
Jennifer B. Ganz
Texas A&M University

Richard L. Simpson
University of Kansas

Emily M. Lund
Texas A&M University

Abstract: Children and youth with autism spectrum disorders (ASD) and other developmental delays frequently experience deficits in functional communication. Identifying and using suitable communication enhancement and augmentative and alternative communication supports is essential to achievement of positive outcomes for these learners. This article discusses the use of the Picture Exchange Communication System (PECS), a commonly used and utilitarian AAC system for children and youth who lack sufficient functional communication skills. Particular attention is given to practitioners’ use of this promising tool.

The Picture Exchange Communication System (PECS; Frost & Bondy, 1994, 2002) is an icon-based form of augmentative and alternative communication (AAC). While the system is appropriate for use with a variety of individuals with communication deficits and disorders, it has most commonly been used with children with autism spectrum disorders (ASD; Magiati & Howlin, 2003; Tincani, Crozier, & Alazetta, 2006). PECS was developed in 1986 by Bondy and Frost and is currently marketed and hosted by Pyramid Educational Consultants, Inc. Since its development, PECS has received considerable attention in peer-reviewed literature and has generally been shown to be relatively useful promising practice in promoting functional communication in individuals with moderate to severe disabilities (Flippin, Reszak, & Watson, 2010).

Description of PECS Materials

One attractive feature of PECS is that it requires relatively few materials, all of which can be created or obtained at relatively low cost (Ogletree, Oren, & Fischer, 2007). As the name implies, a key feature of PECS is the picture cards, which contain pictures, also referred to as icons, that represent objects (e.g., ball, computer, cookie), people (e.g., Mom, Dad), or activities (e.g., hug, draw). The icons can be made using a computer graphics program or actual photographs and should be fastened with Velcro® on the back. This will allow the icons to be stored on a Velcro® communication picture board or book, from which the child will be able to select the icons of appropriate or desired items, people, or activities. Additionally, PECS materials include several sentence stems (e.g., “I HEAR,” “I SEE,” “I WANT”), which can be combined with icons to form phrases and sentences in later stages of training and should also be affixed to the communication picture board or book with Velcro®.

PECS’ format has several advantages (Ogletree et. al, 2007; Yoder & Stone, 2006). Because PECS requires few materials, the system can easily travel with the child to multiple locations, thus increasing the potential for training and generalization across multiple settings. Also, icons can easily be created to correspond to items in the user’s environment, allowing for specific tailoring to his or
her settings or preferences. Finally, the “low-tech” nature of the PECS materials eliminates the issues of technological failure and greatly reduces the probability and cost of the materials being damaged or lost.

Credentials and Training for PECS Trainers

Official PECS training workshops are offered by Pyramid Educational Consultants, Inc. (http://www.pecsusa.com/training.php), including basic and advanced levels. Basic training is designed for individuals seeking certification as a “PECS Certified Implementer,” allowing them to implement the PECS intervention with an assured level of competency. Within two years of attending a basic PECS workshop, the prospective implementer must submit evidence of competency in the areas of: (a) implementation of PECS in each of the six phases, (b) error correction, (c) implementation of PECS during functional activities, (d) writing PECS instructional lessons for clients, (e) data collection within the phases of PECS, and (f) writing summaries of PECS implementation. Practitioners must also pass a written exam covering accurate PECS practice. After passing the exam and demonstrating competency in all six areas, individuals are granted certification, renewable every three years.

Advanced PECS implementers may choose to pursue PECS supervisor training through Pyramid Educational Consultants, Inc. (http://www.pecsusa.com/training.php). According to the company, this training is reserved for experienced implementers who have not only shown knowledge and skills in implementing PECS properly in all six phases but have also demonstrated the ability to critique PECS instructors in a positive and constructive manner. Individuals who qualify as PECS supervisors may not offer PECS training workshops or other formal training but may advise and critique co-workers who have undergone basic PECS implementation training on best implementation practices for PECS and may offer basic information on PECS to other professionals.

Suitability for PECS

PECS is designed for people who lack an effective system of functional communication (Frost & Bondy, 2002). It is typically not needed or used by individuals who have high verbal functioning, such as those with Asperger syndrome or high functioning autism (Simpson & Myles, 2011). While people with higher functioning variants of ASD, such as Asperger syndrome, have communication and language difficulties, such as understanding metaphors or figures of speech, or have difficulties mastering the social aspects of communication, their communication deficits are usually not severe enough to require PECS or other AAC systems and are most effectively addressed through other types of intervention (Wetherby & Prizant, 2005).

Assessing suitability. Pyramid Educational Consultants, Inc. does not publish an official measure to assess suitability for PECS but broadly states that the system may be useful for individuals who (a) lack a method of functional communication that allows them to adequately express their needs and wants, (b) have trouble making their communication understood by others, (c) have a functional communication system that is not adequate in its ability to convey needs and wants, or (d) lack a communication system that allows spontaneous expressive communication across a variety of settings (http://www.pecsusa.com). It is clear that relatively little is known about student characteristics that make them the best candidates for PECS. However, a recent review of PECS methodology and outcomes by Flippin and colleagues (2010) suggested that children who have relatively poor joint attention (e.g., have difficulty sharing interest in an object with another person) and relatively strong interest and tendencies to search out and explore a variety of objects in their environment but relatively limited motor imitation skills have the best outcomes relative to PECS use.

Additionally, existing measures that assess functional communication may be useful when determining an individual’s suitability for PECS. These supplemental measures can either be part of a formal, structured evaluation or informal assessments, such as parent- or proxy-report checklists. Informal evaluation measures may include the Assessment of Social and Communication Skills for Children with Autism (Quill, Bracken, & Fair, 2000) or Verbal Behavior Milestones Assessment and Placement Program (VB–MAPP; Sundberg, 2008). Examples
of more formal, complex assessment include the *Test of Early Language Development* (Hresko, Reid, & Hammill, 1999) and the *Brigance Diagnostic Inventory of Early Development* (Brigance, 2004). The primary purpose of these measures in relation to PECS is to determine if the child in question would benefit from an AAC system to improve functional communication and should be interpreted with professional judgment, combining assessment results with observation (Flippin et al., 2010; Ogletree, 2008; Ogletree et al., 2007; Yoder & Stone, 2006).

As the name implies, PECS is a visual form of AAC. The visual nature of PECS may be beneficial when working with children with ASD, as there is some evidence that people on the autism spectrum may be highly visual learners (Schopler, Mesibov & Hearsey, 1995). Accordingly, visually-based AAC systems are often seen as the most effective and preferred choice when working with individuals with ASD (Mirenda, 2001; National Research Council, 2001). PECS symbols are both concrete and static in nature, appealing to the common preference of individuals with ASD for consistent, explicit objects and ideas (Heflin & Alaimo, 2007; Ogletree, 2008). Most icons have a one-to-one correspondence with an object, person, or activity, thus reducing confusion common to many forms of communication wherein abstract interpretations and variable meanings exist. Furthermore, the icons themselves are consistent in appearance and meaning, further reducing linguistic ambiguity and allowing for recognition instead of recall (Heflin & Alaimo).

**Considerations regarding multiple disabilities.** While the visual nature of PECS presents several advantages relative to use with individuals with ASD, the visual focus of PECS may make it a poor choice for people with both ASD and blindness or severe low vision, unless modifications are made (Lund & Troha, 2008). PECS has been used effectively with a blind clinician through the addition of Braille tags to the picture cards (Charlop, Malmberg, & Bergquist, 2008). Of course such a modification with a blind or low vision PECS-user would require that the user read and comprehend Braille.

Lund and Troha (2008) investigated the use of PECS with three adolescents with both autism and severe visual impairment or blindness. Tactile symbols were used as an accommodation, and verbal prompts, which are not typically used in PECS training, were applied if the communication partner deemed them necessary. All three participants showed varying degrees of increased functional communication with PECS over the course of the intervention. Only one of the participants was able to show proficiency—defined as correct independent response rate of 80% or higher in two separate trials—at each of the first three stages of PECS. Lund and Troha speculated that this may be due to the time-limited nature of the study—each participant received only 30 sessions of PECS—and noted that the participants’ rates of improvement were similar to those seen in children without co-occurring visual impairment. It appears the use of tactile symbols may be an effective way to modify PECS for use by those with co-occurring ASD and severe visual impairments.

PECS also requires some degree of proficient motor functioning (Bondy & Frost, 1994; Frost & Bondy, 1994). The user must be able to pick up, carry, and hand the icon cards as needed. In later stages of training, the user must be able to align icons and sentence stems closely enough to demonstrate their association (e.g., show that the “I SEE” sentence string and the “ball” icon are connected). If necessary, modifications, such as creating larger or thicker icons and sentence stems, can be made to increase the ease of use for children with limited fine and gross motor function due to physical impairments or muscle weakness (Bondy & Frost). PECS may be a viable alternative for individuals who lack the fine motor coordination necessary for sign language or typing-based AAC systems (Ogletree & Oren, 2006).

The highly visual nature of PECS also makes it good choice for individuals with ASD and co-occurring hearing impairment or Deafness (Tincani, 2004). Furthermore, PECS attempts to model natural language development through the use of icons and thus does not assume or require the capacity for expressive spoken language (Bondy & Frost, 2001). Additionally, PECS can be used in conjunction with American Sign Language or another signing system or spoken language, depending on the needs, abilities, and preferences of individuals.
the user and his or her support system (Tincani).

Considerations for English Language Learners. Relatively little research has been conducted regarding special education and AAC for children who are also English Language Learners (ELL; Simpson & Ganz, in press). However, current recommendations for the general population of ELL students hold that education should involve both English and the child’s first or familial language, if possible, with a preferred emphasis on the language spoken at home (Donovan & Cross, 2002).

PECS may be a particularly useful AAC system to use with this population, as the visual nature of the icons transcends language barriers (Simpson & Ganz, in press). Thus, a child from a Spanish-language home who has been trained in PECS could use the same set of icons with his or her English-speaking teacher at school and with his or her parents at home. Words and phrases may be translated into both languages, perhaps allowing the child to use one set at home and another set at school. If verbal prompts are used, the prompts could be given in both languages until the user is able to respond appropriately to prompts in both languages. Alternately, the parents or teacher may decide to pursue training in only one language for the sake of simplicity (Simpson & Ganz). Given both the lack of literature on this topic and the highly personal nature of linguistic identity, the decision of what language or languages to use for verbal prompts or icons should be mutually decided by the parents and trainers prior to the start of PECS training.

Use of PECS with adolescents. A vast majority of the existent studies of PECS have focused on young children, as they are more likely to lack an established AAC system and be receiving intensive intervention services (Lancioni et al., 2007). However, older children and adolescents who lack adequate functional communication skills, whether verbal or with another form of ACC, may still benefit from PECS training (Simpson & Ganz, in press). Functional communication is vital in increasing an individual’s ability to live independently, and a lack of functional communication skills may increase the rate of challenging behaviors, thus impacting the individual’s ability to gain and maintain employment and participate in other independent living tasks (Koegel, Koegel, Shoshan, & McNerney, 1999; Prizant, Wetherby, & Rydell, 2000). Thus, PECS would have high social validity if it could increase functional communication in a way that decreased problem behaviors and increased capacity for independent living. The handful of studies (Charlop-Christy, Carpenter, Le, LeBlanc, & Kellet, 2002; Ganz, Sigafoos, Simpson, & Cook, 2008; Lund & Troha, 2008; Tincani et al., 2006) that have examined the use of PECS in older children and adolescents have shown promising results, although two of these studies (Ganz, Sigafoos, et al., 2008; Lund & Troha, 2008) made substantial modification to the standard PECS training procedures. Further research is necessary in order to better understand the utility and limitations of PECS in this population.

Theoretical Grounding of PECS and Implications for Practice

PECS utilizes a behavioral training system, based on the theories of B. F. Skinner and colleagues (e.g., Skinner, 1957) and of applied behavioral analysis (Baer, Wolf & Risley, 1968; Cooper, Heron, & Heward, 2007). Unlike some other communication instructional programs for people with ASD, however, PECS relies primarily on direct reinforcement, similar to the direct reinforcement that occurs during typical language development (Frost & Bondy, 1994). For example, if a child gives his or her communicative partner a “ball” icon, he or she is then given access to a ball, thus strengthening the association between the icon and the corresponding, reinforcing object. This differs from other communication training techniques where the user may be rewarded with a third, unrelated item (e.g., the therapist says, “touch ball,” and the student touches the “ball” picture and is given a cookie as a reward; DeBoer, 2007).

The use of direct reinforcement leads to clearer associations between icons and objects or actions and mimics the naturally occurring reinforcement of verbal speech in typically-developing children (Bondy & Frost, 2001). For this reason, it is important that a child’s preferred reinforcers, such as certain types of toys or specific foods, are identified prior to the start of PECS training and that corre-
sponding icons are created. Reinforcers can be identified through simply observing the user in his or her environment (Bondy & Frost) or through systematic recording and comparison of the user’s responses to several potential reinforcers (Frost & Bondy, 1994).

**Phases of PECS Training**

Bondy and Frost (2001) conceptualized PECS training as occurring in six phases, with the opportunity for additional training. Each phase becomes increasingly complex and demands greater expressive and/or receptive communication skills from the user. For this reason, it is recommended that the phases be completed in order, and that the next phase should be tackled only when the user achieves an adequate ratio of correct responses during two or more separate trials or days. This ratio can be set by the treatment team, although 80% minimum accuracy rates are commonly used in the literature (e.g., Lund & Troha, 2008; Bondy & Frost, 1994). The six phases of PECS training are generally designed to correspond to typical communication development. The descriptions below are provided for informational purposes and are not intended to replace formal PECS training.

**Phase 1: Initial Communication Training**

The first phase of PECS teaches the user that icons can be used as communication tools (Frost & Bondy, 1994, 2002). In this phase, the user is shown a preferred reinforcer by a communication partner; most students instinctively try to reach for the reinforcer. When this happens, a second instructor, the prompter, places the appropriate icon in the user’s hand and guides the learner’s hand to the communication partner’s hand. When the user drops the icon into the communicative partner’s open hand, the user should immediately be allowed to have access to the reinforcer for a brief period of time. If verbal communication is also being modeled, the communicative partner can name the reinforcer as the user releases the icon into his or her hand.

In order to prevent satiation, the reinforcer should be promptly and gently taken away from the user after a few seconds (Frost & Bondy, 1994, 2002). The process should then be repeated until the user consistently and independently hands the communication partner the icon in order to receive access to the reinforcer, as determined by the pre-set correct response ratio. The prompter’s guidance and assistance in picking up the icon and reaching towards the communication should fade over trials, and the communication partner’s open handed prompt may change to a close-handed one as the user demonstrates an understanding of the association between giving the communication partner the icon and access to the reinforcer. This process should be repeated with other icons, in various settings, and with various communicative partners in order to build the user’s vocabulary in anticipation for the item and icon discrimination training that occurs in phase three and to promote skill generalization.

**Phase 2: Retrieval and Delivery of Icons**

In phase two, the child is taught to independently retrieve icons and deliver them to a communication partner who is not immediately available (Frost & Bondy, 1994, 2002). For example, in this stage, a child may be taught to retrieve an icon placed a few feet away from him or her and then deliver it to a communication partner in an adjacent room in order to gain access to the desired item, as represented by the icon. Frost and Bondy (2002) hold that this type of training encourages spontaneous communication by demonstrating to the child that communication that requires effort on the part of the child can still lead to the desired results. Additionally, phase two may be used to teach a child the importance of persistence when communicating wants or needs. For example, the learner may have to learn to give an item to a communication partner who initially has his or her back turned. These skills can be conceptualized as analogous to a speaking child learning that he or she must increase the volume of his or her voice when trying to speak with someone who is a greater distance away (Frost & Bondy, 2002). The amount of effort and persistence required of the learner should be gradually increased throughout phase two. This is also the phase in which a child should start learn-
Phase 3: Icon and Item Discrimination

In phase three, the child learns that presenting his or her communication partner with different icons will result in different consequences and thus learns to discriminate between icons and to select the icon for a desired object from a group of other icon choices (Frost & Bondy, 1994, 2002). This phase begins with presenting the child with two icons based on the results of the pre-treatment preference assessment. One icon should represent a highly desired item while the other icon should represent a much less desired item. If the child picks the less desired icon, he or she should be given that item by the communication partner, and, when the child shows disinterest in it, a follow-up teaching procedure that demonstrates or prompts choosing the icon for the desired item should occur. If the child does indeed initially present his or her communication partner with the icon of the desired item, this should be reinforced with both access to said item and social reinforcement of the selection, such as verbal praise (Bondy & Frost, 2001).

After the child has mastered discrimination between the more desired and the less desired item, he or she should then be given a choice between two icons representing items of equally high desirability that are both in the child’s immediate environment (Frost & Bondy, 1994, 2002). After he or she exchanges an icon, the communication partner should prompt the child to “take it,” being sure to use a pronoun instead of naming the item. If the child attempts to access the item corresponding with the icon he or she selected, he or she should then be granted brief access to the item. If the child attempts to access another item, however, the communication partner should block him or her from obtaining access to any item except the one represented by the previously selected icon, then use an error correction procedure. Once the child has mastered this level of discrimination with two icons, the number of icons and items presented should be increased, until the child can discriminate between five or six icons of appropriately equivalent desirability and even look through multiple pages of the communication book in order to locate a particular icon (Bondy & Frost, 2001).

Phase 4: Phrases

Phase four begins the next major phase of PECS training, in which the child is taught to combine sentence strips with icons in order to form requests (e.g., “I WANT” sentence strip plus the icon for “ball” in order to request the ball; Frost & Bondy, 1994, 2002). Because they are naturally reinforcing, requests are taught first, with the child learning to combine the “I WANT” sentence strip with an icon for the desired item. The child should be taught to give the “sentence” to the communication partner, who should then respond by verbalizing the sentence—for example, saying “I WANT the ball” when the child exchanges a communication board with the “I WANT” sentence strip and ball icon—and giving the child access to the requested item (Bondy & Frost, 2001). Learning to communicate requests via sentence strips may help compensate for the non-verbal deficits of some children with ASD, such as lacking the tendency to point to or reach for a desired item (Bondy & Frost).

Phase 5: Answering Questions

In phase five, the child learns to answer verbal questions posed by the communication partner through the use of sentence strips and icons (Bondy & Frost, 2001; Frost & Bondy, 1994, 2002). The communication partner helps the child learn the association between specific questions and appropriate responses by asking the question (e.g., “What do you want?”) and then physically prompting the child to use the appropriate sentence strip (e.g., “I WANT”) in response and giving the child access to the desired icon after her or she exchanges the responding phrase. Eventually, the child should independently access the sentence strip and respond with no other prompting than the question itself. As with the request training in phase four, this process is naturally reinforcing and thus should be learned relatively quickly (Bondy & Frost, 2001).
Phase 6: Commenting

In the final formal phase of PECS training the child is taught to use sentence strips such as “I SEE” and “I HEAR” to comment on his or her environment (Bondy & Frost, 2001). Unlike the other stages of PECS, the reinforcement in this phase is indirect—the child receives only social reinforcement for his or her correct responses, not actual access to a desired item itself. This allows comments to be clearly distinguished from commands, as taught in phase four, and also makes reinforcing appropriate responses more difficult than in previous stages (Bondy & Frost). Bondy and Frost emphasize the importance of having the child spontaneously comment in situations where a typically developing child would also comment, such as situations where there is something unusual in the child’s environment or when he or she is asked a question like “What do you see,” “What do you hear,” or “What do you have?”

Additional Uses for PECS Training

Once the six formal phases of PECS are mastered, the child can be taught additional icon vocabulary and words forms, such as learning to understand and apply adjectives (Frost & Bondy, 1994, 2002). For example, a child may learn to identify and discriminate between different colors of candy. He or she can then use PECS adjective icons to ask specifically for a preferred color of candy (e.g., “I WANT” sentence strip + “blue” icon + “candy” icon) or to comment on his or her environment (“I SEE” sentence strip + “big” icon + “dog” icon) in greater detail. Similarly, the child can be taught to use icons to express other common needs and wants, such as the need to “take a break” from a frustrating or over-stimulating activity, thereby increasing the utility of his or her functional communication. Icons for situations, objects, and people specific or new to a user’s learning environment can be continually created and taught as needed in order to provide the fullest possible range of functional communication.

Case Example

Assessment. Alex was a five year-old girl diagnosed with autism. She had complex communication needs and did not speak; previous attempts had been made to teach her sign language, but she struggled with adequately imitating many of the signs used by her parents and teacher, Mr. Gutierrez. Following the speech therapist, Ms. Lorrie’s, formal assessment of Alex’s functional communication skills, it was concluded that she would be a good candidate for PECS. A preference assessment conducted prior to the implementation of training revealed that hats and toy cars were preferred objects for Alex while blocks and picture books were less desired objects.

Phase One. In phase one, Mr. Gutierrez put a hat on his head, an icon of a hat was placed on the table in front of Alex, and when Alex reached to take the hat off of Mr. Gutierrez’s head, she was prompted by Ms. Lorrie, to give the icon to the teacher. Giving Mr. Gutierrez the hat icon earned Alex access to a favorite hat for 10 seconds before the hat was gently taken away, and a new trial began. Several other icons, with preferred items pictured, were presented, one at a time, throughout phase one instruction. After seven prompted trials Alex began to independently pick up and exchange the icons. When she achieved 90% accuracy over ten trials in one day, for requesting 25 different items in three settings (i.e., classroom, cafeteria, home), a decision was made to move to phase two.

Phase Two. In phase two, Alex was required to go to her communication board—which only contained the hat icon at this time—retrieve it and bring it to Ms. Lorrie, who was sitting on the other side of the room with her back turned. After Alex achieved 90% accuracy on a set of 10 trials that followed 20 prompted trials Ms. Lorrie moved to an adjacent room, and Alex was required to carry the icon to the other room and exchange the icon in order to gain another 10 seconds of access to her favored hat. Additional school personnel were added as communicative partners and more icons were added to Alex’s repertoire in this phase. She achieved perfect accuracy over 10 trials thus completing phase two.

Phase Three. In phase three, Alex was presented with her communication book, which now included both the icon for hat and an icon for blocks. After Alex handed the blocks icon to Mr. Gutierrez, Alex was handed the blocks and began to cry. He then guided Alex’s hand to the hat icon and prompted her to
give it to him, an act that was reinforced by patting Alex’s shoulder, her preferred form of social reinforcement. Over subsequent trials, Alex began to consistently select and present only the icon that corresponded with the preferred item, granting her 10 seconds of access for each exchange. Once Alex achieved 90% accuracy over ten trials, the non-preferred icons were replaced with the preferred item icons, and Alex was only given access to the item that corresponded with the icon she presented. After she met the pre-established benchmark of 90% accuracy in reaching for the correct item, more icons were presented in an array for discrimination. At the end of phase three training Alex could reliably discriminate between and select specific icons when presented with up to seven icons distributed over three pages of communication book.

**Phases Four and Five.** After Alex met the 90% accuracy criterion for the 10-item discrimination task in phase three, the training team moved on phase four. Alex was prompted to combine the sentence strip “I WANT” with an icon for a preferred object (e.g., hat, cookie, cars) on her communication book. When she presented the sentence strip and icon in the correct order to her communication partner, the communication partner read the sentence “I WANT [icon]” and then gave Alex brief access to that the object represented by the icon. Alex mastered this stage quickly, suggesting that it was highly naturally reinforcing for her. The treatment team observed similarly good success in stage five, when Alex quickly associated the question “What do you want?” as a prompt to present her sentence strip with a phrase asking for a desired object to her communication partner.

**Phase Six.** Phase six was initially more difficult. When Alex correctly used the “I SEE” sentence strip with the cars icon and received only verbal praise instead of access to the cars, she began to cry. The use of the “I SEE” sentence strip in connection with icons of other, less reinforcing items in the immediate environment was repeated several times and was both rewarded with verbal praise, pats on the arm, and prompted with the question, “What do you see?” These were alternated with “What do you want” trials to maintain high rates of reinforcement. After 20 “What do you see” trials, Alex no longer responded poorly to only receiving verbal praise for correctly commenting, and the use of the prompting question and “I SEE” sentence strip was then modeled in situations where unusual or unexpected objects were present. Alex began to comment spontaneously on the presence of some of the unusual objects and received verbal affirmation from Mr. Gutierrez for doing so. After commenting on the “I SEE” strip was mastered with 90% correct responding, similar training was done with other sentence strips, including “I HEAR” and “I HAVE.” The use of these strips was combined with a corresponding prompting question (e.g., “What do you hear?” or “What do you have?”). Mastery of these sentence strips generally occurred at a faster rate than seen with the initial commenting training, indicating there was some degree of generalization of the broad idea and purpose of commenting.

**Further Use.** Following the completion of phase six of PECS training, Alex has continued to increase her vocabulary of icons and sentence strips and thus her functional communication skills across all areas of her life. Alex experiences problems with over-stimulation when in noisy or crowded environments; since learning to request a “break” by using the appropriate PECS icons, her rate of challenging behavior due to over-stimulation has markedly decreased. This suggests that PECS provided Alex with a more socially acceptable way to communicate her need for temporary escape in certain situations and demonstrates a potential secondary benefit of increasing functional communication via PECS.

**Data Tracking**

As mentioned previously, all decisions regarding progression through the PECS should be data-based (Bondy & Frost, 2001; Frost & Bondy, 1994, 2002). Therefore, it is vital that PECS implementers maintain clear and accurate records of independent responses made by the user. Additionally, it may be beneficial to track data on other outcomes or co-occurring phenomena. For instance, a frequently occurring question regarding PECS is whether the training increases verbal as well as icon-based communication. While early reports by
the creators of PECS (Bondy & Frost, 1994) suggested that PECS training frequently lead to increased speech, more recent evidence on the topic is mixed (Flippin et al., 2010; Ganz, Simpson, & Corbin-Newsome, 2008). Increased verbal communication does seem to occur in some users (Ganz & Simpson, 2004) but this phenomenon does not appear to be either universal or consistent in nature (Ganz, Simpson, et al., 2008). Nevertheless, it may prove helpful to track verbal communication that occurs during or after PECS training in individual users in order to better assess the entirety of the impact of PECS training on functional communication skills and speech.

Similarly, it may be useful to track the incidence of challenging behavior before, during, and following PECS training, as increased functional communication may result in a decrease in challenging or problem behaviors (Charlop-Christy et al., 2002). Finally, it may also be helpful to monitor the degree to which functional communication with PECS generalizes across contexts (Ganz, Sigafoos, et al., 2008). In addition to providing valuable information on individual users, collecting PECS-related outcome data on challenging behavior, verbal expression, and generalization may help address several standing research questions regarding the broader utility of PECS.

Summary and Discussion

PECS is a form of AAC designed to increase functional communication among individuals with ASD and other developmental disabilities that have significant communication deficits (Frost & Bondy, 1994, 2002). It is a visually-based AAC system (Mirenda, 2001) and employs direct reinforcement of expressive and receptive communication and other behavioral principles. Users are trained to communicate via icons and sentence strips and PECS uses low-cost materials that are relatively simple to create (Frost & Bondy, 1994, 2002). PECS training occurs in a structured sequence designed to parallel the phases of typical communication and language development. Over the course of training, users are taught to (a) associate icons with their representative items; (b) give an icon to a communicative partner in order to gain access to a desired item; (c) seek out the appropriate icon and travel to a communicative partner to achieve the item; (d) discriminate between multiple icons in order to obtain a preferred item; (e) use phrases to express wants and describe the environment; (f) answer questions and respond to commands; and (g) learn and use descriptors to discriminate between similar items.

**Areas Requiring Further Clarification and Investigation**

In general, PECS has been shown to be effective at increasing functional communication in children with ASD and related disorders (e.g., Flippin et al., 2010; Ganz, 2007). However, relatively little is known about its efficacy in older children, adolescents, and adults. Additionally, more research needs to be conducted regarding best practices for using PECS with children who have other disabilities or functional impairments in addition to ASD and children who are non-English language learners or come from otherwise linguistically diverse backgrounds. Future research should examine the effects of modifying the PECS materials for individuals with disabilities and the relative effectiveness of conducting PECS training in English, the user’s familial language, or both languages. Finally identifying the characteristics of students that make them the best candidates for positive outcomes for PECS intervention is essential. Such research could help guide the creation of best practices for working with individuals who require PECS or another form of augmentative or alternative communication.

Additionally, future research should examine the effects of PECS training on secondary outcomes, including verbal expression, challenging behavior, and academics. By better understanding the broader effects of increasing functional communication through PECS, we can better detect situations where the intervention may result in important, socially valid secondary gains. Similarly, additional data on the generalization of functional communication across multiple settings could aid in our understanding of when and how PECS can be used in an individual’s daily life and in what situations applying PECS becomes difficult.
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