Training Education Professionals to Use the Picture Exchange Communication System: a Review of the Literature

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Abstract

The Picture Exchange Communication System (PECS) is a popular augmentative and alternative communication strategy. Like many communication interventions, the successful use of PECS is dependent on the skills of the communication partner. This article provides a systematic review of the published research on teaching education professionals (EPs) to use PECS. Training of EPs was usually conducted during individual or small group sessions and included a description of the PECS strategy, practice on implementation of PECS, and feedback on performance. Instructional activities typically resulted in an immediate increase in the quality and/or quantity of PECS opportunities provided by the EP; however, mixed findings are reported for maintenance and generalization. Implications for future research and practice are discussed.

Keywords Augmentative and alternative communication · Autism · Communication partner training · Picture exchange communication system

It is estimated that 30% of children with autism spectrum disorders (ASD) will not develop speech sufficient to meet their communication needs (Anderson et al., 2007; Wodka, Mathy, & Kalb, 2013). For these individuals, the use of augmentative and alternative communication (AAC) is recommended to support communication and participation in academic activities, relationships with family and friends, and community events (Beukelman & Mirenda, 2013). AAC interventions have produced strong effects on the acquisition of functional communication skills for individuals with ASD (Ganz, 2015) and have been demonstrated to support, not inhibit, the development of speech (Millar, Light, & Schlosser, 2006).

One popular AAC intervention for individuals with ASD is the Picture Exchange Communication System (PECS; Ganz, Sigafoos, Simpson, & Cook, 2008). PECS is a six-phase

structured training protocol that supports the acquisition of functional communication based on both behavioral and developmental principles (Bondy & Frost, 2001). The PECS intervention begins with teaching the requesting of tangible objects and activities in Phases 1 through 5. As prior phases are acquired and new phases are introduced, the expected behavior for the communicator gradually increases in complexity (e.g., communicating with partners who are farther away in distance, using simple sentence structures, commenting; Bondy & Frost, 2001). See Table 1 for additional information on each of the six PECS phases.

Like any AAC intervention, the PECS intervention requires training for both the communicator (e.g., child with ASD) and the communication partner (Light & McNaughton, 2015). As Bondy and Frost (2001) stated, “the continued success of PECS also will depend on the quality of training provided by those implementing the system” (p. 742). Since it was first introduced, much of PECS intervention research has been conducted with researchers acting as the communication partners, directly teaching PECS to the communicator (Ganz et al., 2013). This research is an important first step in the investigation of the effectiveness of PECS because researchers are likely to be well trained in the use of the PECS intervention. It also is important, however, to address the research-to-practice gap (Scheeler, Bruno,

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Table 1 PECS training sequence

Item	Key Behaviors (Communicator)	Key Behaviors (Partner)	Other Considerations
Phase 1: How to Communicate	<ul style="list-style-type: none"> • Approach partner with picture in hand. • Give picture to partner. • Receive the item requested. 	<ul style="list-style-type: none"> • Have two communication partners, one to show the preferred item to the communicator, the other to physically prompt the child to use the picture. 	Communicator uses a single picture provided by the partner.
Phase 2: Distance and Persistence	<ul style="list-style-type: none"> • Persist in attempts to communicate (e.g., partner at a distance, partner does not respond to first attempt). 	<ul style="list-style-type: none"> • Use cues to help communicator initiate. 	Communicator is given a communication book.
Phase 3: Discrimination Between Symbols	<ul style="list-style-type: none"> • Discriminate between two pictures. • Take item corresponding with picture used. 	<ul style="list-style-type: none"> • Present communicator with a choice of two pictures. • Demonstrate that the choice of picture results in specific outcomes. 	Instruction begins with selections between highly preferred and nonpreferred items.
Phase 4: Using Phrases	<ul style="list-style-type: none"> • Construct a two-picture sentence: stem and item (e.g., “I want blocks.”). • Exchange sentence rather than a single picture. 	<ul style="list-style-type: none"> • Attach sentence stem to the front of communicator’s communication book. • When handed the sentence, partner reads it back and provides requested item. 	Communicator is given sentence stems “I want,” “I see,” and “it is” to expand from requesting to commenting.
Phase 5: Answering a Direct Question	<ul style="list-style-type: none"> • Respond to a question by constructing a two-picture sentence using stem and item (e.g., “I want snack.”). 	<ul style="list-style-type: none"> • Ask target question. • During initial teaching, immediately provide a prompt. 	Communicator is taught to respond when asked a simple question (e.g., “What do you want?”).
Phase 6: Commenting	<ul style="list-style-type: none"> • Exchange sentence rather than a single picture. • Differentially answer requesting and commenting questions. 	<ul style="list-style-type: none"> • Increase time between question and prompt over time. • Ask target question (e.g., “What do you see?”). • Provide social feedback (e.g., “Yes, I see a bird, too!”) but not access to the item. 	Additional questions to teach include “What is it?” “What do you hear?” “What do you have?”

The Picture Exchange Communication System is based on Bondy and Frost (2001)

Grubb, & Seavey, 2009) and to identify strategies to prepare typical communication partners (including teachers, paraprofessionals, and speech-language pathologists) to support the PECS intervention. It is these education professionals (EPs) who often are responsible for the delivery of PECS instruction in natural environments (Ganz et al., 2013; Parsons, Rollyson, & Reid, 2012) and who will directly impact student achievement (Kretlow & Bartholomew, 2010). Given the recent increase in PECS’s popularity (Ganz et al., 2013), it is of increasing importance to evaluate the effectiveness of training EPs to be PECS communication partners in natural settings (Ogletree, Davis, Hambrecht, & Phillips, 2012). As in other communication-partner training activities (Kent-Walsh, Murza, Malani, & Binger, 2015), the goal of instruction is effective, efficient, and socially valid instruction for the use of targeted communication-partner behaviors during everyday communication opportunities.

A variety of training models are available; however, a behavioral skills training (BST) protocol (Parsons et al., 2012) is recommended for training adult partners to implement performance skills, such as discrete-trial instruction (Sarokoff & Sturmey, 2008), mand training (Nigro-Bruzzi & Sturmey, 2010), and guided compliance (Miles & Wilder, 2009). The BST protocol directs the trainer to provide four major components of instruction (Parsons et al., 2012): (a) a description of the target skill(s), often paired with a written definition and rationale; (b) a modeling component, in which the trainer demonstrates the skill(s) for the trainee to observe; (c) rehearsal of instructional steps; and (d) feedback, in which trainers observe the trainee performing the skill and provide feedback. Although there have been recent reviews of the impact of training communication partners in the use of PECS (i.e., Alsayedhassan, Banda, & Griffin-Shirley, 2016), at present it is unclear what instructional elements are typically included when training EPs to act as PECS communication partners, the extent to which these instructional components address recommended practices for performance skill interventions, and the impact of these training activities on the delivery of PECS opportunities by EPs.

This systematic review, therefore, is designed to identify variables associated with successful PECS partner training interventions and to assist in the development of instructional programs that will support EPs in their use of PECS. The review addresses five major questions. First, the literature is reviewed to determine which EPs have been trained to deliver the PECS intervention. Second, the review identifies which phases of PECS the EPs have been taught to support. Third, the review identifies the instructional procedures (e.g., components of BST) that have been used to train EPs in the use of the PECS protocol. Fourth, the review classifies the quality of the current research using the standards proposed by the

National Autism Center (2015). Finally, the review examines the impact of these training procedures on the quantity and quality of the PECS opportunities provided to individuals with ASD.

Method

The studies for this systematic review were identified through a four-step procedure. First, three databases (i.e., Education Resources Information Center, PsycINFO, and ProQuest) were searched with the keyword “Picture Exchange Communication System” limited to abstracts. This resulted in the identification of 150 articles, after duplicates had been removed. Second, the remaining articles were screened by abstract and title for keywords, “train*,” “teach*,” or “coach*,” resulting in identification of 26 studies. Third, the following inclusion criteria were then applied to the 26 studies: (a) an experimental study was conducted and data were reported on communication-partner behavior; (b) the independent variable (i.e., instructional procedures used for communication-partner training) was described in sufficient detail to support additional analysis (i.e., at least three of these five instructional variables were described: description of trainer, format of training, location of training, materials used, and duration); (c) the EP conducted the PECS intervention with an individual with a developmental disability, including at least one individual with ASD, during intervention and/or generalization phases; and (d) the article was published in English. This resulted in the identification of five studies. Last, reference lists of included articles, as well as articles that cited included studies, were examined for any additional studies that may not have been returned during keyword searches, resulting in the identification of an additional two studies.

A total of seven studies met all inclusion criteria and were identified for further analysis. Included studies were then examined to extract information pertaining to the following variables: communication-partner and communicator characteristics, setting, study design, instructional procedures (e.g., format, materials, duration), instructional components (e.g., BST model), instructional targets (e.g., phases of PECS), and measurements of intervention effect (e.g., immediate and long term).

Results

The results provide evidence that a variety of EPs, with a diverse range of skills and experiences, has been successfully trained to provide PECS communication opportunities. Additional results on the EPs, PECS phases, instructional procedures, BST components, and training outcomes are provided next and in Table 2.

Table 2 Summary of reviewed studies

Authors	Independent Variable: Training			Dependent Variable (Phases)	Results		
	Format	Materials	Trainer		Immediate	Maintenance	Generalization
Barnes, Dunning, and Rehfeldt (2011)	1:1	Handout, manual, videos	Researcher	Quality (1–3)	Increase*	–	–
Ganz et al. (2013)	Group with follow-up	Manual, checklist, self-monitoring	Researcher	Quality and quantity (1–4)	Increase in both	–	Not generalized (activity)
Hill, Flores, and Kearley (2014)	Small group	Checklist	Researcher	Quality (1–4)	Increase	–	–
Homlitas, Rosales, and Candel (2014)	Small group with follow-up	Handout	Researcher	Quality (1–3)	Increase	Maintained	Generalized♦ (setting and person)
Howlin, Gorden, Pasco, Wade, and Charman (2007)	Group with follow-up	Self-monitoring	PECS consultant	Quantity	Increase	Not maintained	–
Magiati and Howlin (2003)	Group with follow-up	–	PECS consultant	Quantity	Increase	–	Generalized (activity)
Rosales, Stone, and Rehfeldt (2009)	1:1	Handout, checklist, videos	Researcher	Quality (1–3)	Increase	Maintained	Generalized♦ (setting and person)

An asterisk denotes an increase in quality; however, the increase was still below the mastery criterion. A diamond denotes training with an adult confederate. Dashes indicate data were not reported

Summary of Study Components

EP Characteristics A total of 80 EPs participated in the seven studies. Roles of these EPs could be determined in six of the seven studies: 38 (61.3%) were teaching assistants, one-on-one therapists, or direct-care staff; 17 (27.4%) were teachers; 6 (9.7%) were preservice teachers; and 1 (1.6%) was a speech-language pathologist. Five studies reported that participants had minimal to no prior experience using PECS. EPs' previous work experience with individuals with severe disabilities was reported in three studies (Barnes et al., 2011; Ganz et al., 2013; Homlitas et al., 2014) and ranged from 4 months to 6 years.

Communicator Characteristics In five of the seven studies (71%), the communicator was a young child (i.e., 2–8 years old) with a diagnosis of ASD. Two studies were conducted with adult communicators (Barnes et al., 2011; Rosales et al., 2009). These adults, in addition to having complex communication needs, had also been diagnosed with multiple disabilities, including ASD.

Trainer and Setting Training for the EP was provided by one of the researchers in five of the seven studies. Of these five studies, two provided descriptions of the trainers' competency with PECS. Ganz et al. (2013) described the trainer as having over 15 years of experience implementing PECS with fidelity in research and practice, as well as having completed multiple PECS trainings (i.e., basic, advanced). Hill et al. (2014) reported their PECS trainers were special education faculty who were Board Certified Behavior Analysts. Additionally, Howlin et al. (2007) and Magiati and Howlin (2003) used certified PECS consultants. PECS training for the EP (and evaluation of the impact of the PECS training) was conducted in a classroom or therapy room for all studies. Additional details on the setting are as follows: Five studies used an educational center specific for individuals with developmental disabilities, including ASD (Ganz et al., 2013; Homlitas et al., 2014; Howlin et al., 2007; Magiati & Howlin, 2003; Rosales et al., 2009), one used a university-sponsored extended school year program (Hill et al., 2014), and one used a rehabilitation day program (Barnes et al., 2011).

Study Design Several types of experimental designs were reported. Four of the seven studies used single-subject designs (e.g., multiple-probe design, multiple-baseline design). Additionally, Howlin et al. (2007) and Magiati and Howlin (2003) used group designs, randomized and nonrandomized, respectively.

Instructional Content (PECS Phase) Training for EPs was limited to PECS Phases 1–3 in three of the six studies (Barnes et al., 2011; Homlitas et al., 2014; Rosales

et al., 2009). The remaining two single-subject studies (Ganz et al., 2013; Hill et al., 2014) taught instructional implementation and creation of communication opportunities for PECS Phases 1–4. Within the single-subject studies, Hill et al. (2014) was the only to report specific communicator growth across PECS phases; one participant started and mastered Phase 1, two participants started in Phase 1 and mastered Phase 3, and one participant started in Phase 3 and mastered Phase 4. Magiati and Howlin (2003) reported group results for the 47 EPs and 34 communicators in their study. The average PECS phase for the communicators increased from Phase 1 to mastery of Phase 4, with a coinciding increase of vocabulary from less than one symbol to between 20 and 50 symbols. No studies reported communicators mastering Phases 5 or 6.

Instructional Procedures The format of training varied across the seven studies. In three of the studies, a professional development workshop, with six or more participants, was conducted as the initial instructional component, with individual follow-up training sessions (Ganz et al., 2013; Howlin et al., 2007; Magiati & Howlin, 2003). The remaining four studies provided individual or small group instruction (e.g., less than five people) as the primary method of training (Barnes et al., 2011; Hill et al., 2014; Homlitas et al., 2014; Rosales et al., 2009). The studies were also reviewed for their inclusion of components of the BST model: instruction ($n = 7$; 100%), modeling ($n = 7$; 100%), rehearsal ($n = 6$; 86%), and feedback ($n = 6$; 86%). Barnes et al. (2011) did not include rehearsal and feedback, and all other studies conducted rehearsal and feedback together.

Five of the seven studies provided information on the duration of the training activities. Because four studies included both group instruction and individual training to criterion (which varied across participants), it was necessary to calculate an average time of training for each study. Average training time across participants was calculated (per study) as 21 h (Hill et al., 2014), 16.6 h (Homlitas et al., 2014), 21 h (Howlin et al., 2007), and 9 h (Rosales et al., 2009). The average, for the 27 participants in these four studies, was 17 h of training.

The instructional materials used in these training procedures supported both quality of implementation (i.e., fidelity of use) and quantity of communication opportunities (i.e., number of opportunities). Materials included PECS phase summary handouts ($n = 3$), a checklist of responses ($n = 3$), videos ($n = 2$), portions of the PECS manual ($n = 2$), self-monitoring tasks ($n = 2$), review forms with definitions of behavior ($n = 1$), progress monitoring forms ($n = 1$), and written summaries of individual goals ($n = 1$). Additionally, four studies reported two or more instructional materials (Barnes et al., 2011; Ganz et al., 2013; Howlin et al., 2007; Rosales et al., 2009).

Study Rigor The quality of each study was evaluated using the Scientific Merit Rating Scale (SMRS) developed as part of the National Standards Project (National Autism Center, 2015). This rating scale was created to evaluate the merit of intervention studies for participants with ASD so that conclusions from the results can be interpreted in relation to the strength of the study methods. The SMRS includes a 0 to 5 scale (with 5 being the highest), and scores are assigned for five study elements: (a) research design, (b) measurement of the dependent variable, (c) measurement of the independent variable, (d) participant ascertainment, and (e) generalization and maintenance effects. Each element is individually scored, and a composite score is generated using the following formula: (research design $\times$ 0.30) + (dependent variable $\times$ 0.25) + (participant ascertainment $\times$ 0.20) + (procedural integrity $\times$ 0.15) + (generalization and maintenance $\times$ 0.10) (National Autism Center, 2015).

SMRS scores of 3, 4, and 5 are deemed to have “sufficient scientific rigor” and allow for substantial conclusions about the intervention (National Autism Center, 2015, p. 29). Within the included studies, four met this standard (Barnes et al., 2011; Ganz et al., 2013; Homlitas et al., 2014; Rosales et al., 2009), with Ganz et al. (2013) scoring the highest composite score (4.25). As such, the intervention and results of these studies should be given more weight. Similarly, a SMRS score of 2 provides initial evidence and 1 represents insufficient scientific rigor (National Autism Center, 2015). Studies with scores of 1 or 2 should be interpreted with caution, as there is concern about how likely the results are to occur again and/or the intervention may or may not be beneficial. Within the reviewed studies, Howlin et al. (2007) was scored as providing initial evidence, and Hill et al. (2014) and Magiati and Howlin (2003) were scored as demonstrating insufficient rigor.

For the seven studies included here (see Table 3), scores were typically highest for the measurement of the dependent variable (mean = 3.9) and independent variable (mean = 3.4) and consistently lower for participant ascertainment (mean = 1.9) and provision of information on generalization and

maintenance (mean = 1.9). The average of all scores for the included studies was 3.0, meaning that PECS training provided for EPs can be characterized as having sufficient scientific rigor to support conclusions about the impact of the training.

Description of Outcomes

Quality and Quantity of PECS Opportunities Five studies reported the impact of training on the quality of PECS opportunities provided by the EP as measured by procedural fidelity checklists. Of these five, increases in the percentage of correct steps were reported at or above mastery in four studies. Only Barnes et al. (2011) reported that the quality of EP implementation was still below mastery criterion after the one-on-one training activities. Additionally, three studies reported the impact of training on the quantity of PECS opportunities provided by the EP. All three reported an increase in the quantity of opportunities provided by EPs during intervention (Ganz et al., 2013; Howlin et al., 2007; Magiati & Howlin, 2003).

Maintenance and Generalization Maintenance probes were conducted in three of the seven studies (Homlitas et al., 2014; Howlin et al., 2007; Rosales et al., 2009). In two of these studies, the EP maintained levels of quality above mastery criterion at least 1 month posttraining (Homlitas et al., 2014; Rosales et al., 2009). Conversely, Howlin et al. (2007) reported that the quantity of PECS opportunities decreased after consultation services ended. Four of the seven studies reported generalization measures. Ganz et al. (2013) investigated the impact of a 3-h workshop training followed by an individualized 30- to 45-min coaching session on the quantity and quality of PECS opportunities. One participant received two additional coaching sessions (i.e., booster sessions) when her performance fell below a predetermined threshold. All three EPs increased the number of opportunities during the targeted training opportunity (i.e., an art activity); however, only one EP independently generalized the skill of creating PECS opportunities to an untrained activity (i.e., free play), providing 12 and 1

Table 3 SMRS scores

Study	Research Design	Measurement of Dependent Variable	Measurement of Independent Variable	Participant Ascertainment	Generalization and Maintenance	Calculated SMRS Score
Barnes et al. (2011)	3	5	5	1	0	3.1
Ganz et al. (2013)	5	5	4	3	3	4.3
Hill et al. (2014)	0	1	5	3	0	1.6
Homlitas et al. (2014)	5	5	5	1	5	4.2
Howlin et al. (2007)	5	3	0	2	0	2.7
Magiati and Howlin (2003)	2	3	0	2	0	1.8
Rosales et al. (2009)	3	5	5	1	5	3.6
Mean	3.29	3.86	3.43	1.86	1.86	3.0

opportunities during the two observed generalization sessions, respectively (Ganz et al., 2013).

Additionally, Magiati and Howlin (2003) provided evidence of EPs' usage of PECS across a greater variety of activities. EPs completed questionnaires that suggested an increased quantity of PECS opportunities created throughout the day. For example, it was reported by EPs at the eight participating schools that before training, PECS opportunities were presented most frequently during snack time ($n = 4$) or a single classroom activity ($n = 3$). After PECS training was provided, EPs from six schools reported providing PECS opportunities throughout the day during all classroom activities (Magiati & Howlin, 2003).

Last, Homlitas et al. (2014) and Rosales et al. (2009) reported generalization across settings and people; however, in both studies, an adult confederate (e.g., an adult without disabilities) acted as the communicator during training sessions. Once mastery had been reached with the confederate, the EP progressed to natural environment probes that sampled the use of PECS with an individual with ASD in his or her natural environment (e.g., day program). The EPs in both studies continued to provide high-quality opportunities in these generalization settings, and the approach appears to have been an effective training method. Although this result was promising, and has implications for training, given that the use of PECS with persons without disabilities (as in the training condition) is not the true goal of the intervention, the description of the use of PECS with persons with ASD as evidence of generalization should be interpreted with caution.

Discussion

PECS is a frequently recommended AAC intervention (Barnes et al., 2011; Homlitas et al., 2014); however, much of the research to date has examined PECS that is implemented by a highly trained researcher (Ganz et al., 2013). Although this provides important evidence about PECS, students with ASD will more typically receive educational services from an EP in an educational setting. The EPs in this review had little or no prior PECS experience or training, as well as having a range of experiences in educating individuals with ASD, with the majority of EPs classified as early career (i.e., first 5 years). As such, this review provides detailed information on the impact of PECS training for EPs within educational settings, including an analysis of the instructional procedures used to train the EPs, detailed information on the maintenance and generalization of the use of the targeted PECS behaviors by EPs, and the quality of the published research.

Three major findings from this review merit additional discussion. First, EPs initially increased the quality and/or

quantity of PECS opportunities for Phases 1–4 after training that incorporated BST components. Second, the evidence of skill maintenance and generalization is mixed. Third, although the instructional procedures appear effective, continued work is needed to increase efficiency and assess social validity of these procedures with EPs and other stakeholders. Each finding is discussed in the following sections along with recommendations for future research.

Increasing the Quality and Quantity of PECS Opportunities

In order for persons with ASD to learn new communication skills, they must be provided with high-quality learning opportunities throughout the day (Light & McNaughton, 2015). As in other reviews of communication-partner training (Kent-Walsh et al., 2015), a majority of the studies reviewed here reported either an increase in the quality of PECS opportunities (e.g., at least 80% accuracy) and/or an increase in the quantity of PECS opportunities provided. The 15 EPs who participated in the five studies that reported positive outcomes for the quality measure learned to implement PECs with high levels of fidelity. Due to PECS's highly scripted nature, effective instruction in the PECS protocol can result in high procedural fidelity, even for EPs with limited prior experience. EPs with as little as 4 months' experience working with individuals with ASD and complex communication needs were able to demonstrate increased quality in their delivery of PECS opportunities.

An increase in the quantity of PECS opportunities was also observed for the 68 EPs in the three studies that reported on this information. EPs were successful in delivering these PECS opportunities to communicators with a range of ages (from 2-year-olds to adults). Furthermore, it is of interest to note that the six studies that reported positive outcomes all made use of BST components. Attention to the components of the BST model (i.e., instructions, modeling, rehearsal, and feedback) during instruction for EPs may be associated with initial increases in the quality and quantity of PECS opportunities provided by EPs. The one study included in this review that did not report mastery above 80% accuracy (Barnes et al., 2011) used a "streamlined" training package that deliberately omitted rehearsal and feedback. Although it is not possible to state with certainty that the provision of rehearsal and feedback would have resulted in a more positive outcome, the results of Barnes et al. (2011) provide additional evidence that rehearsal and feedback may play a critical role in training, a finding supported by extant literature (e.g., Hemmeter, Snyder, Kinder, & Artman, 2011).

Finally, although the increases in the quality and quantity of PECS opportunities provided by EPs are of interest, it should be noted that most of the studies only taught implementation of Phases 1–4 of PECS. PECS includes six phases,

which are designed to provide scaffolded instruction in communication, progressing from making simple requests with a single picture to the use of multipicture sentences for a variety of communication functions (Bondy & Frost, 2001). It is in Phases 4, 5, and 6 that communicators are taught to use sentences, answer questions, and comment. Beginning intervention by teaching communicators to request preferred items and activities capitalizes on powerful motivators and supports early success (Charlop-Christy, Carpenter, Le, LeBlanc, & Kellet, 2002). However, there is only limited information on how more sophisticated communication behaviors might best be supported. Beukelman and Mirenda (2013) argue that the primary goal for communication interventions for individuals with complex communication needs should be to develop a full range of communication competencies that allows the communicator to engage in a wide range of social interactions and fully participate in his or her environment. At present, there is no research evaluating the effect of training EPs in those later phases of the PECS protocol (i.e., 5 and 6) that move the communicator beyond requesting desired objects and activities.

Supporting Maintenance and Generalization

Although many studies of AAC intervention provide information on the immediate impact of the intervention, only a small number provide information on the maintenance and generalization of these behaviors (Light & McNaughton, 2015; Schlosser & Lee, 2000). A similar pattern was observed in these studies, with only three of the seven studies providing information on maintenance, and four studies providing data on some aspect of generalization. The studies that reported generalization across people and settings used adult confederates for training to mastery before implementation with individuals with ASD; thus, the generalization probes represented generalization to the socially valid target situation rather than expansion to other aspects of the target repertoire. As mentioned previously, although role-play practice has the potential to be an important training activity, implementation with individuals with ASD is the primary goal, and as such, this result should be interpreted with caution.

Given the wide variety of instructional procedures used in the included studies, it is difficult to link a specific instructional procedure with higher levels of maintenance. However, the two studies in which the EP maintained high levels of quality (i.e., procedural fidelity) both included all four components of the BST model provided in individual and small group training sessions. The one study in which participants did not maintain performance above the mastery criterion (Howlin et al., 2007) also included all four components of the BST model, but training was provided in a large group format. Although Howlin et al. (2007) provided follow-up coaching after the PECS workshop, there were only six half-day visits

across a 5-month period. The limited individualized attention could potentially have influenced the lack of maintained performance. Future research is needed to better understand the impact of training format and individualized practice opportunities with feedback on immediate and long-term outcomes.

The PECS instructional procedure is typically first used to teach the communicator to request a small number of highly preferred objects in a specific setting (Bondy & Frost, 2001). Once these early communication behaviors are established under familiar conditions, the communication partner is directed to support more generalized use of PECS, including the use of PECS to request a wider variety of objects and activities, with additional communication partners, in new communication settings. As noted previously, four studies provided information on generalization, and two provide evidence that the communication partner provided PECS opportunities to untrained activities. Ganz et al. (2013) evaluated the quantity of independent communication opportunities created by the communication partner in contexts that were not explicitly trained. Only one of the three communication partners provided PECS opportunities in untrained contexts, and the number of opportunities decreased over time (Ganz et al., 2013). Conversely, results from EP questionnaires suggest that the number of PECS opportunities created across the day increased as a result of training (Magiati & Howlin, 2003). However, this result should be qualified by extant literature suggesting that EP report does not always match practice, and observational follow-up data are needed to confirm these results (e.g., Hess, Morrier, Heflin, & Ivey, 2008).

Stokes and Baer (1977) argue that generalization is often misunderstood as a passive phenomenon with too great a reliance on “hoping.” However, in recent years, emphasis has been placed on actively programming for generalization, rather than simply hoping for it as a result of training (Schlosser & Lee, 2000). Many of the studies included in this review included all elements of the BST model, which has demonstrated to be effective when teaching adult learners how to conduct functional analyses (Iwata et al., 2000), preference assessments (Lavie & Sturmey, 2002), and discrete-trial instruction (Sarokoff & Sturmey, 2008). Given the behavioral nature of PECS, the use of the BST protocol appears to be an appropriate starting point for developing instructional activities (Sarokoff & Sturmey, 2008). The BST protocol does not necessarily directly address issues of generalization. The trainer might or might not include multiple training exemplars in BST. It is possible that a more comprehensive framework for AAC partner training that explicitly targets generalization may produce better generalization results. For example, Kent-Walsh and McNaughton (2005) recommend that partner training explicitly include steps to promote generalization, including the need to “practice implementing the targeted strategy across a wide range of settings” and to “plan for long-term implementation” (p. 198). Focused attention on generalization

appears to have a positive impact; for example, Stiebel (1999) provided instruction to support generalized use of AAC strategies, which resulted in the use of AAC in untrained contexts.

Providing Effective, Efficient, and Socially Valid Instruction

Clearly BST is effective for teaching EPs to implement PECS with individuals with ASD, and those skills are generally maintained over time. Six of the seven studies included in this review provide evidence of increases in the quality and/or quantity of EPs' immediate implementation of the PECS protocol. Less evidence exists for robust skill generalization. It is also important to consider both the efficiency (Horner et al., 2005) and the social validity (Schlosser, 1999; Wolf, 1978) of the training activities. EPs typically have a limited amount of professional development time each year (Morrier, Hess, & Heflin, 2011). Given the high level of turnover in the field of special education (Cook & Boe, 2007), instruction for EPs not only must be effective but also must be efficient for both the trainer and the EP. Social validity is also an important consideration, as continued use of an intervention is best supported when the learner (in this case, the EP) views both the instructional goal (provision of PECS opportunities) and the instructional activities (PECS training) in a positive manner (Bernstein, 1989).

The instruction reported in these seven studies typically included both group and individual training, and varied between 9 and 21 h (Hill et al., 2014; Rosales et al., 2009; mean = 17 h). The total time required for participants (i.e., EPs) is one consideration; the total time required for the trainer is another. Just as EPs have limited time for training, so, too, do trainers seek efficient methods of supporting effective practice. Approximately 71% ($n = 5$) of the studies provided initial training in a small and/or large group presentation. Of these five studies, four followed up with individualized coaching sessions. The other two included studies, however, conducted all training in individual sessions. There are too few studies at this point to draw firm conclusions as to the most effective and efficient mix of group and individual training, although the inclusion of at least some individualized training, especially during the practice and feedback stage, would appear to be important.

Another possible approach to enhance efficiency is *pyramidal training*, in which an advanced professional first teaches a small group of individuals, who then teach another group of practitioners (Pence, St. Peter, & Giles, 2014). Martocchio and Rosales (2016) described the use of a pyramidal approach to PECS training, with promising results. They found that an initial group of two university students, trained by the researchers, were successful themselves in then teaching PECS to three other university students. This second tier of three university students then in turn taught an

additional three university students for a total of eight university students (i.e., two taught by researchers, six taught by other university students).

With respect to social validity, only limited information was provided in the reviewed studies, including favorable opinions from EPs on the PECS training they received (Magiati & Howlin, 2003); however, this measure was not required for inclusion in the current review. Social validity is a key concern because the goals, treatment, and effects must be considered in order to “provide interventions that are both effective and socially acceptable” (Bernstein, 1989, p. 97). However, a lack of information about social validity is a common area of weakness in communication-partner training research (Schlosser, 1999) and as such represents a significant need for future research.

Summary and Conclusion

PECS provides a highly structured approach to teaching communication skills and has been demonstrated to be successful in supporting individuals with complex communication needs in learning early communication behaviors. The findings reported here are in keeping with other studies of communication-partner training (Kent-Walsh et al., 2015), with the EPs who received training demonstrating an increase in the desired communication-partner behavior (i.e., providing PECS communication opportunities). These changes in EP behavior are all the more impressive because of the rigorous standards for treatment fidelity for the PECS protocol and the challenging classroom conditions in place for some of the EPs who participated in these studies (Boyer & Lee, 2001).

The studies included in this review had an average SMRS score of 3.0 (see Table 3), so the literature on providing training for EPs to deliver PECS opportunities can be characterized as demonstrating sufficient scientific rigor. Future research should address areas of methodological concern, notably providing additional information on participant ascertainment and data on generalization and maintenance of the targeted skills (National Autism Center, 2015). Additionally, interventionists and researchers are encouraged to identify strategies to support EPs in providing PECS opportunities for a wider range of communication behaviors, in both the PECS protocol and beyond. PECS has been demonstrated to be an effective approach in teaching persons with ASD to communicate needs and wants. However, continued work is needed to support all persons in being able to participate in a wide variety of communicative interactions.

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Compliance with Ethical Standards

Conflict of Interest Ashley McCoy declares that she has no conflict of interest. David McNaughton declares he has no conflict of interest.

Ethical Approval This article does not contain any studies with human participants performed by any of the authors.

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