Training Parents to Implement the Picture Exchange Communication System Via Telehealth and Behavioural Skills Training

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Abstract

Research indicates that deficits in functional communication skills correlate with problem behaviour. Results from previous studies suggests that by teaching functional communication skills to an individual, it may be possible to replace problem behaviour with more socially appropriate means of communicating their needs and wishes. The primary aim of the current study was to investigate whether parents could be trained to implement the Picture Exchange Communication System (PECS) effectively with their adolescent son, Jack (pseudonym), who has an intellectual disability. The effectiveness of telehealth to administer PECS training was evaluated in conjunction with the use of behavioural skills training. Additionally, errors made by the parents in their use of PECS during training sessions where the researcher provided them with prompts were also examined. The secondary aim of the study was to investigate the effect of the aforementioned PECS training on the functional communication skills of Jack in the home environment. The most significant findings of the current study were that telehealth was a viable method of teaching PECS to parents, that parents made fewer errors for subsequent sessions within each phase, and that a greater number of errors were made in the role of communicative partner compared to physical prompter during Phase One. Results of the study also suggest that the intervention resulted in increased functional communication skills for Jack; namely the emergence of mands for particular toys and for making requests for the continuation of activities he enjoyed.

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Communication is a fundamental social behaviour that allows individuals to convey their basic needs and wants. Many individuals, particularly those with intellectual disabilities, may struggle with functional communication. This often results in challenging behaviour being substituted in lieu of this (Durand & Merges, 2001; Frea et al., 2001; Koegel et al., 1992; Sigafoos, 2000). Carr and Durand (1985) define functional communication training (FCT) as a means of replacing "child behavior problems" with functionally equivalent "verbal communicative acts." Augmentative and alternative communication (AAC) systems are one way that functional communication skills can be improved.

The Picture Exchange Communication System (PECS®) is an AAC system established by Bondy and Frost (1993; 2001) to teach functional communication skills to those with minimal or no verbal behaviour. Parents, teachers and caregivers may all be involved in teaching and communicating with individuals who use PECS. However, previous literature on the use of PECS by parents has indicated that many errors are made when they implement the system without any professional training (Jurgens et al., 2012). Telehealth may be a possible means by which parents and caregivers can be trained in PECS implementation. Behavioural Skills Training (BST), an evidence-based practice (Schaefer & Andzik, 2020) delivered via telehealth may be a useful addition to training parents.

Communication

Communication can be defined as the transmission of a message from one person to another, that can take many forms. Communicating with others is a fundamental social skill that aids in requesting basic needs or removing aversive stimuli (Mirenda, 1997). Additionally, the United Nations recognizes "freedom of expression and opinion" as an

intrinsic right of persons with disabilities (UN General Assembly, 2006). Despite this, many individuals struggle with communicating for a variety of reasons (American Speech-Language-Hearing Association (ASHA),1993). Deficits in communication may refer to a disruption in processing or understanding of vocal, verbal and/or visual stimuli.

Physical, neurological, neurobiological, or genetic factors may result in communication impairments (International Society for Augmentative and Alternative Communication, 2018). Communication issues may present and develop early in life, or may emerge later as the result of an acquired illness, injury or disorder. These deficits may be due to disorders with auditory processing as well as speech and/or language processing (ASHA, 1993). A progressive decline in functional communication skills may occur for those diagnosed with neurological diseases such as dementia (Banovic et al., 2018) and Parkinson's (Pell & Monetta, 2008). Other types of neurological diseases may affect an individual's ability for speech, that is, how they physically produce "sounds and words" (ASHA, 1993). Examples could include motor neuron disease (MND) (Bak & Hodges, 2004), which may also cause dysgraphia in some patients (Aiello et al., 2022); and Huntington's disease (Saldert et al., 2010). Amyotrophic lateral sclerosis (ALS) for example, a type of MND, has been observed to impair an individual's motor ability to produce speech (Linse et al., 2018). Similarly, of those who have suffered stroke, up to 40% will have aphasia as a result (Cichon et al., 2021).

Genetic conditions are another major cause of communication deficits. For example, Angelman Syndrome has the hallmark symptom of minimal or no vocal communication (Pearson et al., 2019) whilst Down syndrome has been linked with difficulties in producing articulate vocal verbal behaviour and syntax (Roberts et al., 2007). Physical disability is also a possible contributing factor that may limit communication skills. Cerebral Palsy for example may result in communication issues due to motor-related impairments and/or

intellectual disability (Pennington et al., 2004). Neurodevelopmental disorders such as intellectual developmental disorder (IDD) and autism spectrum disorder (ASD) are inherently defined by an individual's failure to develop communication skills to the level of neurotypical peers (American Psychiatric Association, 2013). Consequently, even within a single disorder, there may be multiple factors contributing to communication deficits.

Communication and Challenging Behaviour

Challenging behaviour (such as self-injury or aggression) is correlated with deficiencies in functional communication skills (e.g., Conklin & Mayer, 2011). Functional communication skills, as defined by Bondy and Frost (2001), are the ability of an individual to perform "behavior (defined in form by the community) directed to another person who in turn provides related direct or social rewards." More simply, functional communication refers to the ability to make requests (mand) for desired items, activities or the removal of stimuli (Luczynski & Hanley, 2013). This verbal behaviour is reinforced by another person who provides access to stimuli or removes aversive stimuli. An absence of functional communication skills may mean that challenging behaviours develop in lieu of this (Esch et al., 2010; Heath et al., 2015). It is critical that skills are taught that replace the challenging behaviour with a functionally equivalent response. A functionally equivalent response is a new behaviour which matches the consequence of the behaviour that is being replaced, for example, if a challenging behaviour had the purpose of gaining attention, then the new replacement behaviour should also result in gaining attention (Esch et al., 2010). An example of this could be teaching a child to hand a picture to their parent of a drink when they are thirsty rather than hitting the parent's arm to communicate their thirst. Research suggests that the severity of challenging behaviours is associated with the level of communication skill, with more severe problem behaviour correlating with lower levels of communication ability (Sigafoos, 2000). This idea is supported in a recent meta-analysis by Chow and Wehby

(2018), who concluded that below-average language abilities and challenging behaviour are linked. Longitudinal research further supports this concept. A meta-analytic review by Yew and O'Kearney (2013) examined the long-term consequences of specific language impairments (SLI) and observed that children diagnosed with SLI were significantly more likely than controls to have more extreme and recurrent clinical behavioural issues later in life. Furthermore, it has been suggested that behavioural, social, and emotional problems are correlated with language problems in school-aged children (Lindsay et al., 2007).

Functional Communication Training

Functional communication training (FCT) is an evidence-based practice that has been shown to effectively decrease challenging behaviours for people with disabilities (Gerow, Davis, et al., 2018). Behaviours that are problematic decrease as a result of teaching children functionally equivalent ways of communicating their wants and needs (Durand & Merges, 2001; Koegel et al., 1992; Sigafoos & Meikle, 1996). FCT has been described in a key paper by Carr and Durand (1985), where the authors conducted two studies on challenging behaviour and functional communication skills. The aim was to explore how attention may reinforce challenging behaviour. While measuring changes in the children's disruptive behaviour, the researchers kept the independent variables of activity complexity, attention, and experimenter feedback constant. When the children were given socially appropriate sentences to imitate to ask for help, concurrent decreases were observed in challenging behaviours. From this key finding, Carr and Durand concluded that by teaching alternative communicative behaviours that have the same outcome as the challenging behaviours, corresponding decreases in the latter occur. The authors reiterate that challenging behaviours should be seen as communicative in function, and suggest that functional analyses should be a key component of similar future research.

Recent interventions involving FCT-based strategies have found benefits in decreasing specific problematic behaviours, such as aggression, self-injury or disruption (Sigafoos & Meikle, 1996). Case studies featuring FCT have shown promise in decreasing behaviours such as excessive TV watching (Anderson et al., 2007), inappropriate sexual behaviour (Fyffe et al., 2004) and off-task behaviour in the classroom (Flood & Wilder, 2002). A systematic review by Walker et al. (2018) noted that the more extreme the challenging behaviour, the less likely it was to be reduced through FCT. The review by Walker observed that participants with physical disabilities, sensory impairments or multiple disabilities were only studied in a small percentage of studies. Few studies on FCT with adult or adolescent populations have been conducted. It is plausible to suggest research on FCT in adolescents with multiple disabilities may be a useful addition to current research.

Several studies have explored how parents may implement FCT. In a review of 26 studies, Gerow, Hagan-Burke, et al. (2018) concluded that parents can implement FCT effectively. The authors outlined that future research should include measures of implementation fidelity as well as follow-up data. Gerow, Hagan-Burke, et al. also state that it is important for future studies to explore effective training methods for parents, and research how fathers can be trained to implement FCT interventions. FCT may be more effective than alternative methods. Compared to other methods such as differential reinforcement of other behaviours (DRO) and differential reinforcement of incompatible behaviour (DRI), FCT is perceived as more effective and is more likely to result in long-standing behavioural change (Durand & Merges, 2001).

Verbal Behaviour

Verbal behaviour is a theoretical framework for language that is grounded in behaviour analysis, defined by Skinner in 1957. It is important to differentiate this from vocal verbal behaviour, which is the formulation of speech sounds that has undergone, and is

subject to, operant conditioning (Skinner, 1986). As well as vocalisations, *verbal* behaviour also is said to include written language or symbols, signs, gestures, braille and other modalities of communication. According to Skinner (1957) one of the most predominant features of verbal behaviour is that it involves a verbal community, which may reinforce (or punish) such behaviour through operant processes. Skinner gives the example of how infants learn to talk through reinforcement from parents; infants initially receive positive reinforcement for any vocalisation but later this is increasingly restricted to certain sounds of a language whilst other vocalisations undergo extinction. Skinner notes that verbal behaviour can be categorised into types according to the function (purpose) it serves. For example, mands are a type of verbal behaviour that can serve the purpose of communicating a need or want, or expressing the desire for a stimulus to be removed (e.g., saying "go away!"). Mands may take the form of requests such as when a child signs "milk" when they want milk; or through demands like signing "Give me a drink." As with the other types of verbal behaviour, the use of mands is reinforced by other people who may grant either access to wanted items/activities, or escape from undesired situations.

Tacts, echoics and intraverbals are other fundamental types of verbal behaviour defined by Skinner (1957). Tacts refer to the labelling of non-verbal stimuli that we experience through our senses. An example of a tact could be a child signing "milk" when they see milk. Echoic refers to a vocal verbal stimulus that is repeated, in the same way by themselves or others (Sundberg, 2014). For example, a child vocalising "milk" after a friend vocalises "milk." Intraverbal is a higher-level verbal behaviour, and refers to responding to a verbal stimulus without point-to-point correspondence (Skinner, 1957). An example of intraverbal behaviour could be a child writing about the last time they drank milk, after being given the verbal prompt to write a story in class. Intraverbal behaviour is critical for conversation and may be used for answering questions, story-telling, arguing and so on.

Verbal behaviour terminology is useful when identifying specific delays or difficulties with language acquisition. The Verbal Behaviour Milestones Assessment and Placement Program (VB MAPP), for example, is based on Skinner's (1957) theoretical framework of verbal behaviour and can be used to determine the presence or absence of specific language skills, such as the ability to mand (Sundberg, 2014). Identifying the absence of certain verbal behaviours can be useful for intervention planning and implementation. PECS has been identified as a possible method to expand missing or delayed verbal behaviour repertoires. More specifically, PECS has been shown to increase participants' ability to mand in a large array of studies (e.g., Boesch et al., 2013; Jurgens et al., 2009).

Augmentative and Alternative Communication

AAC is an umbrella term for a vast variety of communication methods that includes sign language, gestures, braille and speech-generating devices. AAC has been defined in terms of two groups: aided and unaided. Unaided AAC describes actions produced by an individual (such as sign language) for communication purposes, meanwhile aided AAC is used to describe communicating with others via an external device (Lloyd & Fuller, 1986).

Speech-generating devices (SGDs) are AAC devices that synthesize audio from user inputs and have been used successfully in communication skill interventions. SGDs may be low-, mid-, or high-tech. Mid-tech SGDs include electronic aides like the Logan® ProxTalker® whilst higher tech SGDs used in research on communication include iPods® (Achmadi et al., 2012), iPads® (e.g., Agius & Vance, 2016) and related devices (Kagohara et al., 2013). The iPad® is one of the most common high-tech SGD used in interventions targeting functional communication skills (Kagohara et al., 2013). Many studies that include the iPad® as an SGD have reported improvements in the number of requests made by participants diagnosed with ASD (Agius & Vance, 2016; Van der Meer et al., 2012; Wendt et al., 2019). Reviews of SGDs generally support their utility in communication centred

interventions. In individuals with developmental disabilities, one review noted largely positive outcomes for SGDs in improving communication skills (Rispoli et al., 2010). Similarly, in a review of SGD use for individuals with a diagnosis of ASD, Van der Meer and Rispoli (2010) observed that the majority of studies indicated improvements in communication skills. Van der Meer and Rispoli further note that more emphasis on the generalisation of SGDs across different environments should be incorporated into future interventions.

Devices have been developed for the purpose of enabling communication in individuals without cognitive deficits who cannot use vocal communication. For example, recent research has involved the development of implants that are inserted into the brain (Oxley et al., 2021). These brain-computer interfaces (BCIs) have been developed to translate covert (internal) speech into overt (external) speech (Rainey et al., 2019), with the intention of enabling people with disorders such as ALS, paralysis or locked-in syndrome to communicate through their own neuronal activity when connected to the device (Fourneret, 2020; Oxley et al., 2021). BCIs have many limitations however: they are presently restricted predominantly to non-human animal trials, are yet to receive approval by the United States Food and Drug Administration (FDA), have specific applications for those with acquired injuries such as paralysis, and elicit a host of ethical concerns (Rainey et al., 2019).

AAC systems in general may have barriers to their use, including technological failures (McNaughton et al., 2008), cost, limited motivation and lack of professional or familial support (Johnson et al., 2006). The Picture Exchange Communication System (PECS) is an aided AAC system that may be preferable for both children with disabilities and their parents. In a study comparing the use of a PECS folder with an iPad®, authors noted that when three children were allowed to choose between the two systems, two out of three children chose the PECS folder over the iPad for making requests (Agius & Vance, 2016).

Low-tech and low-cost systems like the traditional physical PECS folder and images may be preferrable to higher-tech options, as the latter may be more expensive and complicated to use.

The Picture Exchange Communication System

PECS is a method of communication grounded in Skinner's theory of verbal behaviour (Skinner, 1957; Bondy et al., 2004), designed by Bondy and Frost (1993, 2001) to allow those with functional communication skill deficits to communicate with others. A key advantage of PECS is that there are no pre-requisite skills for the learner; i.e., they do not have to already have the ability to make eye contact, discriminate between pictures or have echoic skills (Bondy & Frost, 1993). Two important features unique to PECS are that the programme is child-led, that is, the child is the one who initiates the interaction. This is paramount to the prevention of prompt dependence (Bondy & Frost, 1993) which is common in communication-based interventions. Secondly, PECS teaches the learner that language has a function. For example, in Phase One, in teaching the learner to mand, or request for an item they want, this means that the learner is rewarded with a physical item or activity that is likely to act as a greater reinforcer than any socially derived rewards (Bondy & Frost, 2001). PECS has six phases which map onto the categories of verbal behaviours described by Skinner.

The first phase of PECS according to Frost and Bondy (2002) involves teaching the learner to independently exchange a picture card for an item. To achieve this the learner must master several steps: picking up the image, reaching and handing a PECS image to a communicative partner. Initially, a physical prompter provides hands-on assistance to make this exchange, but this prompt is faded systematically until the learner is able to do this independently. PECS images typically have a picture of a desired item with a written label.

Once the communicative partner has received the PECS card from the learner, they then immediately provide access to the requested item.

The second phase of PECS, as described by Frost and Bondy (2002) involves teaching the learner to travel increasing distances and to persist in initiating interactions. The folder with the PECS image is no longer positioned in front of the learner, and the learner is taught to travel from their current position to the folder and then take the PECS image off. They are encouraged to travel to the communicative partner and make the picture exchange. The distance between the learner and the PECS folder, and the learner and the communicative partner is systematically increased as greater numbers of independent exchanges are made. In the second phase the learner is also encouraged to make eye contact with their communicative partner and persevere in seeking their attention before initiating the picture exchange. Additionally, in order to generalise these skills, the learner is encouraged to practice with their peers.

The third phase of PECS described by Frost and Bondy (2002) continues to develop the skill of manding, through discrimination training. The learner is taught to distinguish between two or more PECS cards and is also taught to form associations between each card and the equivalent physical item or activity. Phase Three has two parts. Part A involves the image of a reinforcing item/activity of high value to the learner presented simultaneously with an irrelevant “distracter” picture of a mundane item (Frost & Bondy, 2002). Part B involves multiple images of items/activities that are all reinforcing for the learner. Processes are outlined for when the learner chooses the incorrect card, and “correspondence checks” are used in Phase Three B to identify whether or not the learner has made the picture exchange for the item they actually desire.

Phases Four, Five and Six teach the learner to use more complex verbal behaviours including tacts and intraverbals (Bondy & Frost, 1994). In Phase Four the learner develops the ability to tact; i.e., to make simple comments on what they want or see. A "sentence strip" is used for the learner to place multiple cards on such as an image representing "I see" in addition to the PECS card of an item such as a drum. Phase Five involves teaching the learner to reply to the simple question "What do you want" by positioning PECS cards on the sentence strip (Frost & Bondy, 2002). Phase Six expands on this skill by teaching the learner to answer simple questions like "What do you hear?" and "What do you have?" (Frost & Bondy, 2002).

PECS has been successful in increasing the communicative skills for a number of different disabilities including ASD (Charlop-Christy et al., 2002), cerebral palsy (Almeida et al., 2005) and Rubinstein-Taybi syndrome (Bazain & Bari, 2017). PECS has also been successfully adapted for people who have multiple diagnoses (e.g., Adkins & Axelrod, 2001). Additionally, research suggests that PECS may increase communication skills in those with physical disabilities such as visual impairment (e.g., Finkel et al., 2004; Lund & Troha, 2007; Ali et al., 2011). PECS may be more appropriate than other AAC systems in many instances, such as for toddlers who do not yet have the dexterity to sign or point to images (Bondy, 2001) or for people who rely on aided AAC because they lack the physical dexterity for sign language or other gestural means of communicating (Sigafoos et al., 2014). Some evidence suggests that the ability to mand is more readily acquired through PECS-based interventions compared to sign language (Barlow et al., 2013; Chambers & Rehdfeldt, 2003). Many questions remain surrounding the use of PECS by certain populations. The majority of research on PECS has involved participants with ASD, either as the sole diagnosis or with other comorbidities. Furthermore, the majority of interventions with PECS have involved child participants which has left a gap in knowledge surrounding how PECS may apply to

adolescents. Whilst Ganz et al. (2012) concluded that younger children showed larger benefits from PECS compared to older children, their meta-analytic study did not include any participants older than 17. It remains to be seen how older adolescents and adults may benefit from PECS, particularly if such individuals have multiple disabilities such as a hearing impairment and intellectual disability.

It has been well established that interventions using PECS often result in the secondary gain of increasing vocal verbal behaviour. Several studies using PECS indicate that these interventions may correlate with an increased frequency of vocal mands specifically (Bondy & Frost, 1994; Carr & Felce, 2007a; Charlop-Christy et al., 2002; Ganz & Simpson, 2004; Jurgens et al., 2009), although a few studies have observed no change (Howlin et al., 2007). Conversely, some studies have observed increased frequency of vocal mands for some participants but not others (e.g., Tincani et al., 2006). Despite the majority of studies indicating increases in vocal mands, questions remain regarding the individual factors that may influence this acquisition.

Training Others to Implement PECS

Training caregivers, teachers and parents in the use of AAC systems like PECS has numerous advantages. For example, in training caregivers through telehealth modalities, less time is taken up from professional ABA practitioners whose in-home services are more costly (Lindgren et al., 2016) Furthermore, sometimes ABA practitioners are physically unable to conduct interventions in the usual environment, such as during the coronavirus disease (COVID-19) pandemic. Aranki et al. (2022) found that during the pandemic, even when ABA services were offered in telehealth form 40% of the participants reviewed refused to partake in this method of intervention. Previous studies have observed that carers frequently make errors when implementing PECS without professional training (e.g., Jurgens et al., 2012). For example, Barnes et al. (2011) performed a study where three care staff of adult

clients were trained in administering PECS. Despite the use of a package training scheme (video, handouts, reading material) all three care staff were found to have a high number of errors in performing the first three phases of PECS. The authors conclude that video combined with instructional material is not effective in the training of carers for PECS. As the study involved the formal setting of a 'day programme,' and involved only adult subjects, it remains to be seen whether the same finding would apply to adolescents in the home environment. Consequently, it may be necessary for future studies to include more than just video and instructional modes when teaching PECS for treatment fidelity to be achieved by trained carers.

PECS and Parents

Parents of children with disabilities have also been taught to implement PECS. Park et al. (2011) studied how three mothers could be taught to implement PECS with their young children. The mothers were taught how to act as the communicative partner but not as the physical prompter. Important features of the study include high social validity, high treatment fidelity and the suggestion that the children retained the ability to use PECS in follow-up sessions. Only one study has explored how both parents could both be taught to implement PECS. A study by Treszl et al. (2022) aimed to investigate how both parents may be included in PECS training for them to then implement this with their child. BST, telehealth and general case training were all incorporated into the training programme. Treatment fidelity measures for the parents were taken by assessing their accuracy in performing three skills: arranging occasions suitable for PECS communication exchanges, making correspondence checks and effectively using the error correction procedure outlined by Frost and Bondy (2002). Severe challenging behaviour was part of the exclusion criteria set by Treszl et al. (2022) and the child had previous experience using PECS. It may be plausible to suggest that

conducting an intervention with BST and telehealth for an adolescent who had not used PECS successfully may be a useful avenue for future research.

Adolescent children have not been included in research on training parents to implement PECS. It may therefore be warranted to explore how training the parents of an adolescent with a diagnosis of IDD might differ from parents implementing PECS with a younger child with ASD. Analysing a greater range of errors that are most frequently made by each parent across PECS phases may be worthwhile to develop more effective programmes. Investigating differences between errors made in the role of communicative partner compared with physical prompter is a reasonable next step that may help to identify and prevent errors which would otherwise threaten the fidelity of PECS interventions.

Behavioural Skills Training

Behavioural skills training is the combination of instructions, feedback, rehearsal and modelling presented together for teaching or training purposes (Sarokoff & Sturmey, 2004). In a study by Sarokoff and Sturmey, the authors concluded that the combination of the aforementioned components lead to an increase in performance by teachers implementing discrete trial training

An important application of BST has involved teaching parents of intellectually disabled or autistic children to perform a variety of professionally supervised interventions. A review by Schaefer and Andzik (2020) analysed the evidence base for interventions implemented by parents who had been trained via BST. The authors concluded the approach of using BST to train parents could be classified as an evidence-based practice. Though there is strong support for the efficacy of BST for training parents to implement interventions (Schaefer & Andzik, 2020), the study did not examine its use for children with multiple

disabilities. Furthermore, few studies from the review included maintenance or follow-up data collection.

BST has also been used to teach the application of PECS in formal settings. Rosales et al. (2009) tested the fidelity of the implementation of PECS by university students. Compared to the baseline, the percentage of accurate steps completed increased. Similarly, Homlitas et al. (2014) also used BST to train three teachers to implement PECS in the classroom. The findings of the study by Homlitas et al. were consistent with those of Rosales et al., with teachers meeting mastery criterion during the training phase of the intervention. Using BST specifically to teach parents to implement PECS is lacking rigorous scientific investigation. Applying BST methodology to parents learning PECS in the home environment could be a useful avenue for future research to explore. Recent research has explored the administration of BST via telehealth (Svensson, 2022; Treszl et al., 2022); which may be feasible means for upcoming research to use for teaching parents to implement PECS.

Telehealth

Many barriers exist for individuals with disabilities when accessing health services. Access to transport, issues with mobility, cost of travel, distance to services, and available time are all barriers that may inhibit treatment accessibility for members of this population (Theodoros & Russell, 2008). Telehealth is the use of technology, such as audio/video conferencing, to administer health services (Sutherland et al., 2018). Telehealth has been proposed as a possible solution to overcome barriers faced by those with disabilities when accessing in-person health services such as speech language therapy. Furthermore, telehealth has been necessitated in certain situations to provide ABA services, such as during compulsory lockdown periods during the COVID-19 pandemic (Pellicano & Stears, 2020).

Previous research has used telehealth for a variety of applications, including speech-language pathologists (SLP) consultation delivery (Fairweather et al., 2016) and in conducting interventions for decreasing challenging behaviour (Lindgren et al., 2016). There is some evidence that parents see telehealth as preferable to in-person speech-language type consultations (Anderson et al., 2014). Some researchers however still do not recommend the complete substitution of in-person ABA services with telehealth (Reynolds et al., 2009).

Research has explored the application of telehealth to AAC support for parents. Anderson et al. (2014) used telehealth to deliver instruction to parents on how to use their new SGD. Parents reported many benefits of the telehealth methodology including convenience and accessibility. Anderson et al. also found that compared to sessions at home parents reported increased child focus and the benefit of lowered stress (e.g., from tidying the house before the professional arrived). Difficulties expressed by parents in the study included problems scheduling telehealth sessions, technical issues, and limitations surrounding camera angles.

Only one study has explored the use of telehealth in conjunction with BST for training parents in PECS implementation with their child. In a study by Treszl et al. (2022) telehealth was used to deliver BST and GCT to parents. The father was trained via these methods to implement PECS with his child whilst the mother was included in the role play component of training. The researchers concluded that telehealth was an effective means to train the father to implement the second part of Phase Three of PECS. It is unknown whether the BST component of the study or the combination of BST with GCT led to improvements in the parents' performance. It could be suggested that future studies could expand on these results by undertaking telehealth-based interventions for training parents in a wider range of PECS phases, as well as administering training for both parents.

An increasingly popular tool used in the field of telehealth research is the bug-in-ear device. A bug-in-ear device is a piece of technology fitted into the ear which allows professionals to administer auditory feedback to participants for training purposes (Schaefer & Ottley, 2018). A review by Schaefer and Ottley of bug-in-ear technology set to evaluate whether the device could be considered an evidence-based practice for training purposes for professionals. The practicality of the device was also assessed in the review. The authors concluded that using bug-in-ear devices for feedback purposes could be characterised as an evidence-based practice. Schaefer and Ottley suggested that future research should explore whether bug-in-ear technology could be effectively used in combination with BST and related training methods.

Conclusion

A range of disabilities may contribute to deficits in functional communication. Individuals with IDD may experience profound difficulties expressing their needs and wants, which may result in the expression of challenging behaviours. Communication skills may be improved for people with IDD through FCT, an evidence-based method that regularly results in corresponding decreases in challenging behaviours (Durand & Merges, 2001; Gerow, Davis, et al., 2018). AAC systems have been used in FCT interventions to teach functional communication skills. PECS is a widely researched form of AAC that appears to increase functional communication skills for participants with a variety of diagnoses (e.g., Maladraki & Okalidou, 2007). Recent research suggests that teachers and parents can be trained as implementers of PECS with children who have disabilities. Few studies, however, have measured the fidelity of implementation of PECS by parents with their children. Treszl et al. (2022) produced the only study to date that has involved both the mother and father of a child with IDD being trained to implement PECS. There are still several questions that remain in

regard to the simultaneous training of both parents because the mother was not directly taught in the study by Treszl et al.

Little is known about how an additional disability such as a hearing impairment may influence the acquisition of PECS skills. Research on how PECS and other FCT interventions may improve the functional communication skills of children is plentiful but information on the application of these interventions to adolescents with multiple disabilities is scarce. Furthermore, whilst research is beginning to explore the possibility of training mothers to implement PECS with their children, there has been only one study where both the mother and father are trained. Consequently, there are three aims for this study:

1. Can parents be effectively trained via Telehealth to implement PECS with their child?

2. What types of errors arise when parents attempt to implement PECS with their child?

3. What is the effect of PECS training using Telehealth on the functional communication of a young person with an intellectual disability, who has limited functional communication skills?

Method

Participants

Four groups of participants were involved in the study. The first group was Jack (pseudonym), who was the learner in the PECS training. The second group consisted of the mother and father of Jack. The third group were caregivers of Jack. The fourth group was Jack's teacher.

Young Person Participant

The young person needed to meet the following criteria for inclusion in the research project:

- Had limited functional communication skills
- Aged between 15 years and 25 years
- Met the DSM criteria for intellectual or developmental disability
- Had a goal to use AAC that was not successful prior to the intervention

Jack was an 18-year-old male. He resided at home with his mother and attended a school for those with intellectual disabilities. Jack had been diagnosed with auditory neuropathy and met the DSM -5 criterion for intellectual disability. After completion of this project, Jack was diagnosed with EIF3F-related neurodevelopmental disorder. Jack took Risperidone each evening to prevent problems with sleep. Jack attempted to communicate with others by pulling them by the arm or hand to desired locations or by handing them objects. He demonstrated eye contact when engaging with others but had minimal to no functional communication skills. Anecdotally, Jack had said "I want mum" on one previous occasion many years ago. This is the only report of vocal verbal behaviour from all of the participants surveyed. Jack engaged in several challenging behaviours on a daily basis. Aggressive behaviours towards others were operationally defined as kicking others (i.e., using his foot to make contact with another person's body from a distance of at least 15 cm), grabbing the clothing of caregivers (i.e., using his hand(s) to grab onto any part of the clothing of another person before pulling it forcefully) and hair-pulling (i.e., grabbing the hair of another person using his hand(s) before pulling it forcefully). Another challenging behaviour displayed by Jack was lifting and throwing objects that weren't designed for this purpose, for example school bags, buckets, clothing or drum kit parts. Jack also engaged in self-injurious behaviours including hitting his head with objects, chewing his fingers, and hitting his forearm or upper thigh with his hand. The father hypothesised that some of the challenging behaviours Jack exhibited were communicative in nature: "he does have his way of communicating, such as pulling clothing, which I have learnt is his way of telling us

something even if, at times, we have no idea what that is." Jack's occupational therapist had worked at the special education school for many years and had worked with Jack on a part-time basis during this time. She had worked with Jack since he started at this school at age five. The occupational therapist hypothesised that PECS was not successful with Jack in the past because he was unable to discriminate between images. This perception was shared by two teacher aides (who worked full-time with Jack at the school) as well as Jack's main teacher.

Parent Participants

Jack's mother had some experience with using PECS previously, but had not had any formal training with the system. She had attempted to use PECS in the past in the home without any success.

Jack's father had been his caregiver since birth. He did not live with Jack per se, but swapped with the mother to stay at Jack's home on a regular basis, for one to three nights a week. Jack's father had not had any previous training in PECS implementation.

Caregiver Participants

Two caregivers participated in the current study. One caregiver was Jack's older sibling, whilst the other caregiver was a paid employee. Both worked with Jack on a part time basis. Neither had had any formal training in the use of PECS.

Caregiver One had worked with Jack for less than six months. She worked with Jack at his home for between one to three days a week after school. Her role was to supervise Jack as well as perform personal cares and some food preparation. She cared for Jack for three hours at a time.

Caregiver Two, Jack's sibling, had worked with him as a caregiver for several years. Her role as a caregiver involved taking Jack on outings, supervising him at home, and performing personal cares.

Teacher Participant

Jack's main teacher had not used PECS with Jack. She had not had any formal training in the use of PECS. The teacher worked at a school for those with intellectual disabilities and had taught Jack for a year and a half at the onset of the study.

Setting

Training sessions were conducted in the lounge area in Jack's home. Generalisation sessions occurred at the home in various rooms including the mother's bedroom and the kitchen. To implement video conferencing the program Zoom was used on a Microsoft laptop. The video conferencing software was used for the training phase in Jack's home. Due to privacy and ethical reasons, as well as COVID-19 restrictions, video conferencing was not used for baseline sessions at the school - these were instead observed in person by the researcher.

Materials

PECS Folder

A 26 cm x 31cm folder was used for Phases Two and Three of PECS. Laminated pictures 9.5 cm by 9.5 cm were created using photographic depictions of objects. These pictures were used for all phases and were able to be attached to the folder by using a Velcro backing.

Training and Recording Devices

The researcher used a Microsoft Corporation Surface Laptop 4 ® with Windows 10 ® and headphones to conduct video conferencing using Zoom for all sessions. This was used

for baseline (home setting only), intervention, generalisation and follow up sessions. Parent participants chose to use their Dell laptop, without a headset, for video conferencing.

Reinforcement Inventory for Children and Adults

The child section of the "Reinforcement Inventory for Children and Adults" (Willis et al., 1993) was administered to caregivers and parents prior to baseline. The Reinforcement Inventory is a list of 13 categories including edible, physical and social items/activities, used to determine potential reinforcers for a given person. The instructions for the inventory are to "check each item in the column that describes how much the person enjoys the things described." The items can be ranked across five levels of enjoyment from "not at all" to "very much." There are open-ended questions on the final page of the inventory that instruct the person to "list… those event or activities the person does more than" 5/10/15/20 times a day. A list of activities such as "watching television" is provided and the person is asked to write how much time the child spends on each activity. The inventory ends with five more open-ended questions that include the person's favourite and least favourite thing to do. The inventory has a second section designed for adults that was not used in the current study.

Items/activities as Reinforcers

As determined by the Reinforcement Inventory for Children and Adults (Willis et al., 1993), the items/activities rated the most highly reinforcing for Jack were sensory toys and drums/drumsticks. Other highly reinforcing items included watching TV, listening to music, and having social interactions that included happy faces/smiles. Moderate reinforcers included ribbons and watching movies (especially the movie Shrek), followed by potato chips/fries.

Data Recording

The frequency of challenging behaviours within baseline, generalisation and follow-up sessions was recorded using a partial interval recording form, designed by the researcher for this study (Appendix K). This was completed by the researcher in the aforementioned stages of the intervention.

The modified Primary Intervention Scale (PRIS) (Lane et al., 2002) was adapted by the researcher for use in the current study (see Appendix J). Six additional open-ended questions were included in the social validity survey, adapted from questions used by Greenberg et al. (2012) (see Appendix J). The survey was e-mailed to parent and caregiver participants to measure the social validity of the intervention. All four of the participants completed the survey.

Recording sheets developed and used previously by Svensson (2022) were adapted by the researcher and used for collecting data on errors made by the parents for the roles of physical prompter and communicative partner (Appendices L-P). The sheets were used for Phases One through Three A, during the intervention stage of the project. Sheets for monitoring the progress of Jack for PECS Phases One through Three A were sourced from Frost and Bondy (2002).

VB-MAPP

The Verbal Behavior Milestones Assessment and Placement Program (VB-MAPP) is an assessment guide developed by Sundberg (2014) designed to measure an individual's verbal behaviour and skills that relate to communication. These are split between three levels that correlate with typical developmental milestones of infants and toddlers (0-18 months, 18-30 months and 30-48 months) (Sundberg, 2014). Milestones assessed by the VB-MAPP include social, play, imitation and classroom skills. Language markers assessed include

mands, tacts, intraverbals as well as echoics. Listener and matching to sample skills are also evaluated. The VB-MAPP was completed by the researcher during baseline.

Design

A changing criterion design was used in the current study. This was applied to both the parents and their son. Jack had to meet the set criterion of 80% before progressing to the next PECS phase, as specified in the PECS manual by Frost and Bondy (2002). The parents also had to meet the set 80% criterion for accuracy before they were trained in the next phase of PECS. Interventions that involve testing accuracy of defined behaviours are well suited to changing criterion designs (Cooper et al., 2019). To strengthen the experimental validity of the intervention, pre- and post-intervention measurements were also taken.

Independent Variables

The main independent variable for the current study was the phase of PECS taught to the mother and father by the researcher, through behavioural skills training (BST). BST consists of four elements: instructions, modelling, rehearsal and feedback. Instructions were given to the parents via e-mail prior to the first session of each phase (appendices Q - S). Modelling was included in this email, in the form of video clips of the relevant PECS phase. Rehearsal and feedback took place in Jack's home, where the parents practised using the relevant PECS phase with Jack, under the supervision (via telehealth) of the researcher. The researcher provided feedback (prompts) in real-time through video conferencing. Post-session feedback was given through e-mail, as required. The first three phases of PECS were included in the study, as taken from Frost and Bondy (2002):

Phase One:

Phase One involves the learner picking up a picture of their requested item or activity which is then handed to the communicative partner. The physical prompter's role is to

physically assist the learner to pick up the image, reach to the communicative partner and release the image in their hand.; if the learner is unable to do this independently. Once the picture has been handed to the communicative partner the learner is immediately rewarded with the desired item or activity depicted on the PECS card. The communicative partner must be trained on when and how to react to the learner.

Phase Two:

The intention of Phase Two is for the learner to be able to travel systematically increasing distances for the card exchange to occur. The learner is also required to persist in their initiation of the interaction when the communicative partner is less easily accessed (i.e., the communicative partner may be engaged in another activity or looking away). Generalisation across people, places and with different reinforcing items/activities is an important part of Phase Two. The communicative partner must be taught to encourage such persistence from the learner throughout their acquisition of the aforementioned skills.

Phase Three:

The learner is presented with at least two pictures positioned on the front of their PECS folder. They are trained to discriminate between the pictures and to identify the image that produces their desired reinforcer prior to making the picture exchange. As the learner begins to make increasing numbers of correct picture discriminations, the number of pictures on the folder is increased and multiple pictures with a high reinforcement value are included.

Dependent Variables

Several dependent variables were measured in the current study. Data was collected on the type and frequency of errors made by the mother and father of the young person, separated into the roles of communicative partner and physical prompter. This was for Phase One and for the beginning of Phase Two, where a physical prompter was initially necessary

as suggested in the PECS manual. The errors listed below were directly sourced by those defined in the PECS manual by Frost and Bondy (2002). Some of these have also appeared in research by Jurgens et al. (2012). Error types derived from Frost and Bondy, which appear in the research by Jurgens et al. as well as in the current paper, are indicated with an asterisk. Definitions for communication opportunity, reinforcement timing and error correction, as used in the baseline, generalisation and follow-up phases of this study were derived from the research by Svensson (2022).

Secondary dependent variables were the frequency of independent PECS mands made by Jack. Mands, spontaneous communicative attempts and challenging behaviours were recorded for all phases of the study except for the intervention phase. These were all derived from the operational definitions outlined by Svensson (2022).

Operational Definitions

Primary Dependent Variables (For the Parents), for Baseline, Generalisation and Follow-Up:

Communication Opportunity: when the parent changes the environment in some way so that Jack must use PECS to gain access to a reinforcer. For example, placing a desired snack in a container that can't be opened by Jack, waving a ribbon that he cannot reach, or pausing when playing a song. Jack indicates that he wants access to the item/activity by using the PECS image to "ask" for it.

***Vocal Prompting:** vocal communication produced by the mother or father that increased the likelihood of Jack using a PECS card for a communicative attempt.

***Physical (Gestural) Prompt:** Any physical act produced by the mother or father that increased the likelihood that Jack would exchange the PECS card to gain access to a reinforcer or remove an aversive stimulus.

***Prompted Speech (Insistence on Speech):** any occasion where either parent required Jack to produce a vocalisation to gain access to a reinforcer or remove an aversive stimulus.

***Error Correction:** the parent performs the four-step error correction procedure described by Frost and Bondy (2002) in the PECS manual, when relevant to the situation.

***Reinforcer Timing Error:** counted as any discrete event where the mother/father did not respond to Jack's communicative attempt (using PECS cards) by giving him the item, within 5 seconds of him making an attempt.

***Open Hand Prompt Error:** the 'open hand' prompt is used prior to Jack reaching for the item or picture.

Primary Dependent Variables for Phase One – Errors Applicable to Physical Prompter:

***Waits for Learner:** The prompter waits for Jack to reach for the item before providing any physical assistance.

Physically Guides Pick Up/Reach/Release: The prompter provides physical assistance to perform the step of picking up the card, reaching over to the communicative partner with the card, and/or releasing the card as required.

Fades Prompts Effectively: The prompter gradually and systematically fades the amount of physical assistance they provide.

Interrupts Inappropriate Behaviours: If Jack walks away, picks up other items in the room, plays with the PECS card etc. the prompter provides physical assistance to engage in the exchange instead.

Does Not Interact Socially with Learner: The parent does not talk to Jack during trials or use gestures/facial expressions in any way.

Primary Dependent Variables for Phase One – Errors Applicable to Communicative Partner

Arranges the Training Environment Effectively: The parent positions a single PECS card directly in front of the learner. They have the reinforcing item ready to give to the child.

***Does Not Use Gestural Prompts:** The parent does not point to or gesture towards the PECS image.

***Does Not Use Verbal Prompts:** The parent does not use any vocalised prompts during trials, such as "hand me the card."

Entices appropriately: The parent shows Jack the reinforcer.

***Uses Open Hand Appropriately**: The parent holds out their hand, palm upwards, ready to receive the image only after Jack has reached for the reinforcer or the image.

***Provides Reinforcer Within .5 seconds and Provides Label:** As soon as Jack deposits the image into the communicative partner's hand, the parent verbally labels the image (e.g., "drum!") whilst simultaneously giving him the item.

***Does Not Insist on Speech:** The parent does not require Jack to speak in order to gain access to the reinforcer.

Returns the Picture at the Correct Time: The parent positions the card in front of Jack whilst he is consuming or playing with the reinforcer.

Primary Dependent Variables for Phase Two: Physical Prompter

Prompts removal of the picture from the book: The parent assists Jack to remove the image from the folder, if and when necessary.

Physically Assists the Learner to the PECS Folder: The parent helps Jack walk to the folder as required.

Physically Guides the Learner to the Communication Partner: The parent physically helps Jack to walk to the communication partner as required.

Uses Back-Stepping: When required, the parent restarts the trial by putting the image back onto the folder and physically providing assistance to help Jack take the image off and take it to the communicative partner.

The error types "Waits for initiation/learner" and "does not socially interact with learner" are the same as for Phase One.

Primary Dependent Variables for Phase Two: Communicative Partner:

Arranges the Environment Effectively: The parent has the folder ready with a single image positioned on the front, and has the corresponding reinforcer ready to give to Jack during the picture exchange.

Entices Appropriately: the parent makes the reinforcer visible to Jack.

Gradually Increases the Distance from the Learner: the parent systematically moves further from Jack with each successful trial

Teaches the Learner to Cross the Room: The parent moves further towards the other side of the room at the beginning of each trial.

Gradually Increases Distance Between the Learner and the PECS Folder: the parent systematically increases the distance between Jack and the PECS folder at the onset of each trial.

Turns Away from Learner: The parent reduces prompts by systematically increasing the degree to which they turn their body away from Jack.

Eliminates Subtle Prompts. The parent gradually decreases the amount of eye contact and other physical prompts such as facial expressions with Jack and the visibility of the reinforcer.

Teaches the Learner to Travel from One Room to Another: the parent gradually increases the distance until Jack can travel between rooms. They initially position themselves in front of the doorway, then in the doorway, then into the next room, as Jack performs successful trials for each position

The error types "Reinforces within .5 s and provides label," and "doesn't insist on speech" are identical to those described for Phase One.

Primary Dependent Variables for Phase Three: Communicative Partner

Arranges Effective Training Environment: The parent has both pictures available for Jack to choose from, as well as having the corresponding items ready.

Entices with Both Items: The parent has both of the reinforcing items visible to Jack.

Social Reinforcement when Learner Touches the Correct Image: Either smiling, giving a thumbs-up signal, and/or providing verbal praise, as soon as Jack touches the correct image.

***Reinforces with Requested Item:** The parent gives Jack the item that matches his request (i.e., matches the card). The parent does this even if Jack mistakenly gives the parent the image for the item he doesn't want e.g., if he wants the drink but hands the picture of the bells to the mother, the mother then gives him the bells.

Varies the Position of the Picture: The parent changes the position of the images regularly, so that Jack does not become dependent on card position to make the correct choice.

Secondary Dependent Variables (For Jack):

Independent PECS Mand*:* A unprompted request made by exchanging a physical picture card for a reinforcing activity or object, or to remove a stimulus or activity that is aversive. This may include an accompanying vocalisation by Jack.

Vocal Mand: A vocalisation that is a request to access an item or activity or to remove an item or activity. It is not used in conjunction with the use of a PECS image. For example, saying "drink" when a drink is desired.

Challenging Behaviour: Any action displayed by Jack that resulted in actual or probable physical harm to themselves, others, or objects; or which otherwise adversely affected themselves or others. Challenging behaviour may result in isolation or exclusion for Jack either socially or physically. For example, throwing an object two metres across the room, whether someone else was present or not, would be considered a challenging behaviour.

Spontaneous Communicative Attempt: any unprompted action or vocalisation displayed by Jack that was intended to communicate something with another individual. This excluded both vocal and pictorial mands. For example, spontaneously pulling a caregiver's arm towards the TV remote and then pointing at the TV.

The error types "Error correction procedure" and "conduction of second error correction procedure" as identical to those described in Phase One.

Procedure

Pre-baseline

The researcher contacted the parents of Jack and his caregivers to arrange a meeting. After consenting to the project, the researcher introduced and explained the "Reinforcement

Inventory for Children" (Willis et al., 1993). This was emailed to the parent and caregiver participants to be filled out and returned.

The researcher met with several individuals from the school that Jack attended. The occupational therapist and speech-language therapist, both of whom had worked with Jack, were consulted over Zoom. Jack's main teacher was informally interviewed in person by the researcher, to gather information about Jack's previous use of PECS. Two teacher aides, both of whom had worked with Jack for a number of years, also attended this meeting and gave their perspectives on why PECS had not been successful with Jack in the past. The researcher observed Jack in the classroom environment and noted the frequency of challenging behaviours, use of PECS, mands and communicative attempts.

Prior to baseline the researcher also assessed Jack using the VB-MAPP (Sundberg, 2014) through observations conducted at Jack's home and in his classroom.

Baseline

Dependent Variables: The researcher conducted two 30-minute observation sessions for each parent and caregiver over the span of two weeks. Jack, his parents and his caregivers were assessed on the dependent variables in a natural setting.

School Environment: Data on Jack's challenging behaviours in the classroom was collected by the researcher during two sessions of 30 minutes duration, within a single week. Independent PECS mands, vocal mands and spontaneous communicative attempts were all recorded by the researcher.

Intervention Sessions

For the Behavioural Skills Training, both parents were first emailed an information pack for PECS Phase One. The pack included links to YouTube videos of Bondy and Frost performing the steps in Phase One, as well as written instructions in a Word document. Next,

the mother and father attended three sessions of 30 - 45 minutes duration. In these sessions, parents were instructed to try to correctly implement PECS with Jack. The researcher used video conferencing to communicate with the parents and provide prompts as required. During these sessions, the researcher assessed both parents on the implementation of PECS and provided anecdotal feedback after each session.

If Jack displayed distress or disengagement during a session, the session was immediately stopped and rescheduled. The parents were given the opportunity to communicate their opinion to the researcher as to why they thought he was exhibiting distress or disengagement.

Once Jack met the mastery criterion for Phase One, parents were emailed the information pack for Phase Two. Again, the pack included written instructions and links to videos. Sessions were conducted in the same way as for Phase One. Once Jack met the mastery criterion for Phase Two, the instructions and video modelling for Phase Three A were emailed to the parents.

Generalisation

Generalisation sessions were conducted in the home environment and took place after the final session for Phase One training, and again following the final training session for Phase Two. Generalisation sessions ran for 30 minutes. The dependent variables for both the mother and father were recorded. No feedback from the researcher was given during these sessions. Generalisation data was also gained qualitatively, outside of these set sessions, with the parents and caregivers taking videos of successful PECS interactions and submitting these to the researcher via e-mail.

Post Intervention

Follow-up sessions were arranged after Phase Three A training had ended. The sessions were 30 minutes in length, took place at Jack's home and were recorded via video conferencing. Follow-up sessions were originally planned to take place in the classroom as well as in the home, however, after the six-week end-of-year holiday the researcher was informed that Jack was going to be in a new classroom with a new teacher and teacher aides. Because this no longer represented baseline conditions the follow-up sessions at the school were omitted.

Treatment Integrity

Treatment integrity was maintained by closely following the original PECS manual (Frost & Bondy, 2002), using specific operational definitions and gathering inter-observer data for the parents during baseline, intervention and follow-up sessions. Treatment integrity data was gathered for the parents by recording the errors they made as well as the type of errors (as described previously). Treatment integrity data was not gathered for the researcher.

Social Validity

A questionnaire with both closed and open-ended questions (based on the MPIRS, adapted from Lane et al., 2002; and questions from Greenberg et al., 2012) was emailed to the mother, father and caregiver participants for completion. All four completed the survey.

Interobserver Agreement

The training phase of the intervention was recorded using video conferencing software for interobserver agreement calculations. The interobserver viewed 27% of all sessions. For baseline and generalisation sessions, IOA was calculated by using the exact count per interval method; where the number of intervals in which there was 100% agreement between observers was divided by the total number of intervals. For training sessions, IOA

was calculated using the trial-by-trial method. This involved taking the number of trials where the interobserver and researcher agreed, and dividing this by the total number of trials. Two methods of calculating IOA were used because baseline/generalisation sessions involved partial interval recording whilst training sessions were observed on a trial-by-trial basis. For both methods, the percentages were averaged to give a total percentage for each entire session. The mean agreement for all IOA sessions was 96% (range of 94% to 98%). The suggested ≥85% criteria set by Kleinmann et al. (2009) was well exceeded in the current study, suggesting a high degree of believability (Cooper et al., 2019).

Results

VB MAPP

The VB-MAPP was used to assess Jack's language and social abilities. The VB-MAPP helped to recognize barriers that may have previously influenced Jack's ability to mand and use more advanced verbal behaviours. Strengths were able to be identified that were useful for implementing PECS.

Figure 1

VB MAPP for Jack, Prior to Intervention.

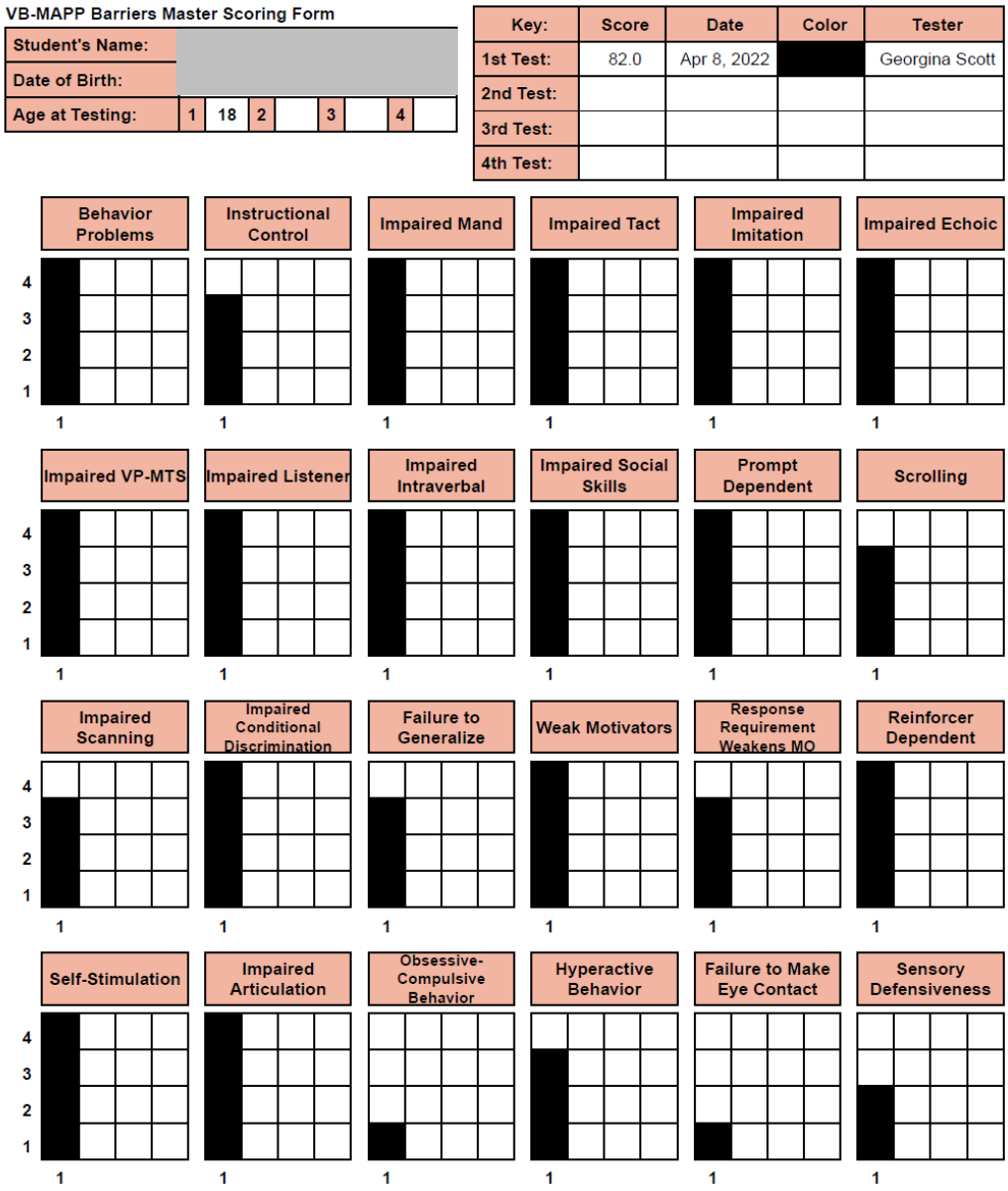

Figure 1 Continued

Note. Barriers and Milestones Master Scoring Forms. From "Verbal Behavior Milestones Assessment and Placement Program (VB-MAPP)" by M. Sundberg, 2014. Copyright 2023. Adapted with permission.

Jack had low scores for the Transitions and Milestones sections of the VB-MAPP. The high score for the Barriers section of the VB-MAPP suggests that multiple factors may have inhibited his acquisition of verbal behaviour and related learning skills. The scores in the milestones section of the VB-MAPP may support the conclusion that Jack does not have the ability to use basic verbal behaviours (including manding, tacting, using echoics and imitating) that are typically acquired during infancy. An inability to mand is problematic in that he is unable to ask for basic reinforcers like food when he is hungry; or request the removal of aversive items or activities. The acquisition of the ability to mand through PECS training would likely act as a pivotal behaviour for Jack and enable him to potentially go on to develop more advanced verbal behaviours such as tacting.

The majority of Jack's acquired skills fall into the level one category; however, he demonstrates skills across all three levels of the VB-MAPP. Jack has particularly strong skills relating to the 'play' category of the VB-MAPP as demonstrated by his achievement of most of the level one milestones and two out of the five components of level three play milestones. Jack is able to make vocalisations as shown by the ability to pass the first vocal milestone (one of five, within the level one category). He also shows some achievement within the listener, social and matching to sample categories.

Parent Participant Results

During each session for Phase One and Two of PECS where the researcher was the trainer, data on parent variables was collected. Errorless trials were those that did not contain any errors of any type. Trials with errors contained one or more errors from the list of error types. The average percentage of errors by type was calculated by taking the number of trials where the error type occurred and dividing this by the total number of trials where it was possible for the error to be made.

Figure 2

Errorless Trials for Parents During 'Researcher as Trainer" Sessions.

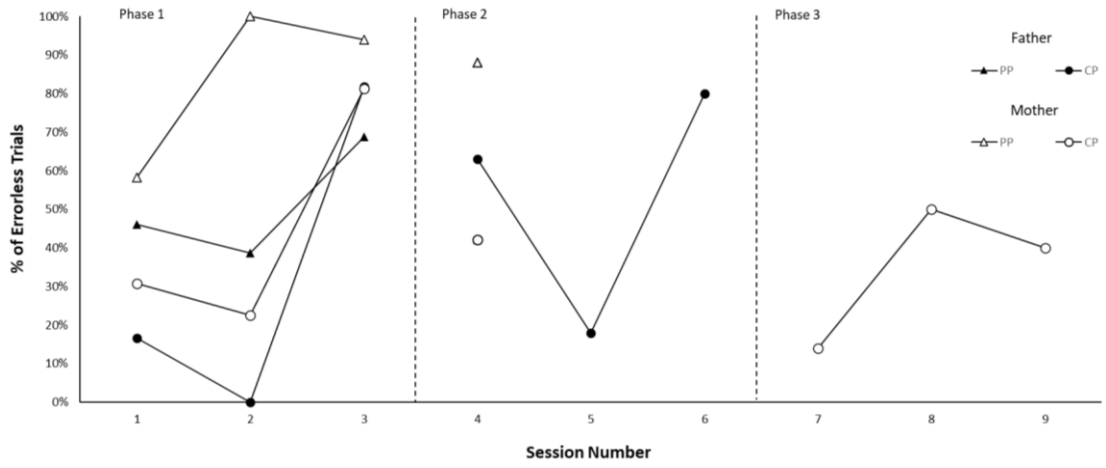

Figure two shows the percentage of trials that were errorless and without prompts from the researcher. Both the mother and father generally demonstrated improved performance across Phase One training sessions, for both the roles of physical prompter (PP) and communicative partner (CP). The criterion for mastery for the parent's implementation of PECS was 80% as demonstrated by the mother in the third session for both the role of communicative partner and physical prompter (Phase One). Though the father did not reach this criterion for the role of physical prompter in the third session for Phase One, Jack had reached the Phase One mastery criterion by this point and demonstrated generalisation of these skills so the decision was made to progress to Phase Two.

Results for Type and Frequency of Errors for Phase One

Figure 3

Errors Made by the Mother Across Phase One Training Sessions

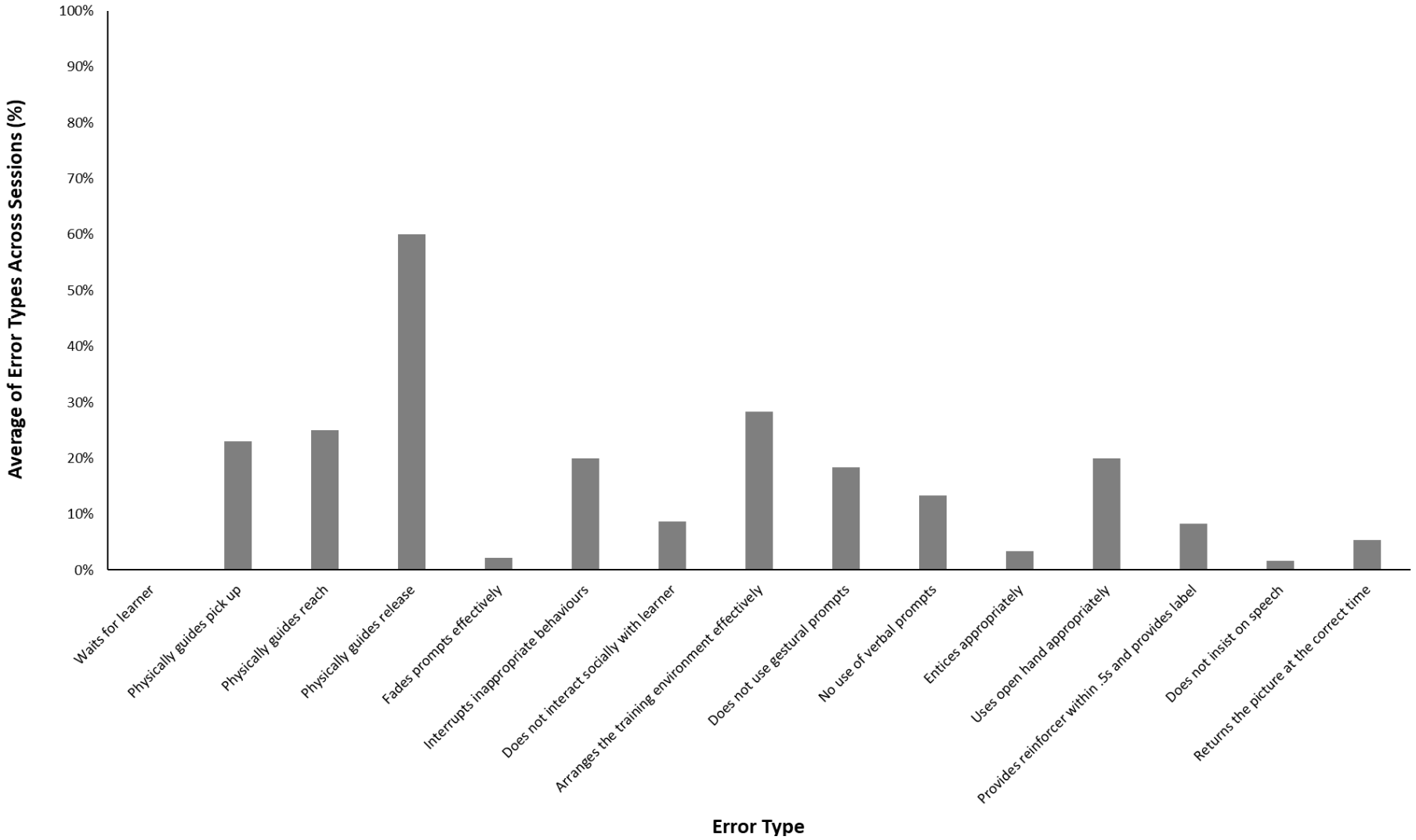

Figure three represents the type of errors made by Jack's mother during Phase One training sessions. The average percentage of errors by type was calculated across the three sessions by taking the number of trials where the error type occurred and dividing this by the total number of trials where it was possible for the error to be made. Notably, the most frequent errors were: not physically guiding release, not arranging the training environment effectively and not physically guiding the reach or pick up. The least common errors were: not waiting for the learner, not fading prompts effectively, insisting on speech and not enticing appropriately.

Figure 4

Errors Made by the Father Across Phase One Training Sessions

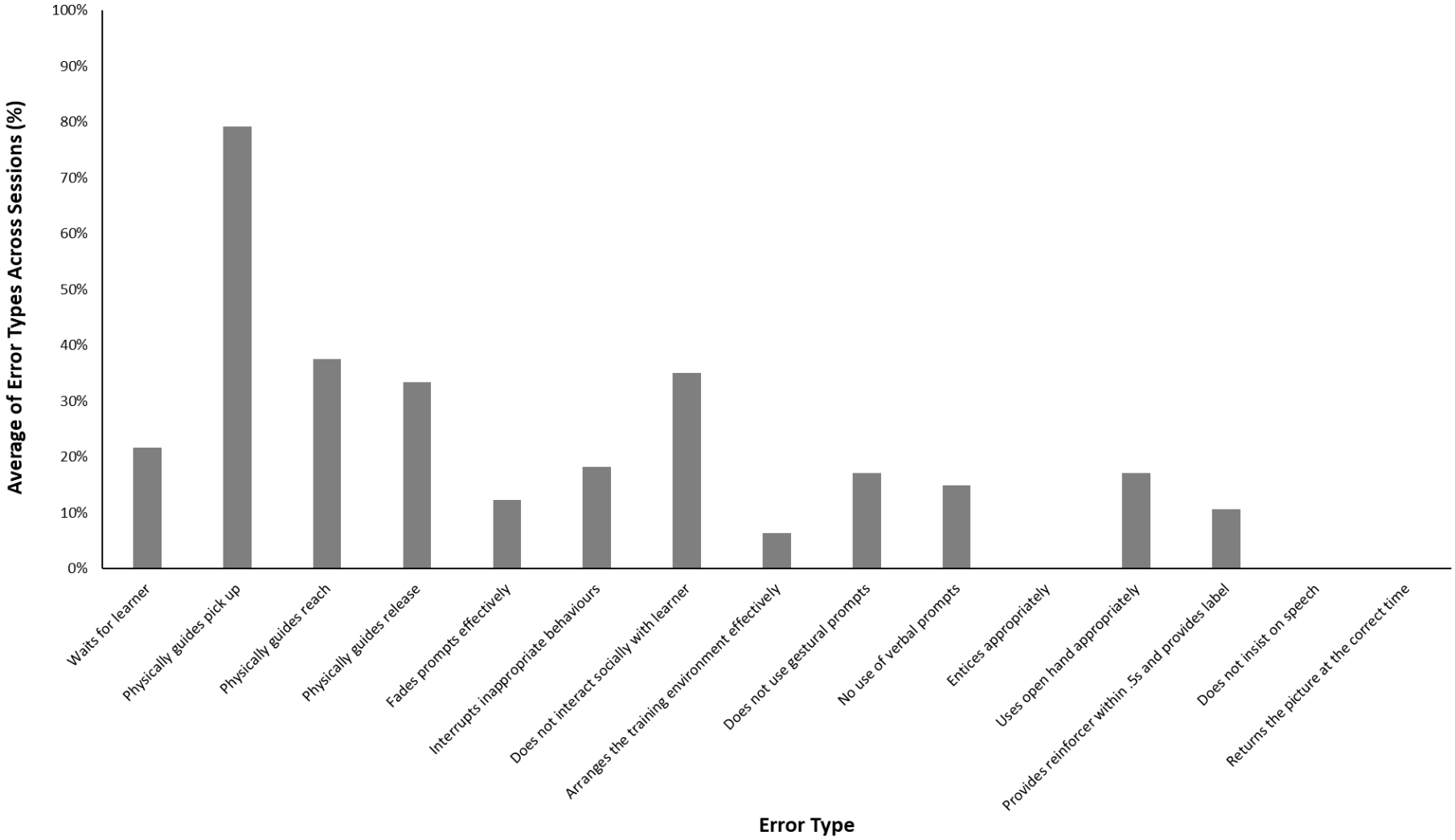

Figure four shows the type of errors made by the father in Phase One training sessions. As with Figure three, the average percentage of errors by type was calculated across the three sessions by taking the number of trials where the error type occurred and dividing this by the total number of trials where it was possible for the error to be made. The most frequent errors were: not physically guiding pick up, reach or releasing the image, and interacting socially with the learner; whilst the least frequent errors were: not arranging the training environment effectively, failing to return the picture at the correct time, insisting on speech and not enticing appropriately.

Results for Type and Frequency of Errors for Phase Two

Figure 5

Errors made by the Mother During the Phase Two Training Session:

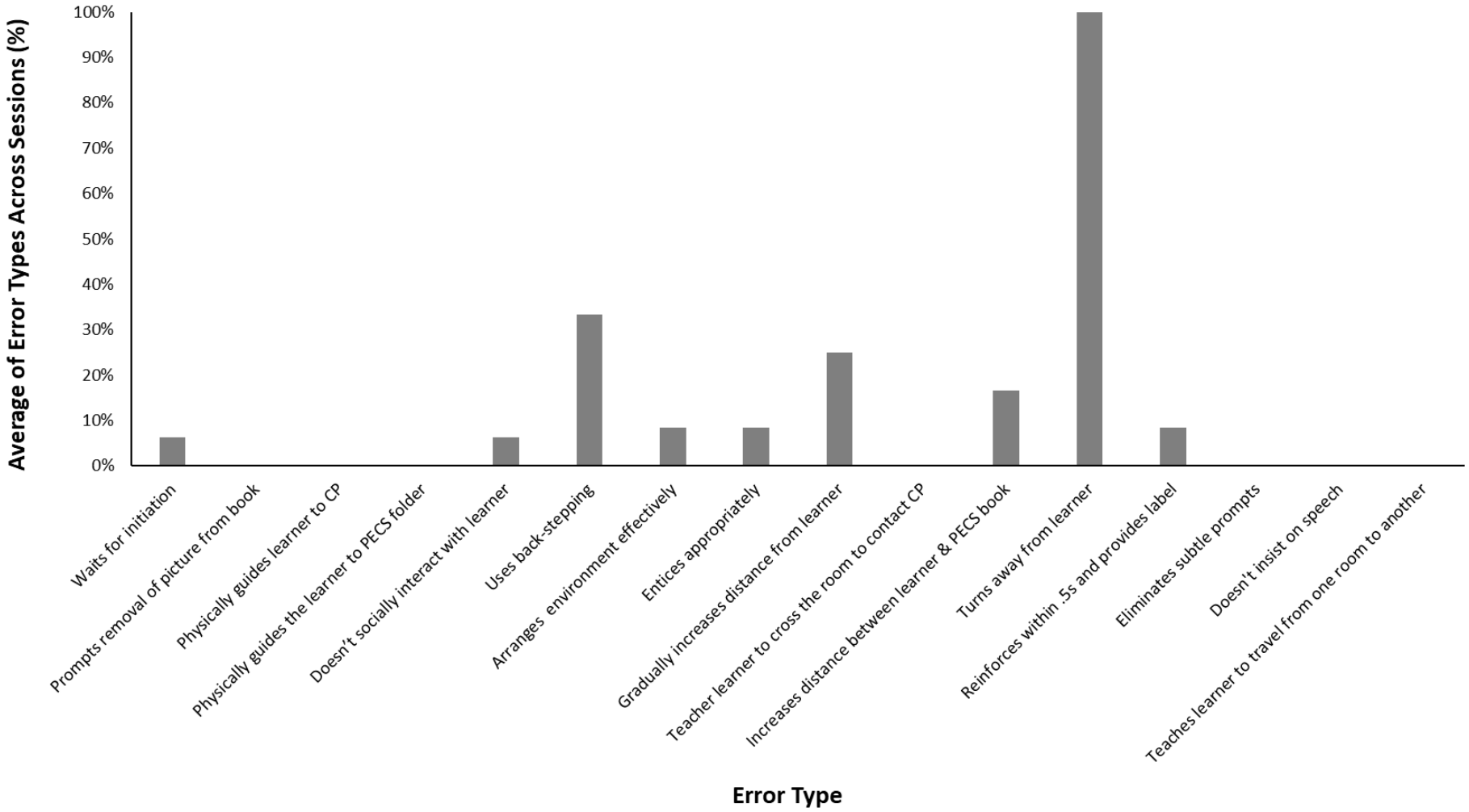

Figure five shows the number of errors made by the mother during Phase Two sessions. She was only present for one of the Phase Two training sessions so an average across sessions was not taken. Within the single session, the average percentage of errors by type was calculated by taking the number of trials where the error type occurred and dividing this by the total number of trials where it was possible for the error to be made. The graph shows that the most frequent errors were failing to turn away from the learner, not using the back-stepping procedure correctly and not gradually increasing the distance from the learner. The least frequent errors included not physically guiding the learner to the communication partner, and insisting on speech. The errors of eliminating subtle prompts, prompting the removal of the picture from the book, physically guiding the learner to the folder and teaching the learner to travel from one room to another were all 0% because there were no trials where they applied.

Figure 6

Errors Made by the Father During Phase Two Training Sessions

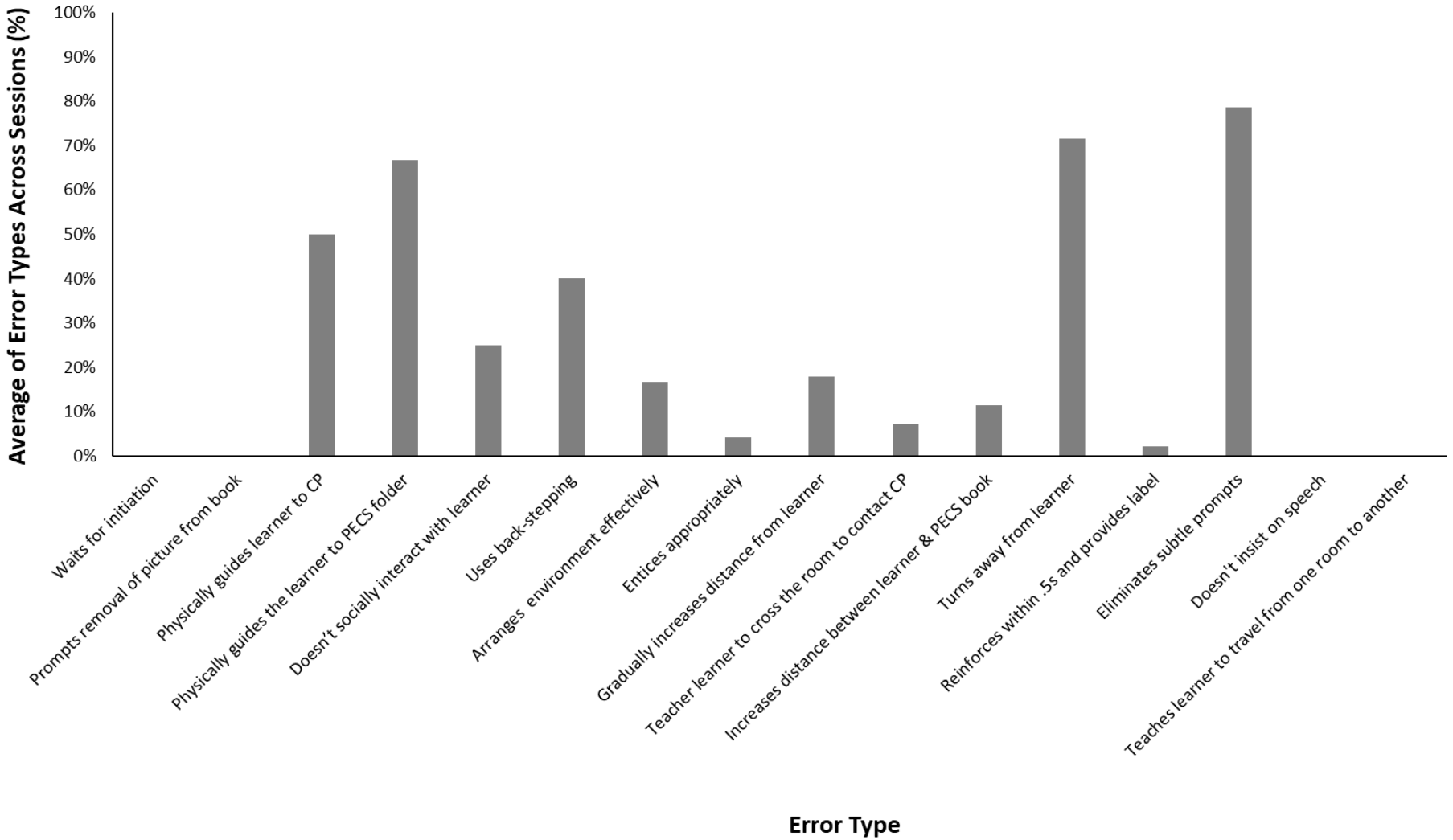

Figure six shows the type of errors made by the father across three Phase Two training sessions. The average percentage of errors by type was calculated by taking the number of trials where the error type occurred and dividing this by the total number of trials where it was possible for the error to be made. Errors that apply to the role of the physical prompter were only calculated for the first session because a physical prompter was not required by the second session. The most frequent errors were: failing to eliminate subtle prompts, not turning away from the learner to encourage persistence, and not physically guiding the learner to the PECS folder, as well as failing to physically guide the learner to the communication partner. The least frequent errors were not waiting for Jack to initiate the communicative exchange, and insisting on speech. Eliminating subtle prompts may have been falsely inflated because many errors were made in the second session but not the first or third. Similarly, for the errors of failing to physically guide the learner to the communicative partner/ PECS folder, limited trials were available where this error could be made. Again, physical prompter errors were only applicable in the first session so an average was not taken. Failing to prompt the removal of the picture from the book and not teaching the learner to travel from one room to another were errors that were not applicable and therefore excluded from the analysis.

Results for Type and Frequency of Errors for Phase Three

Figure 7

Errors Made by the Mother Across Phase Three Training Sessions

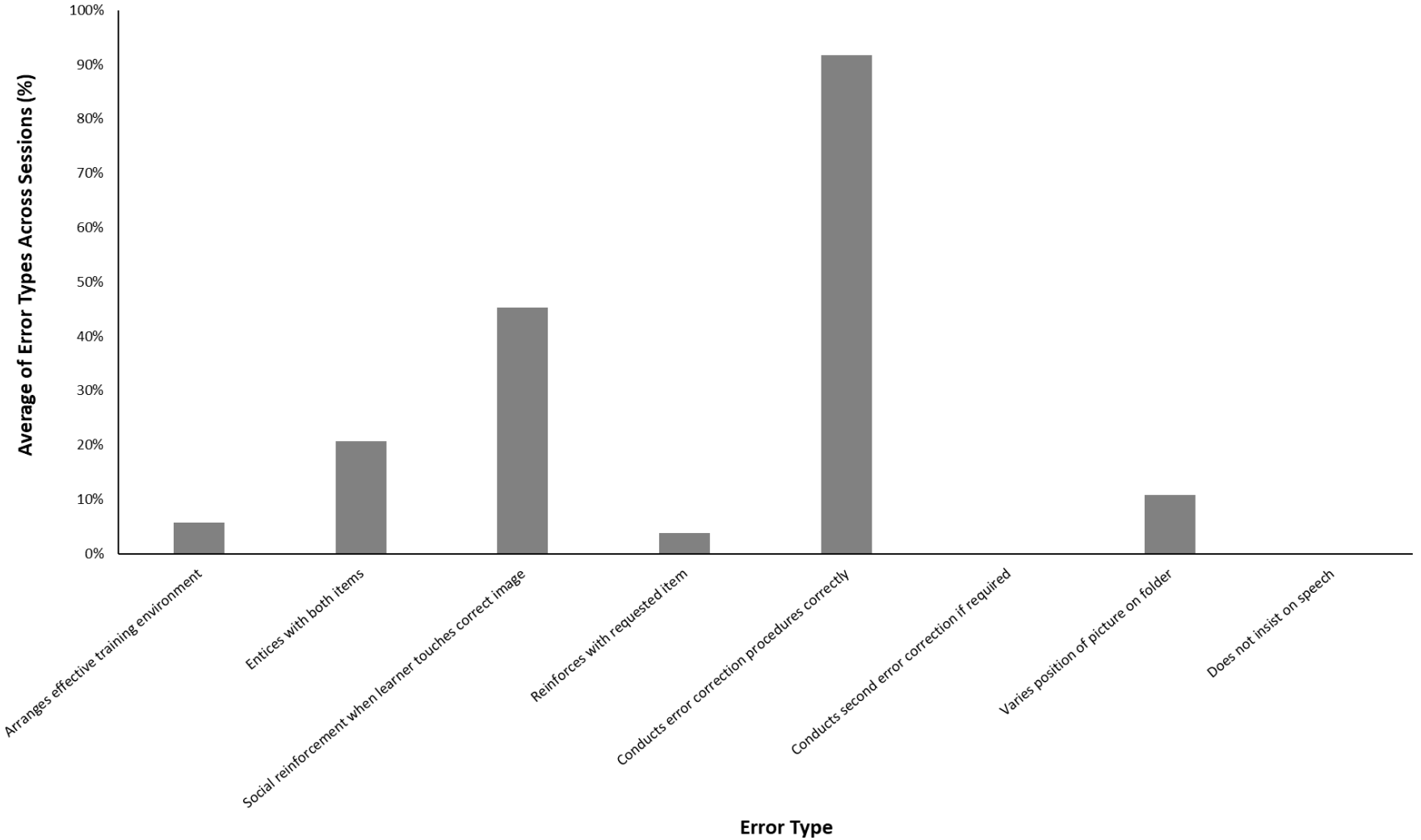

Figure seven illustrates the types of errors made by the mother across the three Phase Three training sessions. The average percentage of errors by type was calculated by taking the number of trials where the error type occurred and dividing this by the total number of trials where it was possible for the error to be made. The most frequent errors were: failing to conduct error correction procedures correctly, not providing immediate social reinforcement the moment the learner touches the correct image and not enticing with both items. The least frequent errors were: insisting on speech, not reinforcing with the requested items and not arranging an effective training environment.

Results for Jack

Figure 8

Independent PECS Exchanges in Training Sessions:

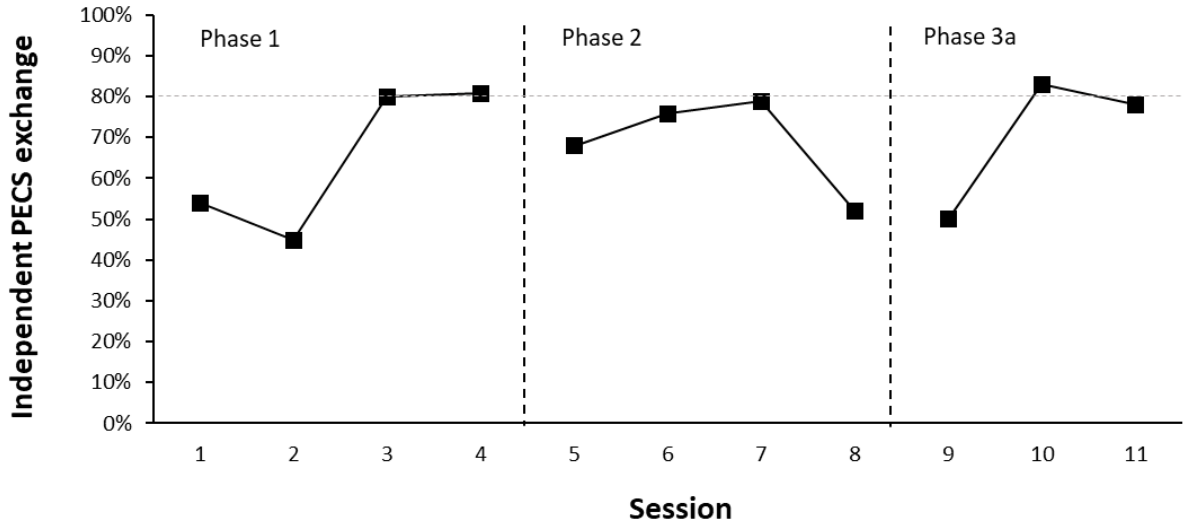

Figure eight shows the percentage of trials where Jack independently performed a PECS exchange. This was during sessions where the researcher provided prompts to the parents in order to implement PECS correctly. For Phase One of PECS Jack met the mastery criterion (80%) in session three and this was maintained in session four. In session eight the parents reported that Jack was unwell. The acquisition and mastery of Phase One PECS skills were further demonstrated during generalisation sessions, where Jack independently made

PECS exchanges for various toys, with multiple communicative partners, and in three different rooms in the home.

Figure 9

Jack's Progress for Each Step of Phase One PECS.

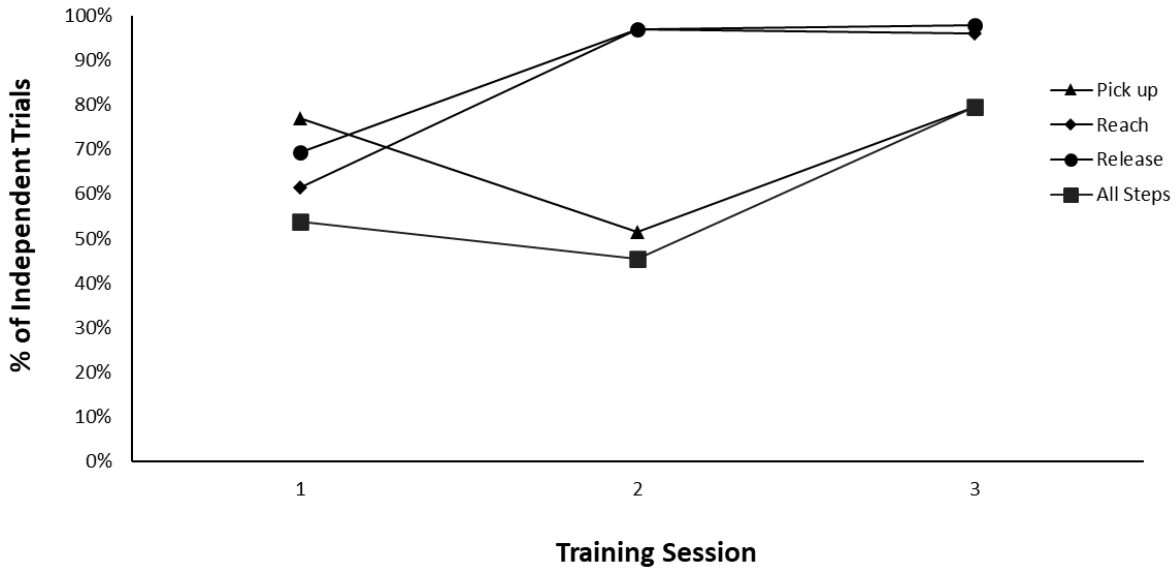

Figure nine shows a breakdown of the various steps involved in making an independent PECS exchange, during Phase One sessions. The data shows that Jack was most competent in independently releasing the PECS image, followed by the "reach" and "pick up" steps respectively. This suggests that once Jack had picked up the card (either independently or prompted), he was able to follow through with the reach and release steps independently for most trials. This was especially the case in the second and third training sessions. "All steps" illustrates the trials where Jack independently performed all three steps of the PECS exchange (pick up, reach, release).

Figure 10

Challenging Behaviour, Spontaneous Communicative Attempts and PECS Mands

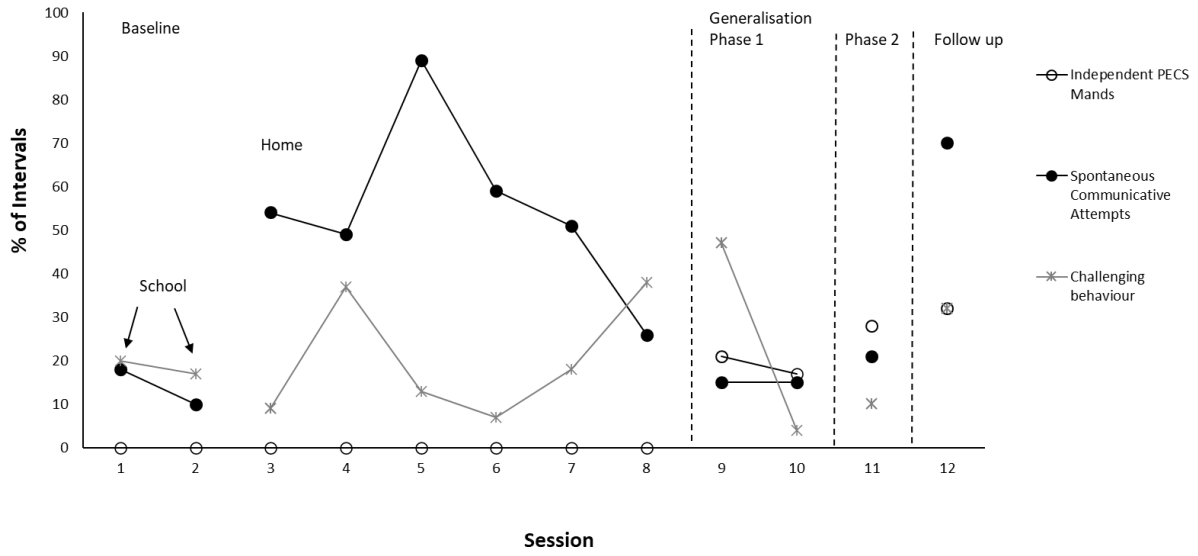

Figure seven depicts the spontaneous communicative attempts (SCAs) and independent PECS mands that Jack made in baseline, generalisation and follow-up phases. The frequency of challenging behaviour is also shown. Spontaneous communicative attempts appear to trend downwards in frequency during baseline and appear to stabilise in generalisation sessions. Additionally, spontaneous communicative attempts were much higher in the follow-up session compared to generalisation sessions. Jack did not use any independent PECS mands in baseline, however, in generalisation sessions for Phase One PECS mands begin to be used; albeit at a low frequency. Unfortunately, Jack became unwell at the end of PECS Phase Two training sessions and thus additional generalisation sessions could not be scheduled. Generalisation sessions for Phase Three A of PECS were not scheduled because Jack was not consistently meeting the mastery criterion. PECS mands appear to be increasing slightly during generalisation sessions for Phase One/Two and in the follow-up session. Challenging behaviours show a moderate degree of variability in baseline sessions, with a slight upward trend in the later baseline sessions. Session 10 and 11 show low levels of challenging behaviour; though this increases during the follow-up session.

Social Validity

The mother, father and two caregivers completed the social validity survey. Both parents and one caregiver strongly agreed with the statements that Jack's "communication deficits were severe enough to warrant the use of PECS." They also all indicated that they either agreed or strongly agreed that "most caregivers would find PECS suitable for increasing functional communication," and that "PECS was a fair way to encourage functional communication." The mother, father, and the same caregiver also agreed/strongly agreed with the statements that they "liked the procedures used in PECS" and "would be willing to use PECS again." They agreed that there were little to no negative side-effects of PECS for their son.

In the section with the open-ended questions, the mother stated that it was beneficial to have "the ability to connect with each other remotely for sessions on a regular basis rather than [the researcher] having to co-ordinate being present at our house." One caregiver (Jack's sibling) commented that one of the most enjoyable parts of the intervention was how interactive the activity was and how they enjoyed "seeing [Jack's] joy when he got it right." Meanwhile, for the questions specific to the use of telehealth, the father said the best part of using telehealth was "the ability for the observation of the PECS interaction […] in the home, and the ability to make suggestions to improve." Similarly, one of the caregivers commented that they:

> believe that Telehealth practice is advanced enough to still feel as though the researchers support is adequate, despite no physical presence. I understood the researchers' instructions clearly […] The most beneficial part of Telehealth was the ease in organising PECS sessions between the researcher, caregiver and the client. We were able to spark PECS sessions when they best aligned with the client's positive

> behaviours/moods […] I believed the use of Telehealth by the researcher across our sessions was appropriate and managed well.

The parents both made comments that their son was willing to use PECS, with the mother remarking that Jack "enjoyed the sessions greatly on the whole." Meanwhile, the father wrote that Jack "showed great willingness to use PECs in the exercises".

Discussion

The research aimed to answer the following three questions:

1. Can parents be effectively trained via Telehealth to implement PECS with their child?

2. What types of errors arise when parents attempt to implement PECS with their child?

3. What is the effect of PECS training using Telehealth on the functional communication of a young person with an intellectual disability, who had limited functional communication skills?

Can parents be effectively trained via Telehealth to implement PECS with their child?

Results from the current study indicate that parents can be effectively trained through Telehealth to implement PECS reliably, as shown by their increased accuracy within phases. Within each phase, parents generally made fewer errors with subsequent training sessions. Results from Phase One training sessions show a significant increase in errorless trials for both the mother and father. Both parents generally performed more errors when in the role of communicative partner compared to physical prompter during Phase One, with the mother implementing PECS with greater accuracy than the father. This finding conflicts with the observation made by Svensson (2022) who found more errors made by staff in the physical prompter role compared to communicative partner, especially for Phase One. One potential explanation for the lower number of errors made in the physical prompter role could be that

the role of the physical prompter involved a chain of related behaviours that may have occurred in response to the discriminative stimulus. The discriminative stimulus may have been Jack needing help to pick up the card. Each behaviour for the physical prompter role likely acted as an antecedent for the next i.e., helping Jack pick up the picture easily transitioned to helping them pass the image to the communicative partner. Chaining is a sequential series of behaviour, where each consequent response reinforces the previous (Cooper et al., 2019). Reinforcement of the final behaviour in the series is crucial for the maintenance of the behavioural chain (Cooper et al., 2019). Seeing Jack being reinforced with a desired item may have acted as this reinforcing stimulus for the physical prompter. Conversely, the communicative partner role entailed a greater range of topographies, which may have meant that errors were more easily made in this role compared to the physical prompter.

For Phase Two, a comparison between the mother and father regarding role type cannot be made. This is partly due to the absence of the mother in the fifth and sixth sessions due to illness and a holiday, and partly due to the fading out process for the physical prompter role. Despite this, session four does seem to replicate the start of a similar pattern than to that observed in Phase One; where the role of the physical prompter was associated with fewer errors in comparison to the communicative partner. Whilst the father was not available for Phase Three, the results of the mother appear to indicate that less errors were made across sessions.

During Phase One both the mother and father reached the 80% criterion for the role of communicative partner; however, the father did not meet mastery for the role of physical prompter. For Phase Two neither parent achieved the criterion for the role of communicative partner. Overall, more errors were made in Phase Three compared to Phase Two. This may have been because the measures alternated between the father (Phase Two), and the mother

(Phase Three), but could also reflect treatment drift (Cooper et al., 2019). Alternatively, as Jack became sick during Phase Two for several weeks, this may have acted as a confounding variable (Cooper et al.). Due to the scarcity of literature available that specifically compares performance between parents implementing PECS through BST and telehealth, it is difficult to surmise which of these factors led to the overall decrease in performance between the phases.

Few studies have examined the performance of parents when implementing PECS. A similar study by Treszl et al. (2022) analysed the accuracy of a father implementing PECS with his child. Both telehealth and BST were featured in the study, though the researchers also incorporated general case training into the teaching regime. Results from the current study replicate the findings by Treszl et al. (2022) through the finding that parents implemented PECS more accurately with subsequent training sessions, within phases. Compared to Treszl et al. (2022) the current study provides greater insight into how both parents can be directly taught to implement PECS rather than just the father. Furthermore, instead of measuring skill acquisition, findings from the current study highlight how role type (communicative partner vs physical prompter) may influence the accuracy of PECS implementation by parents. Compared to the broader literature on the application of telehealth to teach parents, teachers or staff to implement PECS, several similarities are found. For example, similarly to the findings by Svensson (2022), the results of the current study suggest that with behavioural skills training delivered via Telehealth performance of participants implementing PECS improved, with fewer errors being made over time within phases. Therefore, the findings in the current study strengthen the eternal validity of using Telehealth to train individuals in PECS implementation, through behavioural skills training. A systematic replication of the current study may help to identify factors that have contributed to a lower accuracy of implementation by the parents in Phase Two and Three A.

This may help to verify whether factors related to the learner (i.e., their health status) influence the acquisition of PECS skills. Overall, the results of this study tentatively add to the existing literature that supports parents as effective implementers of functional communication skill interventions with their children (Chaabane et al., 2009; Suberman & Cividini-Motta, 2020; Tait et al., 2004)

What Types of Errors Arise when Parents Attempt to Implement PECS with their Child?

Data from the current study supports the notion that parents perform a variety of errors when implementing PECS with their child. Compared to the errors made by parents in YouTube videos that were analysed by Jurgens et al. (2012) there were both consistencies and variances in the observed rates. For example, whilst Jurgens found that vocal prompts were one of the most common errors made by parents in PECS YouTube videos, findings from the current study observed a lower frequency of vocal prompts. The findings of this study were similar to the study by Jurgens when comparing the error of "insistence on speech." This error was observed to occur at a very low rate in the study by Jurgens, and not at all by either parent in the current study. The most frequent mistake made by parents in the current study during Phase Three A was the incorrect use of the error correction procedure (as outlined by Frost & Bondy, 2002). This finding is consistent with the research conducted by Jurgens, who also observed high frequencies of this error occurring. It may be the case that vocal prompts were rarely made in the current study because Jack is hearing impaired; therefore, the parents may be more inclined to use gestures rather than vocally communicate with him. This could also apply to the error of insisting on speech. Due to discrepancies in the current literature on how to measure the accuracy of implementation of PECS by parents, it is difficult to generalise the error types from the current study. A study by Treszl et al. (2022) monitored how accurately parents implemented PECS; however, the authors measured

this in relation to three target skills rather than error types. Furthermore, the study by Treszl only trained parents in the implementation of Phase Three B. This compounds the difficulty in making comparisons between the two studies due to the lack of data on other PECS phases.

The Effect of PECS Training Using Telehealth on the Functional Communication Skills of Jack

Jack appeared to show increased functional communication skills as a result of his parents being trained to effectively implement PECS - despite the parents making errors. Jack met the mastery criterion during at least one session for Phases One through to Three A. Jack developed the skill to mand for a variety of objects; including toys (ribbon, tassels, Santa toy), activities (drumming, music) and food/drink during training sessions with his parents where the researcher provided prompts to both the mother and father. During the intervention Jack also generalised this skill to a degree, and was able to mand in a variety of rooms in the home, including the kitchen, lounge and bedroom; with different caregivers. For Phase Three A, Jack met the mastery criterion however this dropped slightly below this standard in the last session. The frequency of errors made by the parents did not appear to correspond to changes in Jack's performance in making independent PECS exchanges.

Improvements in functional communication skills have been described in previous studies that involve parents undergoing training to implement interventions with their children (Tait et al., 2004). More specifically, the finding in the current study whereby independent PECS exchanges increased appears to support the findings of Park et al. (2011). In the study by Park et al. the authors found that by training three mothers how to use PECS, secondary gains were found in increased independent PECS exchanges by all three of their children. Comparable results were also noted in a case study by Svensson (2022), where training staff in a residential facility had concurrent effects of increased manding by a

resident who had an intellectual disability. The current study, therefore, extends knowledge surrounding training parents in PECS implementation by having applied this to both mother and father of a young person with an intellectual disability in a home environment.

Previous research with young children learning the PECS system has recurrently found corresponding developments in vocal verbal behaviour (e.g., Bondy & Frost, 1994; Carr & Felce, 2007a; Charlop-Christy et al., 2002; Ganz & Simpson, 2004). Unlike previous studies, results from the current intervention did not indicate an increase in vocal verbal mands for Jack. One possible reason could be due to his hearing impairment. There is a serious void of research involving interventions where PECS is taught to those who are hard of hearing; however, a case study by Malandraki and Okalidou (2007) where PECS was implemented with a deaf child had the interesting finding that vocalisations developed but not vocal verbal behaviour. From this, it is plausible to cautiously suggest that a hearing impairment may prevent the acquisition of vocal communication during PECS. Another possible explanation of the failure to develop vocal verbal behaviour could be that the intervention of this project did not progress far enough along for PECS to influence Jack's vocal communication. Ganz and Simpson (2004) for example, noted that one of their participants showed great improvements in vocal verbal behaviour in Phase Four. The other two participants, although both demonstrated a degree of increased verbal abilities in Phase Three, did not show rapid improvement until Phase Four. Therefore, it is possible that Jack may have developed the verbal ability to use words in the later stages of Phase Three or Four, had these been achieved. It should be noted that whilst PECS has been effective in increasing vocal verbal behaviour in many children, this is not always the case. A smaller number of studies do report that some children have not acquired functional vocal communication during PECS training (Howlin et al., 2007; Tincani et al., 2006). Future studies should

consider possible factors that may prevent the development of this skill, such as the presence of multiple disabilities such as hearing impairment in addition to ASD or IDD.

Another common finding from interventions concerning the use of PECS is that challenging behaviours decrease as communication skills increase (Durand & Merges, 2001; Malandraki & Okalidou, 2007; Sigafoos & Meikle, 1996). This is theorized to be the result of the individual being taught to use functional communication, which decreases the necessity for challenging behaviour to communicate. In the current study, challenging behaviours were variable during baseline. Insufficient baseline sessions were conducted in the school environment due to various time and access constraints, which meant no trend can be seen. For the home environment, it appears as though there is an increasing trend between sessions five to eight. There are not enough data points for the generalisation sessions in the current study to make any conclusions surrounding challenging behaviour. A greater number of data points would be needed to show stable responding, which would increase the likelihood of experimental control (Cooper et al., 2019) and provide support for a conclusion that PECS may have led to a reduction in challenging behaviour.

In conjunction with independent PECS mands, data on Jack's spontaneous communicative attempts was also gathered. In baseline, spontaneous communicative attempts appear to be much higher in the home environment compared to the school environment. Due to the lack of sessions observed in the school environment, it cannot be surmised that this was definitively the case. For the baseline, there seems to be a decreasing stable trend with little variability (except for session 5). Spontaneous communicative attempts appear to stabilise somewhat during generalisation sessions; although conclusions about trends cannot be formulated due to the absence of sufficient data points. Finally, follow-up data may cautiously be interpreted as illustrating an increase in spontaneous communicative attempts that exceed those observed in generalisation sessions and most baseline sessions. This

conclusion would support the results by Carr and Felce (2007b), who observed that spontaneous communicative initiations increased rapidly during their PECS intervention.

Social Validity Data

Social validity is a necessary part of evaluating any behavioural intervention (Cooper et al., 2019). Anecdotal data from the parents suggests that following the intervention Jack was able to make requests in his everyday activities; which included asking for his Fortisip at night and making continual requests for an activity to continue (drumming). Both parents were particularly impressed at their son who on some occasions, was able to find the image of a drink, pick it up and carry it whilst looking for them to then hand it over to them to ask for his Fortisip; independently of prompts. From the combination of anecdotal reports, adapted MPIRS survey, and open-ended questions based on those developed by Greenberg et al. (2012) it is possible to surmise that the intervention had high social acceptability. Furthermore, it is plausible to suggest that the intervention met two of the aspects of social validity as defined by Wolf (1978): the social validity survey results in the current study indicate the intervention was perceived by the parents and caregivers as having an acceptable methodology and resulted in valuable functional skill acquisition.

By comparison, the parents also expressed concern that it may be difficult for them to maintain the progress their son has made. Both parents and one caregiver stated that one of the most frustrating things about using Telehealth was trying to get the right angle or position of the laptop because Jack moved around often. Furthermore, one caregiver (the sibling) indicated that additional in-person sessions with the researcher may be useful in the future.

Limitations

Certain limitations were observed in the current project. The main restriction was the difficulty in conducting regular and frequent sessions with the parents, to train them in the

use of PECS. The main reason for this problem was that only small windows of time were available each week where both parents could be present in the home. This especially impaired progress in conducting sessions for Phase One, where two people were required to fulfil the roles of communicative partner and physical prompter. Delays from illnesses of various participants as well as school and recreational holidays also contributed to the irregularity of the sessions. The study provides a degree of evidence that Telehealth may be useful in overcoming some of these issues due to the ease of scheduling sessions when it best suited the participants. In reality though, it is unlikely that the behaviour analyst implementing such a programme would be able to commit to sessions at short notice despite how well this may suit the participants. In summary, the project reflects many of the challenges that occur in real-life interventions. The high social validity of the study supports the value of conducting such an intervention regardless and suggests improvements in communication skills can be developed even when the environment is not perfectly set up to maximise such gains as in clinical settings. The use of telehealth and BST provides an additional treatment option to traditional in-person ABA interventions.

Difficulties were experienced in the collection of generalisation data, and the incidental use of PECS in the home environment. Unfortunately, it was not feasible to collect data on generalisation in other settings such as in Jack's classroom. Research in the past has exhibited similar issues with generalisation data and has, as in the current project, relied heavily on anecdotal evidence from participants to support this (e.g., Svensson, 2022).

Another limitation observed in the project involved the restrictions from video recording via computer. As one of the caregivers noted in the post-intervention survey at certain points Jack would wander out of view of the camera; which may have resulted in a discrepancy between what actually occurred and what the researcher saw. On the other hand, it is important to note that the mother in particular had praise for how well the laptop set-up

worked and that her son did not seem interested in the computer for the majority of the sessions. In addition to the occasional issue with camera angles there were some minor issues with Wi-Fi, Zoom, and audio quality. These were easily resolved in most instances by restarting the call.

Findings from the current study have several implications for where, how, and for whom PECS is used. Unlike previous research, the current project involved parents, caregivers, and an adolescent participant with multiple disabilities. Increases in independent manding suggest that it is both feasible and useful for PECS to be applied in cases of those with limited functional communication skills, even if they are not children. As previously stated, communication is recognized as a human right (U.N., 2006) and effort should be made across an individual's lifespan to achieve this; regardless of the type or severity of their disability. Furthermore, the adolescent in the study previously had been described by teachers as not able to use PECS independently. This study provides evidence that interventions with PECS may need to be implemented in a different setting or with different communication partners; under the close supervision of a trained PECS professional to yield gains in functional communication skills.

Additionally, the results of the current study also imply that when professionals experienced in PECS applications are not available in person, telehealth may be a viable method of parents or caregivers being trained in PECS. The study adds to previous literature (Homlitas et al., 2014; Rosales et al., 2009; Svensson, 2022) wherein Behavioural Skills Training may be potentially used as a training method for those implementing PECS. In training parents in the effective use of PECS, it could be beneficial to observe whether parents can train caregivers, siblings and/or friends to competently use PECS as well. This would potentially enable more effective generalisation of the PECS skills for Jack.

Conducting more baseline sessions in the school environment would also be beneficial in future research. In the current study, the reliability of the data yielded from baseline sessions conducted in the school environment is questionable. A plausible threat to this reliability was that Jack did not have sufficient chance to habituate to the presence of the researcher because only two sessions were conducted in the classroom. The potential influence of the researcher on both Jack and his teacher/teacher aides may have acted as a significant confound. To remedy this, future studies should allow both the client and teachers to habituate to the researcher's presence, before beginning data collection in subsequent sessions. Conducting a larger number of baseline sessions and with greater reliability would be useful in the analysis of possible trends in spontaneous communication attempts, PECS mands and challenging behaviours; as repeating sessions act as a control for confounding variables (Cooper et al., 2019). Supplementing this data with recordings of the frequency of relevant variables from the teachers themselves could also be useful; as well as conducting sessions in the school for generalisation and follow-up phases of the intervention.

Summary

Research suggests PECS is an effective way to improve functional communication skills (Ganz et al., 2012). A large body of research supports the notion that PECS improves the functional communication skills of children in particular; especially for those with ASD (Carr & Felce, 2007a, 2007b; Carson et al., 2012; Charlop-Christy et al., 2002). Despite this, significantly less is known about whether non-ABA professionals can be trained to effectively implement this with their learners. Similarly, questions surrounding whether PECS can increase the functional communication skills of older adolescents and adults remain. The current study attempted to replicate previous studies on training older learners with PECS; but through training parents via Telehealth and behavioural skills training to implement the system with their 18-year-old son.

The frequency and type of errors made during the parent's implementation of PECS with their intellectually disabled adolescent son were monitored, allowing for comparisons between the mother and father in relation to the errors they each made. Comparisons could also be made between the roles of communicative partner and physical prompter. Secondary to this was the observation of increased independent PECS exchanges by their son during the intervention. Social validity measures completed by parents and caregivers consistently indicated that Telehealth coupled with behavioural skills training was an effective and convenient means that increased Jack's functional communication skills. Future research can explore how Telehealth might be used in multiple settings, such as school and home, to develop functional communication skills of older individuals. Providing services with PECS training that are tailored to individuals and their specific disabilities should be crucial elements of future research on improving functional communication skills; but should be administered with treatment fidelity measures such as error type and rates.

Conclusion

The results from the current study suggest that parents can be effectively trained via Telehealth to competently implement PECS with their child, who has IDD. Both the mother and father in this study made a number of errors during training sessions with the researcher when they attempted to implement PECS with their child. The number of errors, within each PECS phase, generally decreased for both parents. The types of errors made were suggested to be specific to the disabilities of their adolescent son; for example, vocal prompts were rarely made by the parents because Jack had a hearing impairment. PECS training using telehealth appeared to have positive results for Jack as the number of independent PECS exchanges generally increased as the intervention progressed.

Unfortunately, the intervention was limited in the frequency and length of training sessions for the parents. Though the results of the study resulted in functional communication

skill increases for Jack, a more intense training schedule may likely have been more effective. Social validity measures however did indicate that the parents and caregivers all found the intervention valuable, and Telehealth was described as an appropriate means of PECS implementation training.

Future studies should continue to involve fathers in PECS research. Both fathers and mothers of children with disabilities should also be taught to implement PECS. Studies should not be limited to young children with diagnoses of ASD or IDD; they should include a variety of ages and diagnoses to extend and generalise current findings. Replicating the use of the extensive social validity measures could also highlight the benefits of similar interventions to family members and caregivers of young people with disabilities.

To conclude, the current study contributes to the literature base on the topic of telehealth and provides an additional application where this may be used. The study explores the accuracy of implementation of PECS by both parents of an adolescent with an intellectual disability, and suggests that functional communication skills for adolescents might increase as a result of training parents in the use of PECS.

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Appendix A.

School Information Letter

Dear [Deputy Principle],
We are inviting you to have a student and teacher in your school take part in a research project. The research has been proposed to meet the requirements of a Master of Applied Psychology programme at The University of Waikato. The researcher for this project is Georgina Scott, a Master of Applied Psychology student. Georgina can be contacted on [*number removed*] or [*e-mail address removed*] throughout the duration of the research period. Georgina will be supervised by Associate Professor Angelika Anderson, from the school of Psychology at the University of Waikato.

What is the aim of the research?
This research aims to evaluate the impact of teaching the Picture Exchange Communication System (PECS) to a minimally verbal adolescent. The research objectives are to determine:
A*:* If the use of PECS increases the frequency of functional communication acts in a generalised setting for an adolescent with an intellectual disability.
B*:* Whether parents and caregivers can be trained as effective communication partners to support the development of functional communication in individuals with an intellectual disability and limited expressive communication skills.
What will the teacher have to do?

- The teacher will be sent an information sheet and consent form inviting them to participate in the research. The student and their legal guardians have already consented to the project.
- The teacher will also be required to have a meeting with the researcher, of a maximum of one hour duration, to discuss the student's use of PECS at school.
- The teacher will also be required to allow the researcher to enter the classroom to record baseline measures of the young person's behaviour and communication. This will not involve any video recording. This will only involve the young person and will not involve any other student in the classroom. The researcher will not interrupt the learning or schedule of any student but will be present in the room to take notes using pen and paper.
- Baseline measures would involve the researcher's presence in the classroom for up to one hour (at a time chosen by the teacher) twice a week, for one week. Measures will again be recorded after a period of 10-12 weeks has passed. The 10-12 weeks is when the intervention (PECS training) will take place for the young person at their home. These post-intervention measures will again require the researcher to be present in the classroom for up to one hour, two times a week for one week. The times will be chosen by the young person's teacher. As before, there will be no video recording or interruption to the routine in the classroom.

The total time that the researcher will be present in the classroom will be for a maximum of five hours.
What are the expected benefits to the participants?
The young person will likely benefit by developing functional communication skills with a possible reduction in negative behaviour. The young person may also be more receptive to learning if they are able to communicate more easily. The teacher, teacher aides, and other students may benefit from a safer learning environment if negative behaviours of the young person decrease.

What can be expected in terms of rights and confidentiality?
Participation is voluntary. All participants are able to withdraw from the study anytime up until two weeks after data collection is complete. Anonymity and confidentiality will be preserved. The participants will be referred to by pseudonym in any research reporting. During the research period, data will be stored on a password protected computer. After the researcher has submitted their thesis, all data will be given to the supervisor and stored on a secure university drive for a minimum of five years. After the specified time-period has passed the data will be permanently deleted.

Associate Professor Angelika Anderson
School of Psychology, Waikato University
Phone: 07 838 4466 ext. 9209
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Georgina Scott
Student Researcher
Phone: [removed]
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Appendix B.

Group 1 (Young Person Participant) Information Sheet

Associate Professor Angelika Anderson
Faculty of Social Science
Waikato University
Phone: 07 838 4466 ext. 9209
Email: angelika.anderson@waikato.ac.nz

Georgina Scott
Phone: [removed]
Email: [removed]

Dear ( )
Your son is invited to participate in a research project conducted by myself, Georgina Scott, under the supervision of Associate Professor Angelika Anderson from the School of Psychology at the University of Waikato. This project is part of the requirement for the completion of my Master of Applied Psychology in Behaviour Analysis at the University of Waikato. Please read this information sheet in full before deciding if you will permit your son to participate. If you would like further information about the project, please contact myself or Associate Professor Anderson via the contact details above.

What is the aim of the research?
This research aims to evaluate the impact of teaching the Picture Exchange Communication System (PECS) to a minimally verbal adolescent with an intellectual disability in a home environment. The research objectives are to determine:

A: If the use of PECS increases the frequency of functional communication acts in a generalised setting for an adolescent with an intellectual disability in the home environment.

B: Whether parents and caregivers can be trained as effective communication partners to support the development of functional communication in individuals with an intellectual disability and limited expressive communication skills, using Behavioural Skills Training via Telehealth

Picture Exchange Communication System
The Picture Exchange Communication System (PECS) is a kind of Alternative and Augmentative Communication, designed to teach functional communication. It has gained empirical support through a large number of replicated studies.

Who will the participants be?
Group 1 Participant: The young person participant
To be recruited for this research, the young person participant would have met the following inclusion criteria:

- minimally verbal adolescent
- aged between 15 years and 25 years
- has an intellectual or developmental disability
- has an Alternative and Augmentative Communication (AAC) goal associated with an existing support plan, which has not been successfully addressed

Group 2 Participants: Caregiver participants
The research will also include 2-4 caregivers who provide care for the young person participant daily.

What will the participants have to do?

- The young person participant and caregiver participants will take part in PECS training for the first 3 stages of PECS. As recommended in the PECS Training Protocol (Frost & Bondy, 2002), a minimum of five training sessions will be adhered to for each PECS stage. PECS training sessions are expected to be approximately 30 minutes in duration. The researcher will be providing PECS training sessions via video conference, so the young person participant would not be expected or required to engage with the researcher.

- Two 30-minute generalisation sessions will be scheduled to take place immediately following the final two training sessions for each PECS stage. This is where the young person will engage in their normal activities, it is just that they will be observed while doing so.
- All training and generalisation sessions will also be recorded via secure video recording software. This will help the researcher review footage and improve the accuracy of data collection. Video recording will not be used for any data collected in the school setting.
- Follow up observations will also be completed remotely by the researcher. Follow up observations will also be 30 minutes in duration. Two follow up sessions will be completed both at 2 weeks after PECS training has been completed, and at 2 months.
- Participants will be invited to a shared morning tea to mark the end of the research and thank them for their contributions. A results presentation will be included in this, and a written summary with relevant information will be offered to participants.

It is expected that total participation would be 10-12 weeks.

What are the expected benefits to the young person participant?
The young person participant will likely benefit from developing their functional communication skills. Improved communication skills are likely to reduce the young person's vulnerability by reducing the occurrences of negative behaviour and the potential aversive consequences associated with this. A summary of the results can be forwarded to you on request, as can a copy of any published journal articles.

Right to withdraw
Participation in this project is voluntary and you are under no obligation to give consent to participate. All participants have the right to withdraw from the project at any time, for any reason, and with no consequence. This includes the destruction of data, upon request, up to 2 weeks after participation in the project is complete.

Confidentiality
Although the young person's name will be known to me, participation in this project will remain confidential and no identifying information will be disclosed to anyone outside of the study. Codes and pseudonyms will be assigned to all participants to ensure no data can be traced back to any participants. Participants will not be identifiable in the presentation of any results.

What happens now?
If you are happy for your son to participate in this project, please complete the consent form and return to myself. If you have any questions regarding the project, please contact me via the details at the top of this form.

This research project has been approved by the Human Research Ethics Committee (Health) of the University of Waikato. Any questions about the ethical conduct of this research may be sent to the chair of the committee (humanethics@waikato.ac.nz).

Appendix C.

Group 1 (Young Person Participant) Consent Form

Please retain a copy of this form for your personal records.

Research Project: Increasing functional communication skills for a minimally verbal adolescent with an intellectual disability using the Picture Exchange Communication System.

Name of Participant: _____

I have received a copy of the information sheet describing the research project and have been given sufficient time to read it. Any questions that I have relating to the research have been answered to my satisfaction. I understand that I can ask further questions about the research at any time during my participation and that I can withdraw _____ participation at any time (up to two weeks) after completion of data collection.
I understand that I can ask to have the observations stopped at any time.
When I sign this consent form, I will retain ownership of the collected data, but I give consent for the researcher to use the data for the purposes of the research outlined in the information sheet.
I understand that my identity will remain confidential in the presentation of the research findings.

Please complete the following checklist. Tick (✓) the appropriate box for each point	Yes	No
1. I have read the participant information sheet (or it has been read to me) and I understand it.		
2. I have been given sufficient time to consider whether or not for _____ to participate in this study.		
3. I am satisfied with the answers I have been given regarding the study and I have a copy of this consent form and information sheet.		
4. I understand that taking part in this study is voluntary (my choice) and that I may withdraw _____ from the study at any time without penalty.		
5. I have the right to decline for _____ to participate in any part of the research activity.		
6. I know who to contact if I have any questions about the study in general.		
7. I understand that the information supplied by me could be used in future academic publications.		
8. I consent to _____ participating in PECS training and direct observation sessions both at home and at school.		
9. I consent for the teacher of _____ to disclose information about the participant's education.		
10. I understand that _____ participation in this study is confidential and that no material which could identify them personally will be used in any reports on this study.		
11. I wish to receive a copy of the findings.		

Participant: _____ Researcher: _____

Signature of guardian: _____ Signature: _____

Date: _____ Date: _____

Contact details: _____ Contact details: _____

_____ _____

Appendix D.

Group 2 (Parent Participant) Information Sheet

Associate Professor Angelika Anderson
Faculty of Social Science
Waikato University
Phone: 07 838 4466 ext. 9209
Email: angelika.anderson@waikato.ac.nz

Georgina Scott
Phone: [removed]
Email: [removed]

Dear ____
You are invited to participate in a research project conducted by myself, Georgina Scott, under the supervision of Associate Professor Angelika Anderson from the School of Psychology at the University of Waikato. This project is part of the requirement for the completion of my Master of Applied Psychology in Behaviour Analysis at the University of Waikato. Please read this information sheet in full before deciding if you will agree to participate. If you would like further information about the project, please contact myself or Associate Professor Anderson via the contact details above.

What are the aims of the research?
This research aims to evaluate the impact of teaching the Picture Exchange Communication System (PECS) to a minimally verbal adolescent with an intellectual disability living at home. The research objectives are to determine:

A: If the use of PECS increases the frequency of functional communication acts in a generalised setting for a minimally verbal adolescent with an intellectual disability in a home environment.

B: whether support staff and caregivers can be trained as effective communication partners to support the development of functional communication in individuals with an intellectual disability and limited expressive communication skills, using Behavioural Skills Training via Telehealth

Picture Exchange Communication System
The Picture Exchange Communication System (PECS) is a kind of Alternative and Augmentative Communication, designed to teach functional communication. It has gained empirical support through a large number of replicated studies.

Who will the participants be?
Group 1 Participant: The young person participant
To be recruited for this research, the client participant would have met the following inclusion criteria:

- Minimally verbal adolescent
- aged between 15 years and 25 years
- has an intellectual or developmental disability
- has an Alternative and Augmentative Communication (AAC) goal associated with an existing support plan, which has not been met

Group 2 Participants: Support staff participants
The research will also include 2-4 support staff who provide care for the young person participant daily.

What will the participants have to do?
All participants and stakeholders will be invited to an information and informed consent information session. Informed consent will be determined by the researcher's supervisor, Associate Professor Angelika Anderson. If informed consent is determined, the research procedure will be as follows.

- Support staff/caregiver participants will complete a Reinforcement Inventory. It is intended that this will take approximately 30 minutes.
- The young person participant and caregiver/support staff participants will take part in PECS training. It is intended that the young person participant and caregiver participants will take part in training for the first 3 stages of PECS. As recommended in the PECS Training Protocol (Frost & Bondy, 2002), a minimum of five training sessions will be adhered to for each PECS

stage. PECS training sessions are expected to be approximately 30 minutes in duration. The researcher will be providing PECS training sessions via video conference.

- Two 30-minute generalisation sessions will be scheduled to take place immediately following the final two training sessions for each PECS stage. This is where caregiver participants will practice positive learner communication strategies, while the young person participant engages in their normal activities.
- All training and generalisation sessions will also be recorded via secure video recording software. This will help the researcher review footage and improve the accuracy of data collection. Generalisation sessions at school will not be recorded on video.
- Follow up observations will also be completed remotely by the researcher. Follow up observations will also be 30 minutes in duration. Two follow up sessions will be completed both at 2 weeks after PECS training has been completed, and at 2 months.
- Participants will be invited to a shared morning tea to mark the end of the research and thank them for their contributions. A results presentation will be included in this, and a written summary will be offered to all participants.

It is expected that total participation would be 10-12 weeks.

What are the expected benefits to the participants?
It is proposed that you might benefit from gaining improved or alternative strategies to communicate with the young person. Improved communication skills for the young person are likely to reduce the occurrences of challenging behaviour and the potential aversive consequences associated with this. A summary of the results can be forwarded to you on request, as can a copy of any published journal articles.

Right to withdraw
Participation in this project is voluntary and you are under no obligation to give consent to participate. All participants have the right to withdraw from the project at any time, for any reason, and with no consequence. This includes the destruction of data, upon request, up to 2 weeks after participation in the project is complete.

Confidentiality
Although your name will be known to me, participation in this project will remain confidential and no identifying information will be disclosed to anyone outside of the study. Codes and pseudonyms will be assigned to all participants to ensure no data can be traced back to any participants. None of the participants will be identifiable in the presentation of any results.

What happens now?
If you are happy to participate in this project, please complete the consent form for teachers and return to myself. If you have any questions regarding the project, please contact me on the details at the top of this form.

This research project has been approved by the Human Research Ethics Committee (Health) of the University of Waikato. Any questions about the ethical conduct of this research may be sent to the chair of the committee (humanethics@waikato.ac.nz).

Appendix E.

Group 2 (Parent Participant) Consent Form

Please retain a copy of this form for your personal records.

Research Project: Increasing functional communication skills for a minimally verbal adolescent with an intellectual disability using the Picture Exchange Communication System.

Name of Participant: _____

I have received a copy of the information sheet describing the research project and have been given sufficient time to read it. Any questions that I have relating to the research have been answered to my satisfaction. I understand that I can ask further questions about the research at any time during my participation and that I can withdraw my participation at any time (up to two weeks) after completion of data collection.
I understand that I can ask to have the observations stopped at any time.
When I sign this consent form, I will retain ownership of the collected data, but I give consent for the researcher to use the data for the purposes of the research outlined in the information sheet.
I understand that my identity will remain confidential in the presentation of the research findings.

Please complete the following checklist. Tick (✓) the appropriate box for each point	Yes	No
1. I have read the participant information sheet (or it has been read to me) and I understand it.		
2. I have been given sufficient time to consider whether or not to participate in this study.		
3. I am satisfied with the answers I have been given regarding the study and I have a copy of this consent form and information sheet.		
4. I understand that taking part in this study is voluntary (my choice) and that I may withdraw from the study at any time without penalty.		
5. I have the right to decline to participate in any part of the research activity.		
6. I know who to contact if I have any questions about the study in general.		
7. I understand that the information supplied by me could be used in future academic publications.		
8. I agree to take part in PECS training and generalisation sessions.		
9. I agree to take part I completing a reinforcement inventory.		
10. I consent to participating in video recordings of training and generalisation sessions.		
11. I understand that my participation in this study is confidential and that no material which could identify me personally will be used in any reports on this study.		
12. I wish to receive a copy of the findings.		
13. I consent to the researcher discussing the education of _____ with their teacher.		

Participant:	_____	Researcher:	_____
Signature:	_____	Signature:	_____
Date:	_____	Date:	_____
Contact details:	_____	Contact details:	_____

Appendix F.

Group 3 (Caregiver Participant) Information Sheet

Associate Professor Angelika Anderson
Faculty of Social Science
Waikato University
Phone: 07 838 4466 ext. 9209
Email: angelika.anderson@waikato.ac.nz

Georgina Scott
Phone: [removed]
Email: [removed]

Dear ____
You are invited to participate in a research project conducted by myself, Georgina Scott, under the supervision of Associate Professor Angelika Anderson from the School of Psychology at the University of Waikato. This project is part of the requirement for the completion of my Master of Applied Psychology in Behaviour Analysis at the University of Waikato. Please read this information sheet in full before deciding if you will agree to participate. If you would like further information about the project, please contact myself or Associate Professor Anderson via the contact details above.

What are the aims of the research?
This research aims to evaluate the impact of teaching the Picture Exchange Communication System (PECS) to a minimally verbal adolescent with an intellectual disability living at home. The research objectives are to determine:

A: If the use of PECS increases the frequency of functional communication acts in a generalised setting for a minimally verbal adolescent with an intellectual disability in a home environment.

B: whether parents and caregivers can be trained as effective communication partners to support the development of functional communication in individuals with an intellectual disability and limited expressive communication skills, using Behavioural Skills Training via Telehealth

Picture Exchange Communication System
The Picture Exchange Communication System (PECS) is a kind of Alternative and Augmentative Communication, designed to teach functional communication. It has gained empirical support through a large number of replicated studies.

Who will the participants be?
Group 1 Participant: The young person participant
To be recruited for this research, the young person participant would have met the following inclusion criteria:

- Minimally verbal adolescent
- aged between 15 years and 25 years
- has an intellectual or developmental disability
- has an Alternative and Augmentative Communication (AAC) goal associated with an existing support plan, which has not been successfully addressed

Group 2/3 Participants: Caregiver/Parent participants
The research will also include caregivers who provide care for the young person participant daily.

What will the participants have to do?
All participants and stakeholders will be invited to an information and informed consent information session. Informed consent will be determined by the researcher's supervisor, Associate Professor Angelika Anderson. If informed consent is determined, the research procedure will be as follows.

- Parents and caregiver participants will complete a Reinforcement Inventory. It is intended that this will take approximately 30 minutes.
- The young person participant and parent/caregiver participants will take part in PECS training. It is intended that the young person participant and parent participants will take part in training for the first 3 stages of PECS. As recommended in the PECS Training Protocol (Frost & Bondy, 2002), a minimum of five training sessions will be adhered to for each PECS stage.

PECS training sessions are expected to be approximately 30 minutes in duration. The researcher will be providing PECS training sessions via video conference.

- Two 30-minute generalisation sessions will be scheduled to take place immediately following the final two training sessions for each PECS stage. This is where caregiver participants will practice positive learner communication strategies, while the young person participant engages in their normal activities.
- All training and generalisation sessions will also be recorded via secure video recording software. This will help the researcher review footage and improve the accuracy of data collection. Generalisation sessions at school will not be recorded on video.
- Follow up observations will also be completed remotely by the researcher. Follow up observations will also be 30 minutes in duration. Two follow up sessions will be completed both at 2 weeks after PECS training has been completed, and at 2 months.
- Participants will be invited to a shared morning tea to mark the end of the research and thank them for their contributions. A results presentation will be included in this, and a written summary will be offered to all participants.

It is expected that total participation would be 10-12 weeks.

What are the expected benefits to the participants?
It is proposed that you might benefit from gaining improved or alternative strategies to communicate with the young person. Improved communication skills for the young person are likely to reduce the occurrences of challenging behaviour and the potential aversive consequences associated with this. A summary of the results can be forwarded to you on request, as can a copy of any published journal articles.

Right to withdraw
Participation in this project is voluntary and you are under no obligation to give consent to participate. All participants have the right to withdraw from the project at any time, for any reason, and with no consequence. This includes the destruction of data, upon request, up to 2 weeks after participation in the project is complete.

Confidentiality
Although your name will be known to me, participation in this project will remain confidential and no identifying information will be disclosed to anyone outside of the study. Codes and pseudonyms will be assigned to all participants to ensure no data can be traced back to any participants. None of the participants will be identifiable in the presentation of any results.

What happens now?
If you are happy to participate in this project, please complete the consent form for teachers and return to myself. If you have any questions regarding the project, please contact me on the details at the top of this form.

This research project has been approved by the Human Research Ethics Committee (Health) of the University of Waikato. Any questions about the ethical conduct of this research may be sent to the chair of the committee (humanethics@waikato.ac.nz).

Appendix G.

Group 3 (Caregiver) Consent Form

Please retain a copy of this form for your personal records.

Research Project: Increasing functional communication skills for a minimally verbal adolescent with an intellectual disability using the Picture Exchange Communication System.

Name of Participant: _____

I have received a copy of the information sheet describing the research project and have been given sufficient time to read it. Any questions that I have relating to the research have been answered to my satisfaction. I understand that I can ask further questions about the research at any time during my participation and that I can withdraw my participation at any time (up to two weeks) after completion of data collection.
I understand that I can ask to have the observations stopped at any time.
When I sign this consent form, I will retain ownership of the collected data, but I give consent for the researcher to use the data for the purposes of the research outlined in the information sheet.
I understand that my identity will remain confidential in the presentation of the research findings.

Please complete the following checklist. Tick (✓) the appropriate box for each point	Yes	No
1. I have read the participant information sheet (or it has been read to me) and I understand it.		
2. I have been given sufficient time to consider whether or not to participate in this study.		
3. I am satisfied with the answers I have been given regarding the study and I have a copy of this consent form and information sheet.		
4. I understand that taking part in this study is voluntary (my choice) and that I may withdraw from the study at any time without penalty.		
5. I have the right to decline to participate in any part of the research activity.		
6. I know who to contact if I have any questions about the study in general.		
7. I understand that the information supplied by me could be used in future academic publications.		
8. I agree to take part in PECS training and generalisation sessions.		
9. I agree to take part in completing a reinforcement inventory.		
10. I consent to participating in video recordings of training and generalisation sessions.		
11. I understand that my participation in this study is confidential and that no material which could identify me personally will be used in any reports on this study.		
12. I wish to receive a copy of the findings.		

Participant:	_____	Researcher:	_____
Signature:	_____	Signature:	_____
Date:	_____	Date:	_____
Contact details:	_____	Contact details:	_____
	_____		_____

Appendix H.

Group 4 (Teacher) Information Sheet

Associate Professor Angelika Anderson
Faculty of Social Science
Waikato University
Phone: 07 838 4466 ext. 9209
Email: angelika.anderson@waikato.ac.nz

Georgina Scott
Phone: [removed]
Email: [removed]

We are inviting you as the teacher of the young person participant to take part in a research project. This will be conducted by myself, Georgina Scott, under the supervision of Associate Professor Angelika Anderson from the School of Psychology at the University of Waikato. This project is part of the requirement for the completion of my Master of Applied Psychology in Behaviour Analysis at the University of Waikato. Please read this information sheet in full before deciding if you will agree to participate. If you would like further information about the project, please contact myself or Associate Professor Anderson via the contact details above.

What are the aims of the research?

This research aims to evaluate the impact of teaching the Picture Exchange Communication System (PECS) to a minimally verbal adolescent living at home. The research objectives are to determine:

A: If the use of PECS increases the frequency of functional communication acts in a generalised setting for an adolescent with an intellectual disability in a home environment.

B: whether parents and caregivers can be trained as effective communication partners to support the development of functional communication in an individual with an intellectual disability and limited expressive communication skills, using Behavioural Skills Training via Telehealth

Picture Exchange Communication System
The Picture Exchange Communication System (PECS) is a type of Alternative and Augmentative Communication, designed to teach functional communication. It has gained empirical support through a large number of replicated studies.

What will you have to do?

You are invited as the participant's teacher to attend an information and informed consent session. Informed consent will be determined by my supervisor, Associate Professor Angelika Anderson. Following this I would like to:

1. Meet with you at a suitable time to discuss the young person participant's previous training with PECS at school, as well as their current IEP goals.
2. Personally observe the young person participant in person in your classroom for a maximum of an hour, for two sessions in the week prior to the intervention.
3. Observe the young person participant in person during two 30-minute sessions at school. This is so I can test for the generalisation of PECS in the school setting. This would occur two weeks after PECS training ends and then again at two months.

A brief report of relevant results will be made available to you after the study ends.

It is expected that total participation would be for approximately 10-12 weeks.

What are the expected benefits to the participants?

You might benefit by refining your knowledge of PECS. This knowledge could be generalised to other students in your class, where relevant and appropriate. As a teacher, you may also benefit from a predicted decrease in challenging behaviours exhibited by the young person participant in your classroom.

Right to withdraw
Participation in this project is voluntary and you are under no obligation to give consent to participate. All participants have the right to withdraw from the project at any time, for any reason, and with no consequence. This includes the destruction of data, upon request, up to 2 weeks after participation in the project is complete.

Confidentiality
Although the young person participant's name will be known to me, participation in this project will remain confidential and no identifying information will be disclosed to anyone outside of the study. Codes and pseudonyms will be assigned to all participants to ensure no data can be traced back to any participants. None of the participants will be identifiable in the presentation of any results.

What happens now?
If you are happy to participate in this project, please complete the consent form and return to myself. If you have any questions regarding the project, please contact me via the details at the top of this form.

This research project has been approved by the Human Research Ethics Committee (Health) of the University of Waikato. Any questions about the ethical conduct of this research may be sent to the chair of the committee (humanethics@waikato.ac.nz).

Appendix I.

Group 4 (Teacher) Consent Form

Please retain a copy of this form for your personal records.

Research Project: Increasing functional communication skills for a minimally verbal adolescent with an intellectual disability using the Picture Exchange Communication System.

Name of Participant: _____

I have received a copy of the information sheet describing the research project and have been given sufficient time to read it. Any questions that I have relating to the research have been answered to my satisfaction. I understand that I can ask further questions about the research at any time during my participation and that I can withdraw my participation at any time (up to two weeks) after completion of data collection.

I understand that I can ask to have the observations stopped at any time.
When I sign this consent form, I will retain ownership of the collected data, but I give consent for the researcher to use the data for the purposes of the research outlined in the information sheet.
I understand that my identity will remain confidential in the presentation of the research findings.

Please complete the following checklist. Tick (✓) the appropriate box for each point	Yes	No
1. I have read the participant information sheet (or it has been read to me) and I understand it.		
2. I have been given sufficient time to consider whether or not to participate in this study.		
3. I am satisfied with the answers I have been given regarding the study and I have a copy of this consent form and information sheet.		
4. I understand that taking part in this study is voluntary (my choice) and that I may withdraw from the study at any time without penalty.		
5. I have the right to decline to participate in any part of the research activity.		
6. I know who to contact if I have any questions about the study in general.		
7. I understand that the information supplied by me could be used in future academic publications.		
8. I consent to in-person observation sessions of the young person participant in the classroom.		
9. I consent to sharing information about the young person participant with the researcher once consent from the parents has been granted.		
10. I understand that my participation in this study is confidential and that no material which could identify me personally will be used in any reports on this study.		

Participant:	_____	Researcher:	_____
Signature:	_____	Signature:	_____
Date:	_____	Date:	_____
Contact details:	_____	Contact details:	_____
	_____		_____

Appendix J.

Social Validity Rating Scale

Thank you for taking part in the research project. I would appreciate you taking the time to let me know what you found worked well and what could have been done differently. Please circle the number which best describes your experience.

	Strongly disagree	Disagree	Slightly disagree	Slightly agree	Agree	Strongly agree
1. PECS was an acceptable intervention for Jack.	1	2	3	4	5	6
2. Most caregivers would find PECS appropriate in the home environment.	1	2	3	4	5	6
3. PECS proved effective in increasing functional communication for Jack.	1	2	3	4	5	6
4. I would suggest the use of PECS to others.	1	2	3	4	5	6
5. Communication deficits were severe enough to warrant the use of PECS.	1	2	3	4	5	6
6. Most caregivers would find PECS suitable for increasing functional communication.	1	2	3	4	5	6
7. I would be willing to use PECS again.	1	2	3	4	5	6
8. PECS resulted in negative side-effects for Jack.	1	2	3	4	5	6
9. PECS may be appropriate for a variety of young people with functional communication deficits.	1	2	3	4	5	6
10. PECS was consistent with other strategies I have used before.	1	2	3	4	5	6
11. PECS was a fair way to encourage functional communication for Jack.	1	2	3	4	5	6
12. I liked the procedures used in PECS.	1	2	3	4	5	6
13. PECS was a good way to increase functional communication.	1	2	3	4	5	6
14. Overall, PECS was beneficial for Jack.	1	2	3	4	5	6
15. PECS had a positive impact on Jack's behaviour.	1	2	3	4	5	6
16. PECS will produce a lasting improvement in functional communication.	1	2	3	4	5	6
17. Soon after using PECS, I noticed a positive change in Jack's functional communication.	1	2	3	4	5	6
18. Jack's functional communication will likely remain at an improved level even after PECS is discontinued.	1	2	3	4	5	6
19. The PECS maintenance procedures are appropriate and sustainable for the home environment.	1	2	3	4	5	6
20. Telehealth was a good way to communicate with the researcher.	1	2	3	4	5	6
21. I liked the use of Telehealth in this study.	1	2	3	4	5	6
22. I would be willing to use Telehealth again.						

Please answer the following questions:

1. What did you like best about the use of Telehealth? What do you think was the most beneficial part of using Telehealth to implement PECS?

2. What frustrated you most about using Telehealth? What was the least beneficial part of using Telehealth to implement PECS?

3. Do you think that your participation caused Jack's communication to improve? Why or why not? If so, how?

4. What would you change about how Telehealth was implemented in this study, to make it easier for you or other caregivers to use?

5. Is there anything else you want to share about the effects that the Telehealth administration of PECS has had on Jack?

6. Is there anything else you would like to share about your experiences using Telehealth?

Appendix K.

Partial Interval Recording Form

Date (of recording): Today's date: Session number: Experimental condition:

Observation start time (on video): Observation end time: Location: Completed by (circle): researcher interobserver

Behaviour	Time interval (seconds/minutes)														
	20	40	1:00	1:20	1:40	2:00	2:20	2:40	3:00	3:20	3:40	4:00	4:20	4:40	5:00
PECS mand															
Challenging behaviour															
Vocal mand															
Spontaneous communicative attempt															
Offers item or activity															
Communication opportunity															
Vocal prompting															
Physical prompting															
Prompted speech															
Error correction															
Reinforcer timing error															
Open hand prompt error															

Please note that the behaviours of the young person are not bolded, whilst those of the caregiver/parent are presented in bold font

Appendix L.

Phase One Recording Form for Communicative Partner

Date:					Session Length:								Researcher / IOA (circle)		
Target Skill	Trial Number & Initial of Communicative Partner														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Arranges the training environment effectively															
Does not use gestural prompts															
No use of verbal prompting															
Entices appropriately															
Uses open hand appropriately															
Provides reinforcer within half a second and provides a verbal label															
Does not insist on speech															
Returns the picture at the correct time															

Appendix M.

Phase One Recording Form for Physical Prompter

Date:					Session Length:							Researcher / IOA (circle)			
Target Skill	Trial Number & Initial of Physical Prompter														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Waits for learner to initiate interaction															
Physically guides the learner to pick up image															
Physically guides the learner to reach with image															
Physically guides the learner to release the image															
Fades the prompts effectively															
Interrupts and/or prevents inappropriate behaviours															
Does not interact socially with the learner															

Appendix N.

Phase Two Recording Form for Physical Prompter

Date:	Session Start/End Time:				Session Length:						Researcher or IOA				
Target Skill	Trial Number														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Waits for initiation															
Prompts removal of picture from book															
Physically guides the learner to the communication partner															
Physically guides the learner to the PECS folder															
Does not interact socially with the learner															
Uses back-stepping															

Appendix O.

Phase Two Recording Form for Communicative Partner

Date:	Session Start/End Time:					Session Length:						Researcher or IOA			
Target Skill	Trial Number														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Arranges the training environment effectively															
Entices appropriately															
Gradually increases distance from the learner															
Teaches the learner to cross the room to contact CP															
Gradually increases distance between learner and PECS book															
Turns away from learner															
Reinforces within 0.5s and provides a label															

Eliminates subtle prompts such as eye contact															
Does not insist on speech															
Teaches the learner to travel from one room to another															

Appendix P.

Phase Three A: Recording Form for Communicative Partner

Date:	Session Length:												Researcher or IOA		
Target Skill	Trial Number														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Arranges effective training environment															
Entices with both items															
Social reinforcement when learner touches correct image															
Reinforces with requested item															
Conducts error correction correctly															
Conducts second correction if required															
Varies the position of the picture on folder															
Does not insist on speech															

Appendix Q.

PECS Phase One: Instructions for Parents

PECS Phase I - “How to communicate”

PECS has six phases. For Phase One, two people are required to work simultaneously with the learner (Jack – pseudonym used for your son). These two roles are referred to as the “communication partner” and the “physical prompter.” Communication partner refers to the person whom your son communicates with. Physical prompter refers to the person who sits behind Jack and physically helps him to hand the PECS card to the communication partner. During our training session you will have the opportunity to practice both roles and receive feedback on your accuracy in performing each role. The overall goal of this phase is for Jack to acquire the skills to initiate communication spontaneously and without prompts. Jack will learn to exchange the PECS image for the item/activity he wants.

Communication Partner Responsibilities

• Entice or “motivate” Jack
• Ensure that he is given the item or activity within ½ a second of releasing the picture card into your hand
• Name the item at the same time as giving Jack the preferred item/activity
• Ensure that the “open hand prompt” is timed appropriately

Physical Prompter Responsibilities

• Most importantly, wait until Jack reaches for the item/activity!
• Physically assist Jack in picking up the picture card, as well as helping him to pass it to the communicative partner and releasing it in their hand
• As Jack develops the ability to pick up and pass the card to the other person you will be decreasing the amount of physical assistance used as specified below

Setting up the training environment:

1. The communication partner is positioned in front of the learner e.g., across from Jack at the table.
2. The physical prompter is behind Jack.
3. The *picture* of preferred item/activity is placed directly in front of him.
4. The *preferred item or activity* is placed in front of Jack, but out of his reach and closer to the communication partner.

Parts: *(It may be useful for you to print these as a reference during our training sessions)*

Part 1:

1. The communication partner “entices” Jack by bringing his attention to the preferred item or activity. For example, by waving a ribbon toy or drumming on a drum.
2. As soon as he reaches for the item, the physical prompter physically helps him by holding and moving his arm/hand to ensure that he picks up the picture and release it into the communication partner’s open hand. This is called a full physical prompt.
3. The communication partner should not open their hand to receive the PECS card until *after* Jack has reached for the item/initiated the picture exchange.
4. Whilst Jack places the picture in the communication partner’s hand, the communication partner simultaneously gives the preferred item/activity and names the item e.g., “drumstick!”
5. Let Jack have some time to enjoy the item or activity. For an activity, I would suggest up to 30 seconds (depending on the activity). For something like a food item, you would instead just wait for him to finish eating the portion (such as a chip) before starting step one again.

This counts as one trial.

Part 2:

Over the course of several trials, you will begin to decrease the amount of physical assistance used. This is called “backward chaining” and is described below:

1. Decrease the physical assistance for the step of *releasing* the picture card across trials until your son is able to release the picture into the communication partner's hand without any assistance, and can do this for the majority of trials (i.e., at least four out of five). Continue to provide physical assistance for Jack to both *pick up* the picture card and *pass it* to the communicative partner.
2. Once this is successful, then decrease physical assistance for the step of *reaching* for the communication partner's open hand - continue until Jack *reaches* to place the picture in the communication partner's hand independently in at least four out of five trials.
3. Once this has been achieved then decrease the amount of physical assistance to *pick up* the picture - continue until Jack picks up the picture without any physical assistance for at least four out of five trials.

Part 3:

Once the physical assistance from the 'physical prompter' has been decreased and is no longer necessary, the communication partner can decrease and eventually stop the "open hand prompt" - so instead of having their hand extended to receive the picture (palm upwards, hand open) as soon as Jack reaches to *pick up* the picture, they will only do this when your son *reaches towards them with the picture*.

The communicative partner continues to give Jack the item or activity within ½ a second of him placing the picture in their hand. Pair this with social reinforcement such as a happy facial expression (for example smiling whilst saying "Ribbon!" and giving him the ribbon).

Trouble shooting

- If Jack is not attending to you or the item, the communication partner can entice by saying something like "I have a drum" and drumming on the drum (to make a noise). Do not gain attention by using the prompt "what do you want".
- If Jack appears bored by the item/activity, try switching to a different reinforcer (e.g., from a drumstick to a ribbon toy or song).
- If Jack is reluctant to give back the reinforcing item to the communicative partner, it is advisable to use a less reinforcing item initially, followed by increasingly more reinforcing items. This is so he is more likely to give back the item they have in exchange for a different item that they have a greater desire for.
- If he plays with the picture card or does anything other than try to place it in the communication partner's hand, interrupt him and begin the trial again, reintroducing a physical prompt if necessary (can decrease the amount of this again as above). If Jack is repeatedly allowed to play with the card (especially over multiple trials) there is a danger that this behaviour of playing with the card could become reinforced or become habitual and start to occur more frequently.

Videos:

Please watch these two videos to see PECS Phase One in action. The first video is the most important.

https://www.youtube.com/watch?v=mECI6PKVFiA

This video is a great model of how to decrease physical assistance:

https://www.youtube.com/watch?v=eNbucDWEfpg

Additional/optional Resources:

If you have time and wish to know more about PECS the following videos may be useful:

- https://pecsaustralia.com/videos/ This site provides a great overview of PECS and some pointers that may be useful in teaching Jack.

Please be wary of other videos publicly available (such as on social media websites) as many of these contain errors in the PECS procedure so are not appropriate models to follow.

Appendix R.

PECS Phase Two: Instructions for Parents

PECS Phase II – "Distance and Persistence"

Goal: The learner (Jack – pseudonym) will walk to his PECS book and pull the picture off, before walking to the person he is communicating with, getting their attention and giving the picture to them

There are two skills to develop in this phase:

1. Walking to the folder and then to the person Jack wants to communicate with
2. Getting their attention

These two skills are in addition to the skills he has developed in Phase One i.e., independently picking up the image, reaching and releasing the picture to the person's hand in exchange for them giving him the item he wants. We will still need a 'physical prompter' like in Phase One to physically help him when necessary.

This phase is designed to imitate 'real-world' communication more closely. In Phase One, the environment was set up to maximise the likelihood of success. In this phase, Jack will learn to go and get the picture and gain the attention of the person he is wanting an item from. We will still be using various pictures but as in Phase One, these will only be presented one at a time and not simultaneously. After Jack achieves this goal, we will then move on to teaching him to discriminate between more than one image presented simultaneously.

Set up:

1. You will need a single picture *attached to the front* of Jack's PECS folder.
2. The communication partner is positioned in front of Jack e.g., across from him (at the table to begin with if possible). This distance is increased over time.
3. The physical prompter is located behind him
4. To start with, the PECS folder is placed within reach of Jack

Just as we did in Phase One, we want to use one picture at a time and one preferred item/activity per trial. We still need to ensure that a variety of pictures and preferred items/activities are available across training sessions so if he gets bored of the item, we have something else to use.

Step 1: Teaching Jack to pull the image off the PECS book

- This is just like Phase One, except the picture of the preferred item or activity is placed on the front of the PECS folder.
- Following the procedure in Phase One, the communication partner entices Jack with the preferred item or activity by waving it etc.
- Again, like in Phase One, If he reaches toward the item instead of the image the physical prompter may physically assist Jack to pick up the picture from the front of the PECS folder, reach to the communication partner, and release into the communication partner's hand. This physical assistance can then be systematically decreased once he is consistently reaching towards the image on the folder.
- Remember to give the item (or activity) to Jack within ½ of a second of him placing the picture in the communication partner's hand; simultaneously praise and label the item e.g., "Good job! RIBBON!".

Step 2: Teaching Jack to travel with the image

- The communication partner will entice Jack with the preferred item or activity. As he reaches to release the picture in the communication partner's hand, the communication partner will move their hand slightly closer to their body. This aims to encourage him to reach a little bit further.
- In following exchanges, the communication partner will gradually move slightly further away from him. Jack will have to learn how to reach further, stand to reach, and eventually travel small distances to reach the communication partner. The physical prompter can guide him

where necessary, but physical assistance should ultimately be decreased until it is no longer required at all.

The communication partner should not provide any prompting during this phase. Jack has to learn that he needs to gain the communication partner's attention.

Once he is able to independently and consistently travel 1-3 metres to the 'communication partner' we will start step 3:

Step 3: Jack will walk to the folder to pull off the image and then walk to the 'communicative partner' to hand them the image

- The communication partner remains "nearby" (but not directly in front of him). During successive trials, the PECS folder is gradually moved further away from J, so that he learns to travel to access the folder (with the relevant image still placed on the front).
- For example, the PECS folder is moved slightly further away to encourage him to reach, then slightly further away over several more trials until he is able to make a purposeful "detour" to his PECS folder, before approaching the communication partner.
- Again, the physical prompter may assist where necessary, but this physical assistance must be removed as soon as appropriate.

Important points to remember:

During all steps, the person who is in the role of the communicative partner should not provide any type of prompt such as saying "what's this?" "Look," or pointing or gesturing to the card or folder. Even things like looking at Jack with raised eyebrows would be considered a prompt, and thus would be something to avoid. The communicative partner can initially (in the first few trials) attract attention to the object by waving it – but this should be reduced over time, so that they are only holding the object and not attracting attention to it purposefully. This is so that eventually Jack learns to ask for items he can't see.

It is important that the person in the role of the communicative partner does not walk towards Jack if he stops after picking up the image and doesn't walk forward. If the person in the role of the communicative partner does walk forward towards Jack, this teaches him that he doesn't have to walk the whole way and get their attention; instead, they will come to him.

If he makes the mistake of walking towards the communicative partner before the picture, we need to restart – by first getting the communicative partner to move away again, and then the physical prompter needs to provide additional physical assistance to help him get the picture first before going towards the communicative partner.

Appendix S.

PECS Phase Three: Instructions for Parents

PECS Phase Three – Picture Discrimination

In Phase One we have taught Jack to exchange the PECS image for the item he wants.
In Phase Two we are currently teaching Jack to walk to his folder, remove the image from the front and then walk to you to exchange the image for the item. In Phase Two we are also teaching Jack to persist in getting your attention even when you are not immediately looking at him.

Phase Three involves teaching the skill of discriminating between images. The overall goal for this phase is for Jack to be able to select the image that matches the item that he wants, from an array of two or more images. There are two parts to Phase Three:

1. Discriminating between an image of an item that Jack wants and a 'distractor' image.
2. Discriminating between two images of items that Jack enjoys.

I recommend watching the following video to see phase three in action:
https://www.youtube.com/watch?v=rsDBJyrcyh0&t=374s (phase three is from 14:00 to 16:56).

We are only practising Phase Three, Part A. The instructions are as follows:
Setting up:
To begin with, you and Jack will sit at the kitchen table and have the PECS folder within arm's reach. The folder will have two images put on the front; one of a highly enjoyable item (e.g., ribbon) and one of a non-preferred item (e.g., food - if he is not hungry).

You will need a few pictures of preferred items/activities and non-preferred "distractor" items/activities ready to swap with the ones on the folder, when necessary, as well as their corresponding items or activities.

For this phase, use two pictures and two items/activities at a time. One item/activity must be highly preferred (e.g., ribbon) and the other non-preferred (e.g., food). Place the two pictures on the front of the PECS folder.

- Start by "enticing" Jack with both the preferred item and the non-preferred item simultaneously.
- If Jack picks up the correct picture (the image of the item he enjoys) and gives it to you immediately give him the preferred item/activity and say "Good job" and smile/thumbs up (or similar).
- If Jack picks up the incorrect picture (the image of something he does not want, e.g., food) immediately give him the item/activity that responds to this incorrect picture (the food) but do not provide any other reaction. If Jack looks as though he does not want this item (the food), this is good because we can use this as an opportunity to teach him the image that he needs to choose instead, by using the following 4-step error correction procedure:

Name of the step	Your action	Jack's action
	Entice with both items at the same time (e.g., shake both the ribbon and the food box)	
		Gives the incorrect picture (e.g., food)
	Give him the item that matches the image (e.g., food)	
		Reacts negatively or looks like he does not want the item
1. Model / show	Get Jack to look at the correct picture (e.g., image of ribbon), by showing him the image	
2. Practice	Prompt Jack to give you the image (e.g., hold your hand out)	
		Gives you the correct image

	Praise and smile/thumb up etc but do NOT give him the item	
3. Delay	Move the folder with the images on it away or turn it over for a couple of seconds	
4. Repeat	Entice using both items simultaneously (give him time to select the right image)	
		Gives the correct picture
	Praise, label and give him the item (e.g., “Good job! Ribbon!” (Can also do something like thumbs up/smile etc)	

- As with previous phases, we want to use a variety of items Jack enjoys, as well as distractor items or items Jack does not enjoy – so that his learning is not limited to just two images.
- We also want to vary the position of the images on the folder, so that Jack does not learn to just “choose the image on the left”, for example. We don’t want to change the position of the image when we are doing the error correction procedure, however.
- If Jack makes multiple errors, by continuously choosing the incorrect picture despite use of the above error correction process, we may need to end the lesson early or go back to the use of a single picture (of just the item he enjoys) until he is handing this over consistently.