrate a target behaviour during certain practice scenarios, data were recorded as "NA" for those steps on the checklist. Data were collected based on operational definitions (see Appendix B). Scores were converted to a percentage by determining the total number of steps implemented correctly for all trials within a session, then dividing this by the total number of required steps across all trials and multiplying by 100. Steps scored as "NA" were not included in the total number of steps. Percentage correct was calculated on Jeffrey's treatment fidelity for each skill (i.e., setting up a communication opportunity, conducting a correspondence check, and PECS four-step error correction).

***Natural Environment.*** To explore Jeffrey's generalized use of PECS 3B implementation skills across settings, people, and stimuli, data were collected in the natural environment while he interacted with Noah using PECS. Using the same *Parent Treatment Fidelity Checklist* (Appendix A), data were collected as described above. Scores were converted to a percentage by

totaling the number of steps implemented correctly for all trials within a session, then dividing by the total number of required steps across all trials (minus the steps scored as “NA”) and multiplying by 100.

## **Secondary Dependent Variables**

### ***Surrogate Parent Treatment Fidelity – Natural Environment***

Data were collected on Kate’s accuracy of PECS Phase 3B implementation (i.e., treatment fidelity) to assess whether her participation in the PECS mediator training, in the absence of direct instruction and feedback, had an effect on her PECS implementation skills in the natural environment. Separate sessions were conducted in the natural environment while Kate interacted with Noah. Treatment fidelity data were collected and analyzed in a manner identical to the data collected for Jeffrey (described above).

### ***Child PECS Accuracy – Natural Environment***

Noah’s accuracy using PECS Phase 3B was represented as the percentage of correct PECS exchanges per session. Observers collected data on Noah’s PECS Phase 3B accuracy on a trial-by-trial basis. An accurate picture exchange was operationally defined as the child independently removing a picture from the PECS binder, placing it in the communicative partner’s hand, and selecting the item that corresponded with the exchanged picture during a correspondence check. An inaccurate picture exchange was operationally defined as the child removing a picture from the PECS binder and failing to exchange the picture within 3 s (i.e., looks at the picture for 4+ s or puts the picture on the table/floor). Examples of an inaccurate picture exchange also included if Noah exchanged a picture that did not make sense in the current context (i.e., exchanged the picture “open” while playing with a ball), or if Noah accessed/attempted to access a desired item/activity without using PECS (i.e., if the child

grabbed/reached for the parent's hand instead of initiating a picture exchange). Operational definitions for accurate and inaccurate picture exchanges reflected specific requirements for PECS Phase 3B as described in the PECS Training Manual (Frost & Bondy, 2006). Scores were converted to a percentage by determining the total number of accurate picture exchanges within a session, then dividing this by the total number of picture exchanges (trials) and multiplying by 100.

### **Independent Variable**

The independent variable was PECS mediator training in the form of BST and GCT. These two teaching approaches were combined and used during sessions conducted in the training environment to teach parents the skills necessary to teach PECS Phase 3B. Procedural integrity was measured on the researcher's performance delivering PECS training to ensure the training was delivered as designed (discussed below).

### ***Target PECS Skills***

Researchers first identified three target skills that mediators are required to implement to effectively teach PECS Phase 3B when following PECS Protocol (Frost & Bondy, 2006). The three skills were: (a) Skill 1, to effectively set up a communication opportunity (i.e., the parent has a variety of possibly preferred items/activities in their control, identifies child's current preferences; see Appendix C), (b) Skill 2, to conduct a correspondence check to make sure the PECS user exchanges the correct picture to request the currently desired item (i.e., offer the item requested and other preferred stimuli while verbally instructing the child to "Take it"; see Appendix D), and (c) Skill 3, to conduct the PECS four-step error correction procedure to correct a discrimination error (i.e., model, practice, switch, repeat; see Appendix E).

***BST + GCT***

To apply BST the following strategies were implemented: (a) written instructions were given for each target skill (see Appendices C, D, E), (b) video models were shown ( $M = 1.3$  min duration; range, 1 min–2 min) to demonstrate and describe each target skill, and live models of various scenarios that sampled a range of environmental variables and child behaviours were provided by the student researcher and a research assistant (RA), (c) the parent trainee then practiced target behaviours during role play with the surrogate trainer across scenarios, and (d) the parent trainee was given feedback and encouraged to practice to criterion ( $\geq 80\%$ ).

To apply GCT strategies, researchers established the instructional universe for each of the three required skills by: (a) defining all parent responses required to teach each PECS 3B skill, (b) defining target child behaviours for each PECS 3B skill, (c) defining possible variations in child behaviours for each PECS 3B skill (e.g., lack of interest, change in motivation), (d) defining possible variations in the nature of reinforcers (e.g., consumables, non-consumables, small/movable items, large/stationary items), and (e) defining possible variations in binder and picture variables (e.g., binder within the child's arms reach, binder across the room, pictures on the cover, pictures inside the binder). Once these variations in stimuli and responses were identified, practice scenarios were created for each target PECS skill. When creating practice scenarios, the student researcher first identified events that occur during a standard, correct picture exchange (i.e., the PECS binder is within the child's reach, parent has control of the desired item, child initiates communication by exchanging a picture, etc.). These variables were then systematically altered to create diverse practice scenarios (e.g., the binder is not within the child's reach, the item is not within the parents' control, the child attempts to take the item, etc.). This process was repeated in a manner that systematically altered parent responses, child

behaviours, and picture, binder and other environmental variables, in order to ensure that practice scenarios included a diverse array of stimuli and events that parents must respond to during a picture exchange. Practice scenarios were unique to each target PECS skill and the number of scenarios varied across skills. Eight practice scenarios were established for Skill 1, six were established for Skill 2, and 4 were established for Skill 3.

The activities described above were completed by the primary student investigator and her thesis supervisor. The student investigator was a master's student studying Applied Disability Studies with a specialization in Applied Behaviour Analysis (ABA). She had PECS Level 1 certification and 3.5 years of clinical experience, including experience implementing PECS with a variety of children between the ages of 3–11 years. The supervisor was an Assistant Professor at Brock University, a clinical psychologist, and Board Certified Behaviour Analyst at the doctoral level (BCBA-D). Additionally, she had PECS Level 1 and 2 certification, and over 15 years' experience implementing, supervising, and training others to implement PECS across various settings, populations, and age ranges. She was previously the Clinical Director of Pyramid Educational Consultants of Canada and was supervised and trained by Dr. Bondy and Ms. Frost. To confirm the validity of the selected target PECS skills, and to ensure the target behaviours described in the Parent Treatment Fidelity Checklists (Appendix A) followed PECS protocol, a current PECS Consultant from Pyramid Educational Consultants reviewed the checklist. Further, the PECS consultant reviewed the stimuli, events, and conditions that were identified to make up the PECS Phase 3B instructional universe by the first and second authors. The PECS consultant had over ten years' experience implementing PECS with students across their lifespan (early childhood into adulthood), was certified in Level 1 and 2 PECS training, and had been a PECS Consultant for Pyramid for over one year.

## **Procedures**

Across all phases of this study, eight scenarios were presented per session for each of the three target PECS skills. Each scenario created one parent training trial. Therefore, 24 trials were conducted in each training session. Data were collected on Jeffrey's treatment fidelity while role-playing with Kate. Progression throughout the study was dependent on Jeffrey's treatment fidelity in the training environment. Jeffrey had to demonstrate 80% or higher treatment fidelity across three consecutive training sessions to achieve the mastery criterion. In the natural environment, sessions were scheduled separately with parents and communication trials were captured between the parent-child dyad within their home. During sessions in the natural environment, each parent contrived ten communicative trials with their child in various settings in the home (i.e., living room, kitchen, child's bedroom). No additional instructions or feedback were provided. Data were collected on the parent's treatment fidelity and on Noah's accuracy using PECS Phase 3B.

### ***Baseline***

No direct training or feedback was provided during baseline sessions. Parent treatment fidelity data were collected in two settings: (a) training environment, and (b) natural environment.

***Training Environment.*** Both parents (trainee and surrogate) participated in sessions in the training environment. Before a session, the researcher emailed Kate the *Session Outline* (Appendix F) that listed the scenarios and described how she should behave as the "child" during each scenario. The order of scenarios was randomly selected using a random sequence generator (i.e., [randomdraws.com/ca/random-sequence-generator](http://randomdraws.com/ca/random-sequence-generator)). During sessions, the researcher instructed Kate to start a trial, by performing the first scenario listed, and instructed Jeffrey to

respond as he normally would if this scenario occurred with his child. Kate kept the session outline covered so that Jeffrey was blind to each scenario. Sessions were recorded and treatment fidelity data were collected from video. For Skill 1, baseline sessions were conducted in the training environment until stability was observed ( $n = 3$ ;  $M = 25$  min).

***Natural Environment.*** At the beginning of each session in the natural environment the researcher began recording and told the parent she would notify him/her when ten communicative trials were completed. Generalization probe data were collected from video on each parent's treatment fidelity across ten picture exchanges. Sessions were conducted until stability was observed (i.e.,  $n = 3$ ;  $M = 8$  min for Jeffrey and Noah's sessions; ( $n = 3$ ;  $M = 9$  min for Kate and Noah's sessions).

### ***BST + GCT***

***Training Environment.*** At the onset of BST + GCT (target Skill 1, setting up a communication opportunity), the researcher showed a video highlighting important parts of the target PECS skill, verbally read written instructions (while Jeffrey reviewed the written version), modelled correct procedures in a variety of scenarios with a research assistant (RA), instructed the parents to practice the scenario, and then provided Jeffrey with feedback on his performance. If corrective feedback was provided, Jeffrey was required to continue practicing, with feedback, until he was able to demonstrate the target PECS skill accurately within the given scenario. The research team repeated these procedures across trials throughout the session. Training components (i.e., instructions, modelling, feedback) were only provided to Jeffrey, and only when he was learning a new skill during sessions in the training environment. To ensure each scenario was performed as described, Kate's behaviour was closely monitored during training

sessions. If she deviated from the script, the researcher provided feedback and the trial was restarted.

***Natural Environment.*** Similar to baseline, during the intervention phase, no instructions or feedback were provided to parents in the natural environment; however, if Noah demonstrated frustration and/or some degree of problem behaviour (i.e., crying, throwing a picture, hitting the binder) the researcher supported the parent to problem solve the issue, or encouraged the parent to take a minute to regroup before contriving a new communication trial. These types of child behaviours rarely occurred. Jeffrey's sessions in the natural environment averaged 16 min in duration (range 7 min–30 min). Kate's sessions in the natural environment averaged 13 min duration (range 11 min–17 min). Session duration was contingent on Noah's current level of motivation, the parent's ability to identify Noah's current preferences, and their ability to maintain Noah's interest across 10 communication trials.

### ***Post-Training***

Maintenance of previously mastered skills was monitored in the training environment throughout the study. At the beginning of each training session, before the researcher began training unmastered skills, Jeffrey was required to practice scenarios related to previously mastered skills. The researcher observed without providing additional instructions or feedback to Jeffrey on his performance across trials. If Jeffrey's performance fell below the mastery criterion ( $\geq 80\%$ ) on previously mastered skill(s), the researcher was prepared to conduct a booster session by reviewing the checklist and displaying the training video for that skill; however, no booster sessions were required. After completing the post-training trials (previously mastered skills), the researcher provided general feedback to Jeffrey (e.g., "That was great, I saw you identified what she was interested in and cleared the environment when trying to contrive a

communication trial.”) before beginning training for the subsequent skill. Jeffrey’s behaviours implementing target Skills 1 and 2 were assessed in the training environment post-training; however, his performance implementing Skill 3 post-training was not assessed. Training sessions concluded following Jeffrey achieving the mastery criterion for Skill 3.

### ***Follow-up***

To determine if Jeffrey maintained target PECS skills following completion of the PECS mediator training, multiple follow-up sessions were conducted two- and six-weeks post-training. Follow-up sessions were also conducted with Kate to monitor her treatment fidelity.

***Training Environment.*** Similar to baseline, the researcher did not provide Jeffrey with any training but provided general feedback (i.e., “That’s great”; “Okay, we can move on to the next trial now.”) to guide the parent dyad through trials within the session. Parent treatment fidelity data were collected on Jeffrey’s PECS implementation in the same fashion as previously described. Three sessions were conducted in the training environment two-weeks post-training ( $M = 19$  min; range, 18 min–20 min) and six-weeks post-training ( $M = 24$  min; range, 18 min–34 min).

***Natural Environment.*** Researchers observed Jeffrey and Kate individually implement PECS Phase 3B skills with Noah in the natural environment. Three sessions were conducted with Jeffrey during the 2-week ( $M = 18$  min; range, 17 min–20 min), and 6-week follow-up phases ( $M = 11$  min; range, 7 min–15 min). Two sessions were conducted with Kate in the natural environment during both the 2-week ( $M = 12.5$  min; range, 10 min–15 min) and 6-week follow-up phases ( $M = 12.5$  min; range, 9 min–16 min). Consistent with baseline, parents were not provided with any training or skill specific feedback during these generalization probes.

***Social Validity (TARF-R)***

Social validity data were collected using a revised version of the Treatment Acceptability Rating Form (TARF-R) adapted from Reimers and Wacker (1988). The form consisted of nine items on a five-point Likert-type scale, ranging from 1 (*did not like*) to 5 (*liked very much*). Questions on the form assessed the parent trainee's perception of the training (e.g., if he thought it was effective, if the skills he learned were beneficial for his child's communication needs, if the instructions were easy to understand, etc.; see Appendix G). Two open-ended questions were also included to allow participants to describe what they liked most and least about the training. The social validity measure was given to Jeffrey after the six-week follow-up phase concluded.

***Interobserver Agreement (IOA)***

A masters-level ABA graduate student and a recent graduate of an ABA program who was pursuing BCBA certification were both trained to fidelity and collected IOA data from session video recordings. The master's student collected IOA data on parent treatment fidelity data across settings (training and natural environment). IOA was calculated on 30% of treatment fidelity data collected in both settings across all phases of the study (baseline, intervention, follow-up). Sessions chosen to calculate IOA were randomly selected using a random generator app (i.e., Pretty Random). Therefore, IOA for parent treatment fidelity in the natural environment were calculated across both parents. IOA data for parent treatment fidelity were collected on a trial-by-trial basis, ensuring agreement for each checklist item, and calculated as a percentage. The number of items in agreement were totaled across trials, divided by the total number of trial items, and multiplied by 100. The BCBA candidate collected IOA data on Noah's accuracy using PECS with his parents across all phases of the study. IOA data for child PECS accuracy were collected on a trial-by-trial basis and calculated as a percentage. The number of trials in

agreement were totaled, divided by the total number of trials, and multiplied by 100.

Interobserver agreement was high for all forms of data collected across participants and phases of the study (see Table 1 for means and ranges).

**Table 1**

*Summary of IOA Data Collected Across Phases of the Study*

Study Phases	Training Environment		Natural Environment
	Parent Treatment Fidelity	Parent Treatment Fidelity	Child PECS Accuracy
Baseline	98%	94% (88%–100%)	96% (90%–100%)
Intervention	96% (95%–97%)	96% (95%–98%)	86% (80%–100%)
Follow-Up	96% (95%–97%)	95% (94%–97%)	86% (80%–100%)

### ***Procedural Integrity***

The BCBA candidate collected data from video using a *Procedural Integrity Checklist* (Appendix H). Data were recorded as “+” for every training component the researcher delivered correctly. Data were recorded as “-” if the researcher missed or delivered a training component incorrectly. Procedural integrity data were collected on 30% of training sessions during the intervention phase and were randomly selected using a random generator app (i.e., Pretty Random). Scores were converted to a percentage by determining the total number of training steps conducted correctly across trials, then dividing this by the total number of training steps across all trials within a session and multiplying by 100. Procedural integrity averaged 99%.

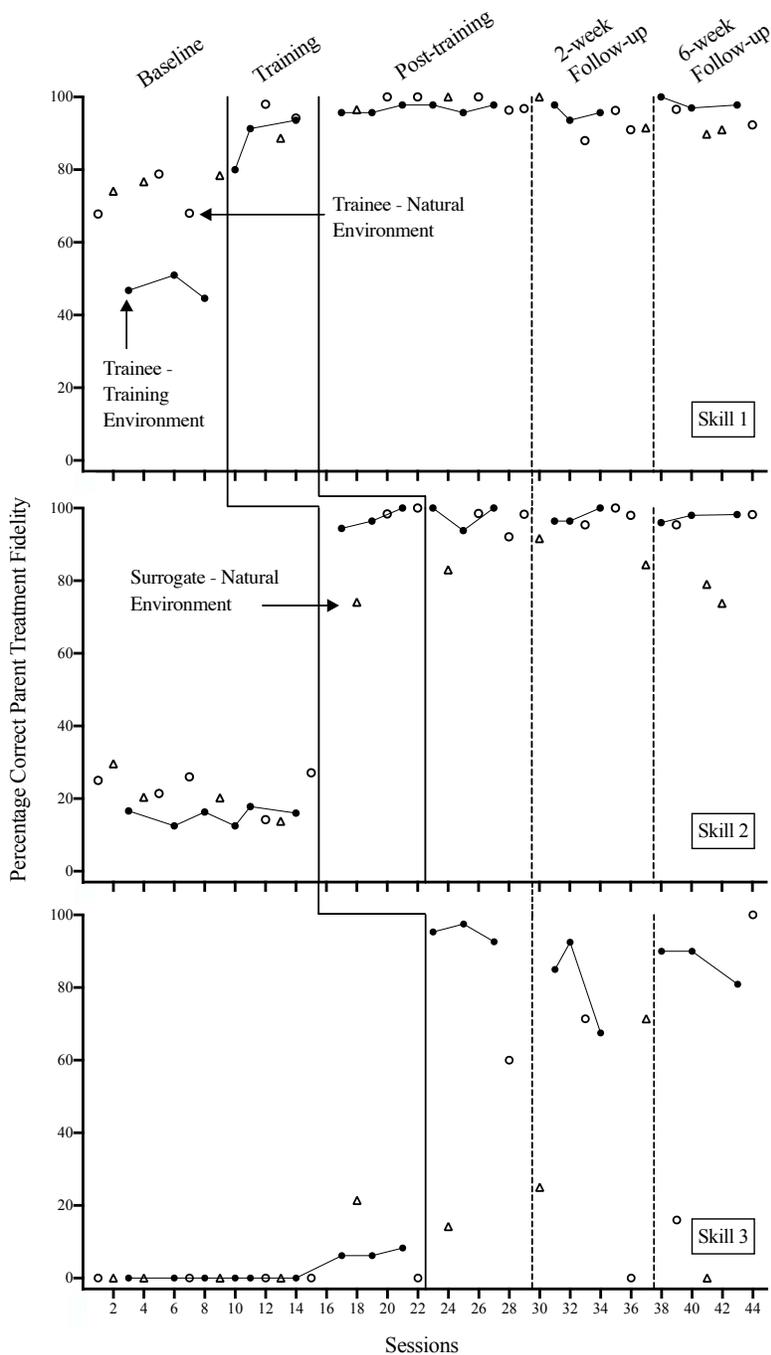
## **Results**

### **Parent Trainee Treatment Fidelity**

Jeffrey’s PECS treatment fidelity across phases is depicted in Figure 1 and Table 2.

Figure 1

Parent Treatment Fidelity for All Phases of the Study (Baseline, Intervention, and Follow-up)



*Note:* Sessions with no generalization probe data for Skill 3 indicate that Noah did not make any picture discrimination errors during those sessions. Therefore, no opportunities occurred for parents to implement the four-step error correction procedure.

**Table 2***Summary of Parent Trainee's Treatment Fidelity Data Across Study Phases*

PECS Skill	Baseline		Intervention		Post-Training	
	Training Environment	Natural Environment	Training Environment	Natural Environment	Training Environment	Natural Environment
1	47% (44%–51%)	71% (67%–78%)	88% (80%–93%)	96% (94%–98%)	96% (95%–97%)	98% (96%–100%)
2	15% (12%–17%)	22% (14%–27%)	96% (94%–100%)	99% (98%–100%)	97% (93%–100%)	95% (92%–98%)
3	2% (0%–8%)	0%	95% (92%–97%)	30% (0%–60%)	NA	NA

*Note.* Data were not collected post-training for target Skill 3 as the PECS mediator training concluded following the trainee achieved the mastery criterion for Skill 3.

***Training Environment***

Jeffrey achieved the mastery criterion within the first three training sessions when introduced to each target PECS skill (i.e., greater than 80% treatment fidelity across three sessions). A substantial increase from baseline treatment fidelity levels was observed after training was introduced for each target PECS skill (i.e., on average, all target skills were performed below 50% accuracy during baseline and above 80% accuracy during training; see Figure 1). Data collected post-training show that Jeffrey continued to implement each target skill with high treatment fidelity across sessions in the intervention phase (see Table 2). The PECS mediator training concluded after Jeffrey achieved the mastery criterion for target Skill 3; therefore, probes were not collected post-training for target Skill 3.

***Natural Environment***

In baseline, Jeffrey's PECS implementation widely varied between settings (i.e., training and natural environment; see Figure 1). Across baseline sessions in the natural environment, Jeffrey implemented target Skill 1 with moderate fidelity (i.e., approximately 70% accuracy), but demonstrated substantially lower treatment fidelity implementing target Skills 2 and 3 (i.e., less

than 25% accuracy, see Table 2). During the intervention phase, Jeffrey reliably demonstrated target Skills 1 and 2 with high treatment fidelity when supporting his child's PECS use in the natural environment (i.e., above 90% on average). Although his performance on target Skill 3 (PECS four-step error correction) increased above baseline levels, Jeffrey did not reliably implement target Skill 3 with equivalent levels of fidelity in the natural environment. Noah made few errors in the natural environment, as such, there were few opportunities for Jeffrey to implement target Skill 3 in the natural environment. Parent performance was only scored if opportunities to implement the error correction procedure (Skill 3) occurred in the natural environment. Throughout the entire study, the parent trainee had a total of seven opportunities to implement target Skill 3 in the natural environment with his child.

### ***Follow-up***

During two-week follow-up sessions, Jeffrey maintained mastery levels of fidelity when implementing all three target PECS skills in the training environment (see Figure 1; Skill 1:  $M = 95.7\%$ ; range, 93%–97%; Skill 2:  $M = 97.6\%$ ; range, 96%–100%; Skill 3:  $M = 81.6\%$ ; range, 67%–92%). However, when monitoring Jeffrey's treatment fidelity in the natural environment, he only implemented target Skills 1 ( $M = 91.7\%$ ; range, 88%–96 %) and 2 ( $M = 97.8\%$ ; range, 95%–100%) with high treatment fidelity. Jeffrey did not implement target Skill 3 with high fidelity in the natural environment, when interacting with his child using PECS ( $M = 35.7\%$ ; range, 0%–71%).

During six-week follow-up sessions, Jeffrey maintained mastery levels of fidelity when implementing all three target PECS skills in the training environment (see Figure 1; Skill 1:  $M = 98.2\%$ ; range, 97%–100%; Skill 2:  $M = 97.4\%$ ; range, 96%–98%; Skill 3:  $M = 86.9\%$ ; range, 80%–90%). However, when monitoring Jeffrey's treatment fidelity in the natural environment,

he only implemented target Skills 1 ( $M = 94.4\%$ ; range, 92%–96%) and 2 ( $M = 96.5\%$ ; range, 95%–98%) with high treatment fidelity. Jeffrey did not implement target Skill 3 with high fidelity in the natural environment when interacting with his child using PECS ( $M = 58\%$ ; range, 16%–100%).

### **Surrogate Parent Treatment Fidelity**

#### ***Natural Environment***

Kate's implementation of PECS Skills 1, 2, and 3 are depicted in Figure 1 and her results are summarized in Table 3. Following exposure to target PECS skill training, Kate's average treatment fidelity increased for all target PECS skills compared to her levels of fidelity in baseline (i.e., increasing from an average of 76% to 89%, from 42% to 74%, and from 4% to 14% for target Skills 1, 2 and 3 respectively; see Table 3). However, her implementation of target Skill 2 did not reach mastery levels of treatment fidelity (i.e., > 80%). Further, her performance implementing target Skill 3 was significantly below commonly accepted performance levels (i.e., 14% treatment fidelity). Similar to sessions with Jeffrey in the natural environment, Kate experienced limited opportunity to implement target Skill 3 (i.e., a total of nine opportunities occurred).

**Table 3**

*Summary of the Surrogate Parent's Treatment Fidelity Data Across Study Phases*

Target PECS Skill Training	Baseline	Intervention	Follow-up (2-Week)	Follow-up (6-Week)
	Natural Environment	Natural Environment	Natural Environment	Natural Environment
1	76% (74%–78%)	89%	95% (91%–100%)	90% (89%–91%)
2	21% (13%–29%)	74%	88% (83%–91%)	76% (73%–79%)
3	4% (0%–21%)	14%	48% (25%–71%)	0%

*Note.* Single percentages are listed without ranges in the intervention column because only one session was conducted, with the surrogate parent, during each target PECS skill training condition.

### ***Follow-up***

During the two-week follow-up phase, two sessions were conducted with Kate and Noah in the natural environment (see Figure 1). Kate implemented target PECS Skills 1 and 2 with high treatment fidelity (i.e., greater than 80%; see Table 3). However, she did not implement target Skill 3 with equivalent fidelity (i.e., 48% accuracy). During the six-week follow-up phase, 2 sessions were conducted with Kate and Noah in the natural environment. Kate only implemented target Skill 1 with high treatment fidelity (i.e., 90% accuracy).

### **Child PECS Accuracy**

#### ***Natural Environment***

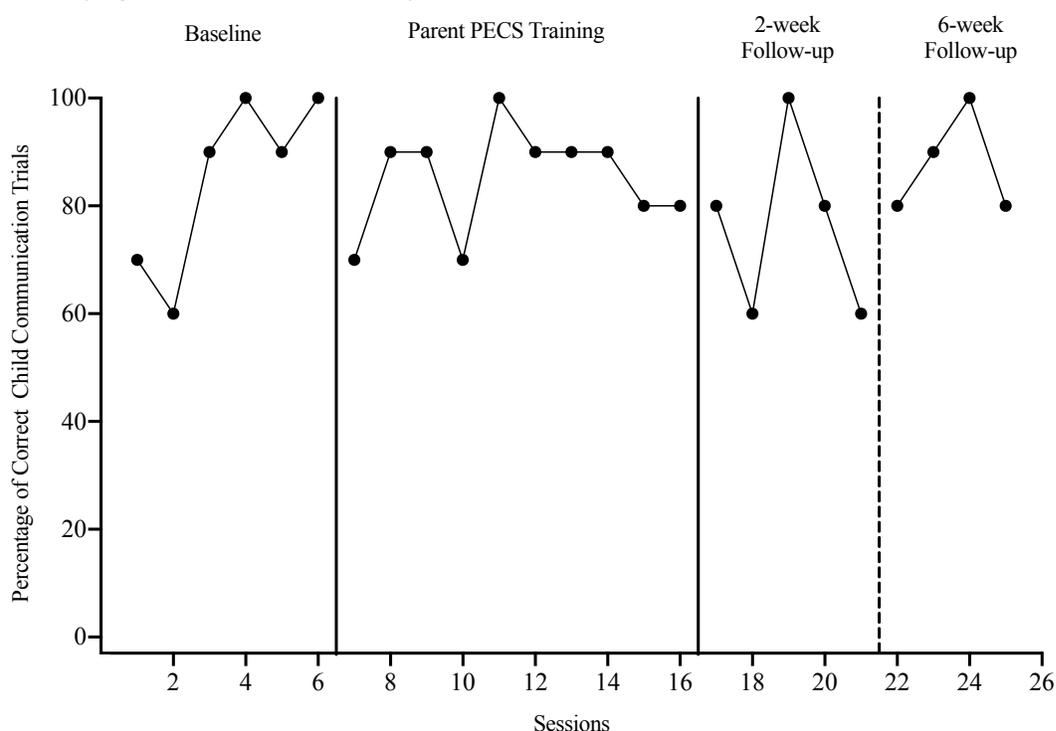
Noah's PECS Phase 3B accuracy is depicted in Figure 2. In baseline, Noah's accuracy using PECS Phase 3B averaged 85% (range 60%–100%) across six sessions (see Figure 2). During intervention, Noah's PECS accuracy was similar, averaging 85% (range 70%–100%) across 10 sessions. Substantial variation was observed in Noah's performance during baseline and intervention.

### ***Follow-up***

During the two-week follow-up sessions, data collected on Noah's accuracy using PECS Phase 3B continued to be variable ( $M = 76\%$ , range 60%–100%; see Figure 2). During six-week follow-up sessions, the data show that Noah's PECS accuracy in general returned to baseline and intervention levels, but was still variable ( $M = 87\%$ , range 80%–100%).

**Figure 2:**

#### *Summary of Child PECS Accuracy Data Collected in the Natural Environment*



### **Social Validity (TARF-R)**

The social validity measure was completed by the parent trainee. Results indicated that his understanding of the study was clear, he found the training to be very effective, the training procedures acceptable, and he felt that the training significantly improved his PECS implementation skills (Appendix I). Jeffrey reported he did not experience any disadvantages from the training itself, but that the virtual set-up of the study was challenging at times (e.g.,

maneuvering the camera around while contriving communication opportunities with his child). Additionally, Jeffery stated that having the second parent participate in the study was beneficial and that both he and Kate felt they gained a great deal of knowledge and application skills from the PECS mediator training.

### **Discussion**

The purpose of this study was to evaluate: (a) if the combination of BST and GCT delivered through telehealth effectively improved parent's PECS implementation skills (i.e., resulted in high treatment fidelity) in a training environment, (b) if this training strategy facilitated generalization of parent's PECS skills to the natural environment, (c) if participation in this training improved PECS implementation skills for a parent who did not directly engage in PECS practice or receive direct instruction and feedback, and (d) if improved parent PECS treatment fidelity influenced child PECS accuracy.

Results indicate that BST + GCT strategies delivered through telehealth produced considerable improvements in the parent trainee's PECS Phase 3B treatment fidelity within the training environment. At the onset of training for each target PECS skill, Jeffrey exhibited substantially higher treatment fidelity compared to baseline levels. The results of this study are consistent with results found by Seiverling and colleagues (2010) who trained staff how to implement natural language paradigm teaching using BST and GCT strategies. In both studies, participant's performance increased during training compared to their performance in baseline and were generally maintained during the post-training.

An additional purpose of this study was to investigate if the combination of teaching strategies (i.e., BST + GCT) facilitated generalization of parent's PECS implementation skills across people, settings, and stimuli. Results indicate that after receiving BST + GCT training,

Jeffrey implemented target Skills 1 and 2 with high levels of treatment fidelity in the natural environment during both intervention and follow-up phases. However, Jeffrey did not reliably implement target Skill 3 with equivalent levels of fidelity in the natural environment during intervention or follow-up phases. As training sessions were discontinued once target Skill 3 was mastered, probes were not conducted post-training for this skill, substantially limiting Jeffrey's practice opportunities. Similarly, target Skill 3, which is error correction, can only be used when a PECS picture discrimination error is made. As Noah's PECS performance was generally above 80%, opportunities to implement this skill in the natural environment were limited. Infrequent opportunities to practice this skill could have negatively impacted Jeffrey's correct implementation of this skill in the natural environment during both intervention and follow-up phases. Similar results were found between this study and a study conducted by Alaimo and colleagues (2017) who combined BST and GCT strategies to teach three parents how to implement a six-bite behaviour protocol when feeding their children who demonstrated food selectivity and significant challenging behaviour. The results indicated that two parents demonstrated response generalization and high treatment fidelity implementing the protocol with their child, during post-training and follow-up phases. These results are consistent with Jeffrey's performance implementing target Skills 1 and 2 in the natural environment during post-training and follow-up phases. However, the performance of the third parent in the Alaimo et al. study initially decreased across the first five post-training sessions, but returned to mastery levels during follow-up. Although the current study did not conduct post-training probes for Skill 3, similar results were observed in Jeffrey's implementation of Skill 3 across follow-up. During the two-week follow-up phase, a decrease was observed in Jeffrey's Skill 3 treatment fidelity in both settings (training and natural environment); however, during the six-week follow-up phase his

performance returned to mastery levels in the training environment and he demonstrated mastery levels of fidelity implementing Skill 3 in one of the two natural environment sessions (see Figure 1).

Similar to Jeffrey's variable generalization results, Kate—who received only limited components of the training (i.e., verbal instructions, modelling)—demonstrated variable treatment fidelity in the natural environment. In baseline, Kate implemented target Skill 1 with moderate treatment fidelity when interacting with Noah in the natural environment. She maintained this performance throughout the intervention and follow-up phases. During baseline, Kate's performance implementing target Skills 2 and 3 was substantially lower (i.e., treatment fidelity lower than 50%). During intervention and follow-up phases, her performance for these skills was variable. Like Jeffrey, Kate implemented target Skill 3 with substantially lower fidelity compared to the other target PECS skills. Although Kate had listened to the instructions how to complete these skills during training sessions and had observed them being implemented by Jeffrey, she did not practice these skills in the training environment or receive any feedback on her performance. Further, target Skills 2 and 3 (discrimination training and error correction) are arguably more complex than target Skill 1 (setting up communication opportunities). Both of these factors may have negatively impacted her PECS implementation fidelity. These results suggest that participation in the PECS Mediator Training as a surrogate may be associated with an initial increase in the parent's treatment fidelity implementing target PECS skills. However, these gains may not be maintained over time in the natural environment. Similar results were found by Eid and colleagues (2017) who conducted a parent training study that investigated the effects of observational learning. Parent observers demonstrated higher performance accuracy after observing other parents receive direct behavioural training; however, two of the three

observers required additional BST training strategies to achieve the mastery criterion. Results of this study and results from previous research may suggest that all four components of the BST model (i.e., instructions, modelling, practice, feedback) are required to ensure skill mastery, generalization, and maintenance—particularly for more complex skills like discrimination training and error correction.

The data collected on Noah's accuracy using PECS in baseline demonstrate he had high accuracy (i.e., average performance  $\geq 80\%$ ) from the beginning of the study; however, parents were not properly implementing Phase 3B skills (i.e., correspondence checks). This means Noah was not receiving discrimination training and his parents would immediately deliver the requested item after Noah exchanged a picture. However, notable variability (i.e., range 60%–100%) was observed in Noah's PECS accuracy throughout all phases of the study. This may have been a function of his parents' variable fidelity implementing discrimination training and error correction procedures. However, additional research would need to be conducted to specifically answer this question. Additionally, Noah had returned to his ABA clinic during the last training condition (target Skill 3) of the intervention phase. Noah demonstrated the highest, most stable, accuracy ( $M = 87\%$ , range 80%–100%) using PECS during the sessions that coincided with his return to therapy. As such, these results should be interpreted cautiously, and in consideration of this confounding variable.

### **Limitations and Strengths**

Several limitations of this study must be acknowledged. First, the results cannot be generalized to all children with ASD (e.g., those who exhibit significant challenging behaviour) due to the small sample size and selective inclusion criteria (i.e., already using PECS to communicate, no history of engaging in significant challenging behaviour). Secondly, only two

parents participated in this study. Both parents were Caucasian, were employed full-time as teachers, and had a university education. Results of this study cannot necessarily be generalized to parents with different educational, demographic, and cultural backgrounds. Thirdly, parents were aware that researchers were observing them interact with their child using PECS and were collecting data on their behaviour. This could have altered or affected their behaviour. Several design flaws of this study are also recognized as limitations. For example, the PECS mediator training concluded after the parent trainee achieved the mastery criterion. Compared to previous skills taught, Jeffrey had substantially fewer opportunities to practice implementing the final skill (target Skill 3). This skill was subjectively the most difficult skill to perform, so limited practice in a training setting and few opportunities in the natural environment, present as limiting characteristics of the parent training. Moreover, reliability assessors were not blind to the objectives of this study during data collection and analysis, introducing the possibility of risk of bias. Finally, the researcher's inability to obtain documentation regarding the child's diagnosis and formally assess the child's PECS use served as limitations caused by the Covid-19 pandemic.

This study also includes many notable strengths. For example, it explored training parents PECS implementation skills when their child already had foundational skills—a common occurrence since children are usually taught PECS in educational or therapeutic settings. Additionally, this study extends the current research literature in several important ways. This study was the first to combine BST and GCT strategies to teach parents PECS implementation skills. The current study collected direct data on parent performance throughout study phases and visually displayed this data throughout each condition (i.e., baseline, training, maintenance, follow-up). This rigorous design allowed for careful analysis of parent behaviour across study

conditions. As previously mentioned, studies that conducted parent training rarely report and/or measure parent behaviour directly (e.g., Carson et al., 2012; Park et al., 2011). Although the use of telehealth is growing, similar gaps exist in the telehealth literature, involving parent training (Heitzman-Powell et al., 2013; Parsons et al., 2017).

This study was also the first to train parents PECS implementation skills using telehealth. Published studies involving parent training, including both telehealth and face-to-face training formats, often overlook generalization and maintenance of the parent's skills (Alsayedhassan et al., 2016; Barton & Fettig, 2013). This study consistently assessed both generalization and maintenance of parent's PECS skills throughout intervention and follow-up phases. And finally, results from this study revealed exceptional procedural integrity (i.e., 99%) and high IOA across all phases of the study. Few published studies that conduct parent training report procedural integrity or IOA on parent data (Barton & Fettig, 2013).

### **Future Research**

More studies that combine BST and GCT strategies are required. Studies should specifically explore whether BST and GCT together help parents learn and generalize various intervention approaches across people, settings, and stimuli and whether the combination of the two approaches is more effective than the individual application of either strategy. Additionally, more research is required regarding PECS training with parents that directly measures and reports parent behaviour. Additional research should investigate whether parents find specific PECS skills more challenging to implement, such as discrimination training and/or error correction. This information would be beneficial for clinicians in order to target training and practice in a manner that ensures parents master and maintain skills. Moreover, future research should explore which components of BST are essential for mastery of various PECS skills to

determine if some skills can be taught in a more streamlined fashion (i.e., using only some parts of BST), while other skills may require the full training package. Lastly, the social validity results from this study support the value of telehealth, especially in times such as these.

However, more telehealth research that conducts PECS parent training and directly measures parent PECS implementation skills is required.

## **Conclusion**

Overall, the results of this study provide preliminary evidence that the use of BST + GCT within a telehealth format was an effective approach to teach parents PECS implementation skills. Further, there was some evidence of skill generalization since the parent trainee demonstrated PECS skill use across settings, people, and materials. However, the findings were not as robust for the parent surrogate who participated in training sessions but did not receive opportunities to practice or receive feedback. These results provide preliminary support for the use of BST + GCT to facilitate skill development and generalized behaviour change. Further, the results may suggest that all four components of the BST model (instructions, modelling, practice, feedback) are required to ensure skill mastery, generalization and maintenance—especially for more complex skills like discrimination training and error correction; though our data do not allow us to make this statement conclusively.

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## Appendix A:

## Parent Treatment Fidelity Checklist and Datasheet

<b>Parent Behaviour</b>	
<i>Indicate a +, -, NA for each of the follow for each trial</i>	
<b>Skill 1: Setting up a Communication Opportunity</b>	1. Parent has a variety of possible preferred items/activities available and in their control, and/or attempts to clear environment of other known preferred items/activities
	2. Parent identifies child's currently preferred item/activity and eventually obtains access of said item/activity
	3. Parent ensures binder is within an arm's reach of the child or is available in the environment (same room)
	4. Parent ensures the pictures that correspond with desired items/activities are available in or on the binder
	5. Parent tries to motivate the child to perform a PECS request (e.g., giving a small sample (edible), models the function of the toy/activity or plays song/show on iPad) without verbally prompting (e.g., "use your words," "ask me with your PECS," etc.)
	6. Parent responds appropriately (e.g., wait for 2 <sup>nd</sup> prompter to prompt the child, redirect child to binder) if the child does not initiate using PECS (i.e., reaches for item or parent's hand) - <b>Parent or 2<sup>nd</sup> prompter must prompt/redirect within 3-5 seconds or sooner</b>
	7. Parent waits for the child to initiate a PECS request or demonstrate interest in item/activity before physically prompting the child to make a request
<b>Total +'s divided by total steps (e.g., 5/7)</b>	
<b>Skill 2: Testing Whether Your Child Knows the Pictures</b>	8. Parent accepts picture from the child
	9. Parent does not verbally label the picture
	10. Parent offers the item requested and other preferred items to the child while verbally instructing the child to <b>"take it"</b>
	11. Parent allows the child to select the item if it matches the picture that was exchanged
	12. Parent verbally labels the requested item once it has been selected
	13. Parent provides verbal praise and access to requested item/activity (e.g., piece of edible, plays iPad for 15-45 seconds, etc.)
	14. Parent returns the picture to the binder, in a new location (i.e., different placement on binder page or cover)
<b>Total +'s divided by total steps (e.g., 5/7)</b>	
<b>Skill 3: Responding to a Discrimination Error</b>	15. When conducting a correspondence check, if child attempts to grab an item that does not match the exchanged picture, the parent blocks access
	16. Parent points to the picture that corresponds with the item that the child attempted to select
	17. Parent prompts the child to practice exchanging the corresponding picture
	18. Parent only delivers verbal praise following this practice trial and does not give the item
	19. Parent returns the picture to the binder in the same general location
	20. Parent switches the child's attention (e.g., high five, clap, or flipping binder over) before re-enticing for the next picture request
21. Parent provides less reinforcement (decreased size, magnitude, or reduced praise) for child's request after an error was made	
<b>Total +'s divided by total steps (e.g., 5/7)</b>	

Parent Behaviour	Trials																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Indicate a +, -, NA for each of the follow for each trial Setting up a Communication Opportunity	1.																								
	2.																								
	3.																								
	4.																								
	5.																								
	6.																								
	7.																								
	Total +s divided by total steps (e.g., 5/7)																								
Testing Whether Your Child Knows the Picture	8.																								
	9.																								
	10.																								
	11.																								
	12.																								
	13.																								
	14.																								
	Total +s divided by total steps (e.g., 5/7)																								
Responding to a Discrimination Error	15.																								
	16.																								
	17.																								
	18.																								
	19.																								
	20.																								
	21.																								
	Total +s divided by total steps (e.g., 5/7)																								

Booster Session Required?  
 Y  N

Booster Session Required?  
 Y  N

Met Mastery?  
 Y  N

Total

Total

Total

## Appendix B

## Operational Definitions and Examples

Checklist Steps	Operational Definition	How to Score If/When...
1. Parent has a variety of possible preferred items/activities available and in their control, and/or attempts to clear environment of other known preferred items/activities	To contrive a communication opportunity, the parent may display/offer choices to the child while maintaining <b>control</b> (i.e., in their hands/arms, displayed on a plate/muffin tin) of at least two items known to be preferred by the child, in addition to clearing the environment of additional items (i.e., the parent puts things away, behind the parent, or up out of the child's reach). Score as a "+" if the environment is clear and the parent controls items behind him/her, impeding the child's ability to access the items/activity. Score as a "+" if the environment is clear and the parent is controlling items by having a hand on the items or blocking access to the items with his/her arm.	<ul style="list-style-type: none"> <li>- the parent has a variety of items presented on the table or floor and items are not in the parent's control (in hands, on lap, or behind him etc.)</li> <li>- the parent has no items in hand, is not controlling items in front of him/her, or only has control of the one item he/she regained control of</li> </ul> <p><b>Note:</b> Do not score as "-" if the child reaches for something not intended for play, like a household item (i.e., picture frame, décor) and the parent removes said item from the child's possession</p>
2. Parent identifies child's currently preferred item/activity and eventually obtains control of said item/activity	Parent notices child is engaged in an item/activity and eventually gains control of said item, attempting to contrive a PECS communication opportunity (e.g., "my turn," while retrieving item from child). Score a "+" if the parent has control of an item while the child is accessing it (e.g., reading a book, singing/playing music) and pauses or puts it away to contrive a new PECS communication opportunity. <b>NOTE:</b> if the parent engages in a variety of these behaviours and the child demonstrates no interest (does not initiate a picture request), the parent may still be scored "+".	<ul style="list-style-type: none"> <li>- the parent does not engage in any of these behaviours and offers items clearly not of interest</li> <li>- the parent struggles/fails to obtain control of an item the child is engaging with and tries to offer alternative items</li> </ul> <p><b>NA</b> child does not have anything for the parent to obtain control of <b>NA</b> the child drops/becomes disengaged with an item that he was previously manipulating and/or the child is now demonstrating interest in an item controlled by the parent.</p> <p><b>NOTE:</b> The child can have access to more than one item/activity at a time.</p>
3. Parent ensures binder is within an arm's reach of the child or is available in the environment (same room)	The parent engages in observable behaviour, ensuring that the PECS binder is in close proximity to the child, so that the child can reach the binder without travelling extended distances (no more than 2 steps). If the binder is initially within an arm's reach of the child but the child is moving around the room still score this as a "+" (the parent must either move the binder near the child again or situate him/herself near the binder after regaining control of a preferred item).	<ul style="list-style-type: none"> <li>- the parent begins enticing the child with items/activities when the child's PECS binder is not within the child's arm reach, requiring the child to travel more than 2 steps to contact the binder</li> </ul>
4. Parent ensures the pictures that correspond with items/activities in the parent's possession are available in or on the binder	The parent will physically look or glance at the binder to make sure the pictures of the items that are in his/her control are available in/on the child's PECS binder. If the parent is engaging in these observable behaviours and the child requests a novel item (has not been previously requested for), score as "+". <b>NOTE: if the child has made frequent consecutive requests for the same item, and the parent is returning the picture of that item back on/in the binder in between trials, this can be counted as evidence of them ensuring the picture is in the binder.</b>	<ul style="list-style-type: none"> <li>- the parent begins to entice/contrive a communication opportunity and allows the child to perform a picture request before checking or making sure the picture is in/on the binder.</li> </ul> <p><b>NA</b> unable to see the parent's face prior to or during a communicative trial (i.e., blocked view or parent's head/face was cropped out of the camera frame)</p>
5. Parent tries to motivate the child to perform a PECS request (e.g., giving a small sample (edible), models function of toy, plays show/song on iPad) without verbally prompting (e.g., "use your words," "ask me with your PECS," etc.)	Parent attempts to provoke child's interest without verbally instructing the child to ask for something or to use his PECS (e.g., giving a small sample (edible or physical activity like tickles, singing), models the function of the toy/activity or offers a variety of items). <b>NOTE: the focus of this item is on the parent NOT using verbal prompting or instructing therefore, if the parent refrains from verbally prompting but is not trying to motivate the child with preferred items in hand, still score as "+".</b>	<ul style="list-style-type: none"> <li>- as the parent entices the child with various preferred stimuli, he/she verbally prompts the child to "request something," "use your words", or says something similar to "What do you want?"</li> </ul> <p><b>NA</b> the child makes a picture request almost immediately after a previous request (i.e., exchanges another picture 1-2 seconds after getting access of previously requested item), or exchanges a picture immediately after (1-2 seconds) parent regains control of item, leaving the parent no time to motivate or entice.</p>
6. Parent responds appropriately (e.g., waits for 2 <sup>nd</sup> prompter to prompt the child, or parent redirects the child to the binder) if the child demonstrates interest but does not initiate using PECS (i.e., reaches for item or parent's hand). <b>Parent or 2<sup>nd</sup> prompter must prompt/redirect within 3-5 seconds or sooner</b>	If the child reaches for the parents' hand or item, the parent physically prompts the child's hand to the PECS binder (making physical contact) or waits for the second prompter to guide the child to his PECS binder <b>within 3-5 seconds or sooner</b> . The parent might fade their level of physical prompts throughout trials (e.g., hand over hand, then prompt at the wrist, then lightly pushing the forearm), so if the parent prompts/redirects the child's hand in the direction of the PECS binder but the child's hand does not make physical contact with the binder, still score as "+".	<ul style="list-style-type: none"> <li>- the parent moves away/moves the item out of the child's reach and/or does not prompt/redirect child's hand to the binder</li> <li>- 6 or more seconds passes before the parent prompts/redirects the child's hand to his binder</li> <li>- the child grabs onto the parent as the parent obtains/regains access of item and the parent does not prompt the child's hand to contact his binder</li> <li>- the child persistently/repeatedly points to or reaches for an item (for a duration longer than 3 seconds) and the parent fails to physically prompt/redirect the child to his binder</li> </ul> <p><b>NA</b> the child does not attempt to reach for the item/parent and initiates with PECS binder <b>NA</b> the child briefly points/gestures to the item/parent after the parent regains control of item and the child almost immediately requests independently (1-2 seconds)</p>

7. Parent waits for the child to initiate a PECS request or demonstrate interest in item/activity before physically prompting the child to make a request.	Parent refrains from prompting (hand over hand, pointing to the binder) the child to exchange a picture UNTIL/UNLESS the child clearly demonstrates interest in an item/activity (i.e., looking/reaching). <b>If the parent does not physically/gesturally prompt the child to make a request before the child initiates/demonstrates interest score as “+”.</b> <b>NOTE: the focus of this item is on the parent WAITING for the child to demonstrate interest (clear EO is in place).</b>	- the parent physically or gesturally prompts (hand over hand, pointing, moving the PECS binder) the child to make a request before the child has demonstrated any kind of interest in an item such as looking at, leaning towards, reaching/approaching an item, communicative partner, or binder.
8. Parent accepts picture from the child	Using his/her hand, the parent receives a picture from the child with an open palm. If the child drops the picture, picks it up, and gives it to the parent, score as a “+”. If the parent drops the picture after the child exchanges it, still score as a “+”. <b>NOTE: The child must reach and contact the parent’s hand to make the exchange for this step to be scored as a “+”.</b>	- the parent forgets to accept the picture, gives the item in advance of the picture exchange - the child drops the picture on the floor, the parent picks it up and offers items to the child to select - the parent does not accept the picture with an open palm or does not give the child an opportunity to make an exchange (i.e., parent takes the picture out of the child’s hand immediately after the child picks up the picture)
9. Parent does not verbally label the picture	The parent looks at the picture but does not verbally tact/label the item that the picture represents. If the parent says general statements like, “okay” or “let me get that” score as a “+” as long as they don’t verbally label what the picture is.	- the parent verbally labels the picture (e.g., “Ball”), or says something like, “Okay, one second, I’ll go get the iPad”  <b>NA</b> the child requests for an action (e.g., open, help, etc.) that cannot be offered in a correspondence check.
10. Parent offers the item requested and other preferred items to the child while verbally instructing the child to “take it”	Parent displays items using their hands, a plate, or a muffin tin and verbally instructs the child to, “take it.” If the parent moves items slightly closer to the child in an offering manner (i.e., extends their hands, plate, or tray), but says nothing, score as a “+”.	- the parent gives the child immediate access to the item after the exchange, failing to conduct a correspondence check - the parent verbally labels the items when instructing the child to “Take it” (e.g., “take ball”)  <b>NA</b> the child requests for the parent to sing a song, give a hug, or other actions/gestures that cannot be offered in a correspondence check. <b>NA</b> if the parent accepts a picture and deems the item as “not available” then items 10-13 and 15-21 should be scored as NA <b>NOTE: if the parent gives access to the item after the child exchanged a picture (failing to conduct a correspondence check) items 11- 13 must be scored as “-”</b>
11. Parent allows the child to select the item if it matches the picture that was exchanged	The parent permits the child to physically contact/access/take an item if it accurately represents the exchanged picture. If the child attempts to grab the non-matching item and the parent does not allow access, score as a “+”.	- the child selects/takes/accesses an item that does not match the picture exchanged - the child takes/accesses more than one item - if the parent did not conduct a correspondence check  <b>NA</b> the child requests for the parent to sing a song, give a hug, or other actions/gestures that cannot be offered in a correspondence check. <b>NA</b> the child does not select any items offered, demonstrating no current interest in the item requested or items being offered <b>NA</b> if the parent accepts a picture and deems the item as “not available” then items 10–13 and 15–21 should be scored as NA
12. Parent verbally labels the requested item once it has been selected	Within 3 seconds of the child’s hand making physical contact with the item that matches the picture, the parent verbally labels the item (e.g., “goldfish”, “cookie”, etc.).	- following the child selecting the parent verbally labels the item 4 or more seconds after the child has selected/had access to the requested item - if the parent did not conduct a correspondence check  <b>NA</b> the child requests for the parent to sing a song, give a hug, or other actions/gestures that cannot be offered in a correspondence check <b>NA</b> if the parent accepts a picture and deems the item as “not available” then items 10–13 and 15–21 should be scored as NA
13. Parent provides verbal praise and access to requested item/activity (e.g., piece of edible, plays iPad for minimum 15-45 seconds, etc.) <b>NOTE: there is no maximum timeframe but, encourage parents to keep reinforcement below 45 seconds to keep motivation high and trials running smoothly.</b>	Example of verbal praise (e.g., “Yes, good job! You have the ball”). The parent allows the child to engage with the item for at least 15 seconds before regaining access of said item and contriving a new communication opportunity. <b>NOTE: if the parent engages with the child while he/she is accessing the item/makes a comment about the item count this as verbal praise and score as “+” (as long as it sounds positive and reinforcing</b>	- the parent does not verbally praise the correct selection of an item but allows access to the item for at least 15 seconds - the parent does not verbally praise the correct selection of an item and/or regains control of the item in 14 seconds or less - if the parent did not conduct a correspondence check  <b>NA</b> the child requests for the parent to sing a song, give a hug, or other actions/gestures that cannot be offered in a correspondence check. <b>NA</b> if the parent accepts a picture and deems the item as “not available” then items 10–13 and 15–21 should be scored as NA
14. Parent returns the picture to the binder, in a new location (i.e., different placement on binder page or cover)	Parent places the picture back in a different position than it was originally, either inside or on the cover of the child’s PECS binder. If the parent returns the picture in the same previous location and corrects him/herself immediately after by placing the picture in a new location, score as a “+”.	- the parent returns the picture to the binder in the exact spot it was before the child removed it - the parent keeps the picture, does not return the picture, or puts the picture down (not directly in or on the binder)

		<p><b>NA</b> the parent returns the picture to the binder, but you are unable to see if it is in a new location (i.e., something blocking your view or you can only see the binder from a distance and are unable to see the individual Velcro strips)</p>
15. When conducting a correspondence check, if the child attempts to grab an item that does not match the exchanged picture, the parent blocks access	<p>Parent moves/physically blocks/impedes the child's ability to fully access an item that does not match the picture that the child exchanged.</p> <p><b>NOTE:</b> If the child's hand contacts the incorrect item, while in the parent's possession and the parent was able to keep control of the item, still score as "+"</p>	<ul style="list-style-type: none"> <li>- the parent gives the child access to the item, failing to conduct a correspondence check</li> <li>- when conducting a correspondence check, the parent is unsuccessful at blocking the child's ability to fully access the item that does not match the picture</li> <li>- the parent and child are out of the camera frame but when returning, the child has possession of an item that was not requested for</li> </ul> <p><b>NA</b> the child does not attempt to select the non-matching item</p> <p><b>NA</b> the child requests for the parent to sing a song, give a hug, or other actions/gestures that cannot be offered in a correspondence check (score NA for the following items of this skill)</p> <p><b>NA</b> the child and parent are out of the camera's frame, unable see whether the parent was successful at blocking the child's ability to block access from the item</p> <p><b>NOTE: if the parent conducts a correspondence check but the child does not perform a discrimination error, you must score items 16–21 as NA</b></p>
16. Parent points to the picture that corresponds with the item that the child attempted to select/take	Parent extends index finger and/or taps the picture that represents the item the child reached for/attempted to select.	<ul style="list-style-type: none"> <li>- the parent does not point to the picture that matches the item the child reached for/attempted to grab</li> </ul>
17. If necessary, the parent physically prompts the child to practice exchanging the corresponding picture	If the child does not independently reach to pick up and exchange the picture that the parent is pointing to, the parent should wait no more than 3 seconds to physically prompt the child to exchange the corresponding picture.	<ul style="list-style-type: none"> <li>- the child does not initiate a picture request and the parent waits 4 seconds or longer before physically prompting the child</li> </ul> <p><b>NA</b> the child initiates a picture request following the parent's prompt (within 3 seconds) so no physical prompt was required to exchange the picture</p>
18. Parent only delivers verbal praise following this practice trial and does not give the item	E.g., "Yes, this one is the ball, good."	<ul style="list-style-type: none"> <li>- the parent gives the child access to the item</li> <li>- the parent does not give the child access to the item but does not provide verbal praise</li> </ul>
19. Parent returns the picture to the binder in the same general location	<p>Parent places the picture back in a similar spot on or in the binder (within an inch of where the picture previously was). If you can't see the exact placement of the picture but can see the parent's hand placing the picture back to the same general location it was previously, score as "+" (e.g., placing the picture back on the sentence strip area).</p> <p><b>NOTE:</b> this only applies to the picture placement for the picture the parent is teaching/pointing to.</p>	<ul style="list-style-type: none"> <li>- the parent places the picture back in or on the binder in a completely new location</li> </ul> <p><b>NA</b> you are unable to see if the picture the parent pointed to was returned to the same location in or on the binder following the practice trial</p>
20. Parent switches the child's attention and re-entices for the next picture request	Before the parent begins re-enticing, the parent instructs the child to perform a simple task to switch the child's attention from the PECS binder (e.g., high five, clap, touch nose). The parent may flip the binder over while delivering an instruction or flip the binder over without delivering an instruction. All of these scenarios are to be scored as "+".	<ul style="list-style-type: none"> <li>- the parent forgets/fails to switch the child's attention before the child initiates a new picture request.</li> </ul>
21. Parent provides less reinforcement (decreased size, magnitude, or reduced praise) for child's request after an error was made	After the parent corrects the child's initial discrimination error, if the child exchanges a picture and selects the matching item the parent provides reinforcement but in a lesser magnitude, quantity, etc. (e.g., less than 15 seconds of access with the item, lower magnitude of verbal praise).	<ul style="list-style-type: none"> <li>- the parent provides the same amount of reinforcement (magnitude/size/quantity/time with item (15+seconds) as he/she would provide for the child making no errors</li> </ul> <p><b>NA</b> if the child does not exchange a picture following an error/previous picture exchange (e.g., the child exchanges a picture but does not select any items offered in the correspondence check. The parent may switch the child's attention and/or re-entice with preferred items but if the child still does not initiate a request, score as NA)</p>

**ACCURATE Child Picture Exchange:** Child reaches/contacts his PECS binder, independently removes a picture, places the picture in the communicative partner's hand, and selects the item that corresponds with the picture during a correspondence check. If the child exchanges a blank picture on the first attempt of a trial (not as a second attempt in an error correction), score the child's request as correct.

**INACCURATE Child Picture Exchange:** If the child removes a picture from the binder but does not complete an exchange **within 3 seconds** (i.e., looks at the picture and puts it down on table/floor). An inaccurate PECS request also includes instances where the child removes a picture and exchanges it but does not select any of the items offered (does not access reinforcement following an exchange), the child makes a discrimination error (i.e., exchanges a picture and selects/grabs the non-matching item), the child exchanges a picture that is out of context,

given the current situation (i.e., exchanges the picture “open” when playing with a ball), or the child accesses/attempts to access a desired item/activity without using his PECS. Additional examples include the child reaching or grabbing for the parent’s hand/arm instead of initiating a picture exchange. Exclusions include the child briefly (for 1-2 seconds) extending his arm or pointing to an item after the parent has obtained/regained access of said item.

**A communication trial:**

**Onset** is either immediately following a previous picture request or when the parent begins to engage in observable behaviours such as arranging the physical environment to support or motivate the child to exchange a picture (i.e. parent begins clearing the area around the child of toys and preferred items, parent entices child with at least two items in his/her hands, parent obtains/regains control of item from child, etc.). In the event that there is an EO already in place and the child makes a picture request before the parent has a chance to set up/contrive another communication opportunity, this would be the onset of that trial.

**Offset** is when the **child has exchanged a picture and accesses the corresponding item** (multiple picture exchanges could occur within a single trial if the child makes a PECS error/makes an error selecting the corresponding item). If the child exchanges a picture that the parent deems as “not available” or unknown/blank this is the end of that trial.

**NOTE: a trial is generally complete when the child is given the item that corresponded with the picture they exchanged; this could be immediate if the correspondence check is correct or delayed if an error correction occurs.**

## Appendix C

## Skill 1 Instructions

**Skill #1 – Setting up a Communication Opportunity**

**One of the most difficult parts of PECS training is creating or contriving a communication opportunity. Setting up a communication opportunity requires you to be creative in order to identify what your child is interested in. Sometimes you may be able to “capture” your child’s interest, meaning that your child is already demonstrating interest in a toy or activity and you can then follow your child’s lead, by using that item/activity for communication training. Other times you may need to “create” communication opportunities by trying to get your child interested in an item/activity. During these initial phases of PECS, your child must be motivated to request for something to be able to learn how to functionally communicate using PECS.**

1. Parent has a variety (at least 2 items) of possible preferred items/activities available and in their control, and/or attempts to clear environment of other known preferred items/activities
  - Clear the environment of additional preferred items (put away or out of reach)
2. Identify your child’s currently preferred item/activity and eventually obtain control of said item/activity
  - Is he currently playing/watching/eating/engaging with something that you can obtain control of?
3. Ensure the binder is nearby/available in the environment (i.e., within an arm’s reach, in the same room)
4. Ensure the pictures that correspond with currently preferred items/activities are available in/on binder
5. Try to motivate your child to perform a PECS request **without verbally prompting** (e.g., by giving a small sample [edible], modelling the function of the toy/activity or offering a variety of items)
6. If your child does not initiate towards his PECS binder (i.e., reaches for the item/activity without requesting, reaches for your hand), wait for your partner to prompt your child **or** you’re going to redirect your child to use his PECS binder - **within 3-5 seconds or sooner**
7. Wait for your child to initiate a picture exchange or demonstrate interest in item/activity









## Appendix F

## Session Outline Sample

Participant \_\_\_\_\_

Date \_\_\_\_\_

Trial	Child Behaviour
1	The PECS binder is NOT within an arm's reach to you and you are engaged in an item/activity – if/when your partner gains control of said item <b>keep looking</b> at the item while in their possession
2	The PECS binder is beside you, you reach for the communicative partner's hand that is controlling access to the item/activity you want
3	The PECS binder is beside you, you are engaged in an activity but when your partner obtains control of said item/activity, immediately entertain yourself with something else
4	The PECS binder is on the other side of the room - you reach for the communicative partner's hand that is controlling access to the item/activity you want
5	Have the binder close by, look at the PECS binder and the items your partner is holding but do not initiate a PECS request – look at something else in the room as if you are interested and go play with it
6	The PECS binder is NOT within an arm's reach to you and you are engaged in an item/activity – if/when your partner gains control of item you are no longer interested in the item ( <b>LOOK/SCAN</b> around the room for other things)
7	The PECS binder is beside you, you are engaged in an activity (e.g., eating a snack, playing with a toy, etc.), let the parent obtain access of the item but remain interested in it (by looking/reaching for the item)
8	The PECS binder is beside you, you are engaged in an activity (e.g., eating a snack, playing with a toy, etc.), but do not give up the item easily when the parent attempts to control access of it
9	PECS binder is beside you - exchange the picture of an item you want, accept the matching item if given to you or select the matching item and play with it
10	PECS binder beside you - exchange the picture of a food item you want and accept the matching food item if given to you or select the matching food item and eat it
11	PECS binder is beside you - exchange a picture that you have not made a request with yet (item/activity must be within the room) and accept the matching item if given to you or select the matching item
12	PECS binder is beside you - exchange a picture or an item, then accept the matching item if given to you or select the matching item, and emit a vocal approximation for the item (e.g., "Bah" for ball, "Coo" for cookie, etc.)
13	PECS binder is beside you - exchange a picture that you have not made a request with yet (item/activity must be within the room) and accept the matching item if given to you or select the matching item

14	PECS binder is beside you - exchange the picture of an item you want, accept the matching item if given to you or select the matching item and play with it
15	PECS binder is beside you - exchange the picture of a big item/activity you want and accept the matching item if given to you or select the matching big item/activity and play with it
16	PECS binder is beside you - exchange a picture of an item and accept the matching item if given to you or select the matching item but don't engage with the item (put it down)
17	The PECS binder is beside you – after exchanging a picture attempt to select more than one item in your partner's possession
18	The PECS binder is beside you – after exchanging a picture do not accept or select any of the items offered by your partner (just sit there)
19	The PECS binder is beside you – after exchanging a picture attempt to select an item in your partner's possession that does not match the picture
20	The PECS binder is beside you – after exchanging a picture do not accept or select any of the items offered by your partner (just sit there)
21	The PECS binder is beside you – after exchanging a picture attempt to select an item in your partner's possession that does not match the picture
22	The PECS binder is beside you - after exchanging a picture, do not accept or select an item, move away from your partner and grab something in the environment and start engaging with it
23	The PECS binder is beside you – after exchanging a picture attempt to select more than one item in your partner's possession
24	The PECS binder is beside you - after exchanging a picture, do not accept or select an item, move away from your partner and grab something in the environment and start engaging with it





## Appendix H

## Procedural Integrity Checklist

<b>Trainer procedural integrity – Baseline Parent Sessions</b>								
<b>Trainer:</b> _____	<b>Date scored:</b> _____							
<b>Video Code:</b> _____	<b>Coder initials:</b> _____							
<b>IOA:</b> Y N								
<i>Please indicate +, -, or N/A for the following steps within each trial</i>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>
<i>Assessing maintenance of skills:</i>								
1. Before beginning to teach the current/new skill, the trainer assesses the parent trainee's performance on previously mastered skill(s)								
2. After the trainer is done assessing maintenance of previously mastered skill(s), the trainer provides the trainee with feedback								
3. If the trainee's performance fell below the mastery criterion (80%), the trainer conducted a booster session by showing the previous skill training video(s)								
<i>Training procedures:</i>								
1. Trainer ensures the parent trainee has the written instructions								
2. Trainer verbally reads instructions to parent trainee								
3. Trainer verbally reads her rationale/explanation to the parent dyad								
4. Trainer asks the parent if he has any questions and clarifies if so								
5. Trainer shows the video model for the skill being taught								
6. Trainer instructs the parent trainee to practice each step of the skill being taught (e.g., Show me how you accept a picture, show me how you would accept the picture without verbally labelling it, etc.)								
7. Trainer provides parent with feedback throughout steps while practicing the skill being taught (e.g., "Yes, exactly like that." "Good!")								
8. Trainer models scenario procedures with the surrogate trainer								
9. Trainer instructs the parent-dyad to practice scenario procedures								
10. Trainer provides feedback to the parent trainee								
11. If corrective feedback was given, the trainer instructs the parent-dyad to practice again, until the parent trainee demonstrates the correct behaviour								
12. Trainer provides feedback for the additional practice trial(s)								
<b>Total +'s above total steps per trial</b>								
								<b>Total:</b>
<b>Total Treatment Fidelity %</b> _____ (total +'s divided by total steps across all trials x by 100)								

## Appendix I

## Social Validity Results

## TREATMENT ACCEPTABILITY RATING FORM—REVISED (TARF-R)

Please complete the items listed below. The items should be completed by placing a check mark on the line under the question that best indicates how you feel about the training you participated in.

1. How clear was your understanding of the purpose for this training?

\_\_\_\_\_  \_\_\_\_\_  \_\_\_\_\_  \_\_\_\_\_  \_\_\_\_\_ X  
 Not at all Neutral Very clear

2. Given that the entire training was delivered virtually, through video-conference platforms, how acceptable did you find the training to be?

\_\_\_\_\_  \_\_\_\_\_  \_\_\_\_\_  \_\_\_\_\_  \_\_\_\_\_ X  
 Not at all acceptable Neutral Very acceptable

3. Given the skills you have learned; how effective did you find the training to be?

\_\_\_\_\_  \_\_\_\_\_  \_\_\_\_\_  \_\_\_\_\_  \_\_\_\_\_ X  
 Not at all Neutral Very effective

4. How confident are you in your ability to apply the skills you acquired from this training appropriately, post-training?

\_\_\_\_\_  \_\_\_\_\_  \_\_\_\_\_  \_\_\_\_\_  \_\_\_\_\_ X  
 Not at all Neutral Very confident

5. Do you feel that this training improved your ability to support your child's PECS use/communication needs?

\_\_\_\_\_  \_\_\_\_\_  \_\_\_\_\_  \_\_\_\_\_  \_\_\_\_\_ X  
 Not at all Neutral Yes, definitely improved

6. Throughout training, did you experience any disadvantages regarding the procedures or virtual format of the training?

\_\_\_\_\_  \_\_\_\_\_  \_\_\_\_\_  \_\_\_\_\_  \_\_\_\_\_ X  
 None Neutral Many disadvantages

7. How demanding was participation in this training?

\_\_\_\_\_  \_\_\_\_\_  \_\_\_\_\_  \_\_\_\_\_  \_\_\_\_\_ X  
 Not demanding at all Neutral Very demanding

8. How likely is it that you will use these PECS skills to support your child's PECS use in the future?

X  
 Unlikely      Neutral      Very likely

9. Would you recommend this treatment to other families who struggle to communicate with their child via PECS?

                        X  
 Unlikely      Neutral      Very likely

10. What was most helpful or your most preferred thing about the online PECS mediator training?

It was nice to have flexibility with scheduling sessions and being able to do it with things that were around the house.

11. What was least helpful or your least preferred thing about the online PECS mediator training?

Having to go through the same information each time before starting the trials. I understand the need for this, but it was repetitive. There were also some challenges at times with having to move the camera around, especially with trying to arrange the exchanges with an active child. Having said that we got a lot out of the training. We knew going into the study that it would take commitment and time to improve skills. The added bonus of the surrogate training made it so both parents were trained simultaneously, which was great.