

PECS Related Publications

Please note: Some of the links listed below may be inactive. This is the result of other webmasters changing their websites. Unfortunately, we have no control over this, but we will do our best to monitor the links listed below.

1. **Adkins, T. & Axelrod, S. (2002). Topography- versus selection-based responding: Comparison of mand acquisition in each modality. *The Behavior Analyst Today*, 2, 259-266.**

Abstract: This study examined the acquisition of a mand repertoire by one child with pervasive developmental disorder and ADHD. The subject was taught to request preferred items using American Sign Language (a topography based response form) and the Picture Exchange Communication System (a selection-based form). There were four types of sessions: (1) training session for PECS, (2) training session for sign language, (3) test for generalization of the PECS words, and (4) test for generalization for the sign words. The number of trials to meet criterion and the occurrence of spontaneous emissions of the taught words was recorded. Also, the same word was taught for five days in both the PECS and the sign session and the results were recorded. It was found that the selection-based verbal response technique (PECS) was more effective in all areas. This finding contradicts the results of previous studies, suggesting that further research is needed. (<http://www.behavior-analyst-online.org>)

2. **Almeida, M., Piza, M., & LaMonica, D. (2005). Adaptation of the picture exchange communication system in a school context (original title: *Adaptações do sistema de comunicação por troca de figuras no contexto escolar*). *Pró-Fono Revista de Atualização Científica, Barueri (SP)*, 17. 233-240.**

Abstract: Background: alternative communication. Aim: to evaluate the efficacy of the adapted PECS and Picture Communication Symbols (PCS) in the communication of a child with cerebral palsy. Method: the participant of this study was a 9 year and 10 months old girl, with athetoid quadriplegia. All stages of the adapted Pecs were applied (Walter, 2000), using the PCS pictures (Johnson, 1998), associated with the functional curriculum proposed by LeBlanc (1991). An experimental AB Design was used in order to test the procedures. Results: the subject was able to pass through all of the adapted Pecs phases and to use her communication board in school activities. Conclusion: the adapted Pecs proved to be effective in improving the subject's communication abilities.

3. **Anderson, A, Moore, D & Bourne, T. (2007). Functional Communication and Other Concomitant Behavior Change Following PECS Training: A Case Study. *Behaviour Change*, 24, 1–8.**

Abstract: The Picture Exchange Communication System (PECS) is widely used to teach children with language delays, including those with autism, functional language. A feature of PECS is that it incorporates principles deemed by some to be pivotal, leading to broader behaviour change. In this study, a 6-year-old child with autism was taught functional language using PECS. Along with measures of language gains, concomitant changes in nontargeted behaviours (play and TV viewing) following PECS training were observed. Results show increases in manding, initiations and cumulative word counts, as well as positive changes in the nontargeted behaviours.

4. **Angermeier, A., Schlosser, R., Luiselli, J., Harrington, C., & Carter, B., (2008). Effects of iconicity on requesting with the Picture Exchange**

Communication System in children with autism spectrum disorder, *Research in Autism Spectrum Disorders*, 2, 430–446.

Abstract: Research on graphic symbol learning suggests that symbols with a greater visual resemblance to their referents (greater iconicity) are more easily learned. The iconicity hypothesis has not yet been explored within the intervention protocol of the Picture Exchange Communication System (PECS). Within the PECS protocol, participants do not point to a symbol but exchange the symbol for an object. The purpose of this study was to examine whether children learn to request more readily with PECS when the symbols involved are highly iconic versus symbols that are low in iconicity. An adapted alternating treatments design combined with a multiple baseline design across subjects was used to evaluate the effectiveness and efficiency of symbol learning under two conditions: high iconicity and low iconicity. Four students with autism or pervasive developmental disorders between the ages of six and nine years participated. Results indicated that students learned to request desired objects under both conditions, lending further support for the effectiveness of PECS. There was little to no difference, however, in the effectiveness and efficiency of requesting between the two conditions during Phases I and II of PECS training. Thus learners do not benefit from symbols that bear more resemblance with their referents during the first two phases of PECS instruction.

5. Bock, S. J., Stoner, J. B., Beck, A. R., Hanley, L., & Prochnow, J. (2005). Increasing functional communication in non-speaking preschool children: Comparison of PECS and VOCA. *Education and Training in Developmental Disabilities*, 40(3), 264-278.

Abstract: For individuals who have complex communication needs and for the interventionists who work with them, the collection of empirically derived data that support the use of an intervention approach is critical. The purposes of this study were to continue building an empirically derived base of support for, and to compare the relative effectiveness of two communication intervention strategies (i.e., PECS and the use of VOCA) with preschool children who have complex communication needs. Specific research questions were (a) Which communication strategy, PECS or VOCA, results in a more rapid rate of acquisition of requesting skills for preschool children?, and (b) To what extent do communication behaviors utilizing PECS and VOCA generalize from a pull-out setting to the classroom setting? Results are discussed and clinical implications given.

6. Bondy, A. (2001). PECS: Potential benefits and risks. *The Behavior Analyst Today*, 2, 127–132.

Abstract: The Picture Exchange Communication System (PECS) is an augmentative/alternative communication strategy for those who display little or no speech. The rationale for PECS and its training sequence is described. Each phase of training is associated with specific behavior analytic teaching strategies. Skinner's analysis of Verbal Behavior forms the basis for teaching particular skills at specific points in the training sequence and also provide guidelines for how best to design the teaching strategies. Common problems and potential solutions are offered for various levels of training. The relationship between PECS and the co-development of speech, as well as its impact upon other behaviors (e.g., behavior management concerns, social orientation, etc.) is briefly reviewed. (<http://www.behavior-analyst-online.org>)

7. Bondy, A. S., & Frost, L. A. (1993). Mands across the water: A report on the application of the picture exchange communication system in Peru. *The Behavior Analyst*, 16, 123–128.

Abstract: This report describes the introduction of the Picture-Exchange Communication System (PECS) to the Ann Sullivan Center, a program for developmentally disabled children and adults in Lima, Peru. PECS was developed in the Delaware Autistic Program, a public school program in the United States with a strong behavior-analytic orientation for children with autism. We will briefly describe PECS, its advantages with people with language disabilities, and our efforts to work with the staff of the Ann Sullivan Center to implement the system. (<http://www.abainternational.org>)

8. Bondy, A., & Frost, L. (1994). The picture exchange communication system. *Focus on Autistic Behavior*, 9, 1–19.

Abstract: A variety of strategies have been used to help children with autism acquire functional communication skills. The Picture Exchange Communication System (PECS) is a unique communication training program that was developed as a means of circumventing some shortcomings associated with these strategies. A description of the steps within PECS is provided. Long-term group data have indicated that a large proportion of children started on PECS as preschoolers acquire speech. Individual and group data supporting the use of PECS are provided. (<http://www.proedinc.com>)

9. Bondy, A. & Frost, L. (1998). The picture exchange communication system. *Seminars in Speech and Language*, 19, 373–389.

Abstract: The Picture Exchange Communication System (PECS) was developed as a means to teach children with autism and related developmental disabilities a rapidly acquired, self-initiating, functional communication system. Its theoretical roots combine principles from applied behavior analysis and guidelines established within the field of alternative and augmentative communication. This approach has several potential advantages relative to imitation-based strategies (both vocal and gestural) and symbol selection strategies. The system begins with the exchange of simple icons but rapidly builds “sentence” structure. The system also emphasizes developing the request function prior to developing responding to simple questions and commenting. The development of requesting with a sentence structure also permits the rapid development of attributes more traditionally taught within a receptive mode. The relationship between the introduction of PECS and various other behavioral issues (i.e., social approach and behavior management) as well as its relationship to the co-development of speech are reviewed.

(<http://www.ovid.com/site/catalog/Journal/1176.jsp?top=2&mid=3&bottom=7&subsection=12>)

10. Bondy, A. & Frost, L. (2001). The Picture Exchange Communication System. *Behavior Modification*, 25, 725-744.

Abstract: The Picture Exchange Communication System (PECS) is an alternative/augmentative communication system that was developed to teach functional communication to children with limited speech. The approach is unique in that it teaches children to initiate communicative interactions within a social framework. This article describes the advantages to implementing PECS over traditional approaches. The PECS training protocol is described wherein children are taught to exchange a single picture for a desired item and eventually to construct picture-based sentences and use a variety of attributes in their requests. The relationship of PECS’s implementation to the development of speech in previously non-vocal students is reviewed.

(<http://www.sagepub.com>)

11. Bondy, A. & Frost, L. (2003). Communication strategies for visual learners. In O.I. Lovaas (Ed.). *Teaching Individuals with Developmental*

Disabilities: Basic Intervention Techniques (pp. 291-303). Austin, TX: Pro-Ed. [Book chapter].

12. Bondy, A., Tincani, M. & Frost, L. (2004). Multiply controlled verbal operants: An analysis and extension to the Picture Exchange Communication System. *The Behavior Analyst*, 27,247-261.

Abstract: This paper presents Skinner's (1957) analysis of verbal behavior as a framework for understanding language acquisition in children with autism. We describe Skinner's analysis of pure and impure verbal operants, and illustrate how this analysis may be applied to designing communication training programs. The Picture Exchange Communication System (PECS) is a training program influenced by Skinner's framework. We describe the training sequence associated with PECS, and illustrate how this sequence may establish multiply controlled verbal behavior in children with autism. We conclude with an examination of how Skinner's framework may apply to other communication modalities and training strategies. (<http://www.abainternational.org>)

13. Bondy, A. & Battaglini, K. (2006). Application of the Pyramid Approach to Education Model in a Public School Setting. In J. Handleman & S. Harris (Ed.) *School-age education programs for children with autism* (pp. 163-193). Austin: TX. Pro-Ed Inc.

14. Bondy, A. & Battaglini, K. (2007). Application of the Pyramid Approach to Education Model in a Preschool School Setting In J. Handleman & S. Harris (Ed.) *Pre-school education programs for children with autism 3rd Edition*). (pp. 283-308). Austin: TX. Pro-Ed Inc.

15. Bondy, A. & Frost, L. (2008). *Autism 24/7: A Family Guide to Learning at Home and in the Community*. Baltimore, MD: Woodbine House.

16. Bondy, A. & Frost, L. (2009).The Picture Exchange Communication System: Clinical and Research Applications. In P. Mirenda & T. Iacono (Eds.) *Autism Spectrum Disorders and AAC*. Baltimore, MD: Paul Brookes Publishing Company. Pp. 279-302.

17. Bondy, A. & Frost, L. (2009). Generalization Issues Pertaining to the Picture Exchange Communication System (PECS). In C. Whalen (Ed.) *Real Life, Real Progress for Children with Autism Spectrum Disorders: Strategies for Successful Generalization in Natural Environments*. Baltimore, MD: Paul Brookes Publishing Company.

18. Bridge, D. & Carter, S. (2007). A personal account of using the Picture Exchange Communication System (PECS) with a child with autism. In J. Sigafoos & V. Green (Eds.) *Teaching and Technology*, pp. 183-193. Nova Science Publishers, Tasmania.

Abstract: This chapter describes the use of the Picture Exchange Communication System (PECS™) (Frost & Bondy, 2002) with a child with autism. It explains the PECS system and offers some examples of how this communication technology was used with the child (Thomas), his parents and teachers in his early learning at home and in his classroom. Through this case some of the strengths of this technology are identified, and Thomas' experiences are linked to research in the area. Some issues related to using such a program are considered.

19. Cannella-Malone, H., Fant, J., & Tullis, C. (2010). Using the Picture Exchange Communication System to Increase the Social Communication of Two Individuals with Severe Developmental Disabilities, *Journal of Developmental and Physical Disabilities*, 22, 149-163.

Abstract: The purpose of this study was to examine the effectiveness of the PECS with Peers protocol developed by Garfinkle and Schwartz (1994), which uses The Picture Exchange Communication System (PECS) as a means of increasing social communication between individuals with disabilities and their peers. Two females with severe communication delays and developmental disabilities served as participants and one male with developmental disabilities and one female without disabilities acted as their peers. A multiple baseline across behaviors (i.e., greetings, requests, and responses) design was used to assess the effectiveness of PECS on social communication as well as to examine whether using PECS led to increases in the participants' verbal communication. Both participants increased their social interactions using PECS with their peer and also demonstrated a general preference for verbal communication. Social validity questionnaires indicated that teachers and parents found the social communication skills to be important and that this intervention was helpful.

20. Carr, D. & Felce, J. (2006). Increase in production of spoken words in some children with autism after PECS teaching to Phase III. *Journal of Autism and Developmental Disabilities*, 37, 780-787.

Abstract: The context for this work was an evaluation study (Carr & Felce, under review) of the early phases of the Picture Exchange Communication System [PECS] (Frost & Bondy, 1994; 2002). This paper reports that 5 of 24 children who received 15 hours of PECS teaching towards Phase III over a period of 4-5 weeks, showed concomitant increases in speech production, either in initiating communication with staff or in responding, or both. No children in the PECS group demonstrated a decrease in spoken words after receiving PECS teaching. In the control group, only 1 of 17 children demonstrated a minimal increase and 4 of 17 children demonstrated a decrease in use of spoken words after a similar period without PECS teaching.

21. Carr, D. & Felce, J. (2007). The effects PECS teaching to Phase III on the communicative interactions between children with autism and their teachers. *Journal of Autism and Developmental Disabilities*, 37, 724-737.

Abstract: The study investigated the impact of mastery of the Picture Exchange Communication System (PECS) to Phase III, on the communications of children with autism. Children aged between 3 and 7 years, formed a PECS intervention group and a non-intervention control group. The intervention group received 15 h of PECS teaching over 5 weeks. Three 2-h classroom observations recorded communications between the children and their teachers. These occurred: 6 weeks before teaching; during the week immediately prior to teaching; during the week immediately following teaching. For the control group, two 2-h observations were separated by a 5-week interval without PECS teaching. Communicative initiations and dyadic interactions increased significantly between the children and teachers in the PECS group but not for the control group. (<http://dx.doi.org/10.1007/s10803-006-0203-1>)

22. Carre A., Le Grice, B., Blampied, N., & Walker, D. (2009). Picture Exchange Communication (PECS) Training for young children: Does training transfer to school and to home? *Behaviour Change*, 26, 54-65.

Abstract: The limited communicative abilities of young children with autism and developmental disabilities may be enhanced by augmentative communication systems

such as the Picture Exchange Communication System (PECS). Both children and adults can learn to use PECS, but research is inconsistent in establishing the degree to which PECS training transfers reliably from the training setting to other settings, for example, regular classrooms, and home. Three 5–6 year-old children, diagnosed as autistic and/or developmentally disabled, were given 1:1 PECS training at school, structured to enhance generalisation and transfer. Concurrent observations were made in their regular classroom and at home to probe the extent of generalisation. All three acquired the ability to request a preferred object or activity by exchanging a picture symbol with a communicative partner. In tests of transfer and generalisation, a multiple-baseline across subjects design showed no use of PECS symbols either in the classroom or at home prior to training, with spontaneous initiations of picture exchange (transfer) occurring to a slight to moderate degree in the classroom and to a slight degree at home. Even with PECS training structured to enhance transfer, functionally significant degrees of generalisation of training may be difficult to achieve, and cannot be assumed to occur.

23. Chaabane, D. Ben, Alber-Morgan, S., & DeBar, R. (2009). The effects of parent-implemented PECS training on improvisation of mands by children with autism. *Journal of Applied Behavior Analysis*, 42, 671-677.

Abstract: The present study examined the extent to which mothers were able to train their children, 2 boys with autism, to exchange novel pictures to request items using the picture exchange communication system (PECS). Generalization probes assessing each child's ability to mand for untrained items were conducted throughout conditions. Using a multiple baseline design, results demonstrated that both children improvised by using alternative symbols when the corresponding symbol was unavailable across all symbol categories (colors, shapes, and functions) and that parents can teach their children to use novel pictorial response forms.

24. Chaabane, D., Alber-Morgan, S., & DeBar, R. (2009). The effects of parent-implemented PECS training on improvisation of mands by children with autism. *Journal of Applied Behavior Analysis*, 42, 671-677.

Abstract: The present study examined the extent to which mothers were able to train their children, 2 boys with autism, to exchange novel pictures to request items using the picture exchange communication system (PECS). Generalization probes assessing each child's ability to mand for untrained items were conducted throughout conditions. Using a multiple baseline design, results demonstrated that both children improvised by using alternative symbols when the corresponding symbol was unavailable across all symbol categories (colors, shapes, and functions) and that parents can teach their children to use novel pictorial response forms.

25. Chambers, M. & Rehfeldt, R. (2003). Assessing the acquisition and generalization of two mand forms with adults with severe developmental disabilities. *Research in Developmental Disabilities*, 24, 265-280.

Abstract: The purpose of this study was to determine whether manual sign or the Picture Exchange Communication System (P.E.C.S.) (Frost and Bondy, 1994) would be more effective in teaching mand skills to adults with mental retardation in the severe and profound range. Four participants were taught to mand for four reinforcing items using both communication modalities, in an alternating treatments design. Three of four participants demonstrated criterion performance across all four mands using P.E.C.S. first. Two of those three participants later demonstrated criterion performance for the mands using manual sign. The fourth participant was removed from the study during training due to illness, but her progress indicated greater acquisition with P.E.C.S. Generalization probes conducted at participants' respective residences showed that three

participants demonstrated generalization across settings using P.E.C.S., and two participants demonstrated generalization across settings using manual sign. Participants were also more likely to mand for reinforcing items not present using P.E.C.S. than using manual sign. (www.sciencedirect.com/science/journal/08914222)

26. Charlop-Christy, M.H., Carpenter, M, Le, L., LeBlanc, L, & Kelley, K. (2002). Using the Picture Exchange Communication System (PECS) with children with autism: Assessment of PECS acquisition, speech, social-communicative behavior, and problem behaviors. *Journal of Applied Behavior Analysis, 35*, 213-231.

Abstract: The picture exchange communication system (PECS) is an augmentative communication system frequently used with children with autism (Bondy & Frost, 1994; Siegel, 2000; Yamall, 2000). Despite its common clinical use, no well-controlled empirical investigations have been conducted to test the effectiveness of PECS. Using a multiple baseline design, the present study examined the acquisition of PECS with 3 children with autism. In addition, the study examined the effects of PECS training on the emergence of speech in play and academic settings. Ancillary measures of social-communicative behaviors and problem behaviors were recorded. Results indicated that all 3 children met the learning criterion for PECS and showed concomitant increases in verbal speech. Ancillary gains were associated with increases in social-communicative behaviors and decreases in problem behaviors. The results are discussed in terms of the provision of empirical support for PECS as well as the concomitant positive side effects of its use. (<http://seab.envmed.rochester.edu/jaba/articles/2002/jaba-35-03-0213.pdf>)

27. Charlop, M., Malmberg, D., & Berquist, K. (2008). An application of the Picture Exchange Communication System (PECS) with children with autism and a visually impaired therapist. *Journal of Developmental and Physical Disabilities, 19*, 509-515.

Abstract: The Picture Exchange Communication System (PECS) (Bondy and Frost, Focus on Autistic Behavior 9: 1–19, 1994) is a visually-based alternative and augmentative communication system that is considered appropriate for many special populations. However, a variety of challenged populations, such as people with visual impairments, would initially be considered unable to communicate with PECS users. In the present study, a multiple baseline reversal design across children was used to explore the viability of a Braille-modified PECS system for use between a visually impaired therapist and three children with autism. The PECS cards were slightly modified with the addition of Braille labels so that the visually impaired therapist would be able to understand and respond to the requests of the children with autism. Results indicated that the addition of Braille labels allowed children with autism and the visually impaired therapist to communicate with each other using PECS. In addition, children had ancillary decreases in problem behaviors during work sessions with the Braille-modified PECS. This study demonstrated the versatility of PECS and its potential for use with non-sighted populations, increasing opportunities of visually impaired persons in the job market.

28. Conklin, C. & Mayer, G.R. (2010). Effects of implementing the Picture Exchange Communication System (PECS) with adults with developmental disabilities and severe communication deficits. *Remedial and Special Education (Online First) 2011 32* 155-166.

Abstract: The purpose of this study is to evaluate the effects of *Picture Exchange Communication System* (PECS) training, using a multiple baseline design on the independent initiations of three adults with developmental disabilities and severe communication deficits. All participants increased their independent initiations, although at different levels of quality and quantity throughout PECS training. Results demonstrate

a functional relationship between the teaching of PECS and the increase of independent initiations, and these independent initiations continued to improve after initial training. In addition, problem behaviors (off-task and tantrum behaviors) were monitored to assess the collateral effects of PECS training. Results of data collection on untreated problem behaviors showed marked decreases, especially in the last half of PECS training, and remained below baseline levels during follow-up. The results of this study suggest that participants taught via PECS increased their initiation of requests, thereby increasing their independence and choice making, which also appears to have collateral effects on problem behaviors. This study extends the literature on PECS training with adults with developmental disabilities and severe communication deficits by demonstrating that at least one of the participants learned all six phases. This study also demonstrates collateral changes in untreated problem behaviors in this adult population.

29. Danov, S., Hartman, E., McComas, J., & Symons, F. (2010). Evaluation of two communicative response modalities for a child with autism and self-injury. *The Journal of Speech-Language Pathology and Applied Behavior Analysis, 5*, 70-79.

Abstract: There is little empirically replicated guidance from the research literature on selecting a communication response modality when implementing functional communication training (FCT). In this study, two forms of communicative responding (verbal speech and picture cards) were evaluated during FCT treatment of self-injury for a three-year-old boy with autism. The functional analysis indicated the self-injury was maintained by positive reinforcement in the form of access to preferred items. Findings indicated (1) SIB was eliminated during FCT sessions, and (b) independent picture cards (but not verbal speech) were used in all evaluation sessions. Results are discussed in relation to the clinical issue of choosing among different possible communication response modalities to effectively compete with severe problem behavior.

30. Dogoe, M., Banda, D & Lock, R., (2010). Acquisition and Generalization of the Picture Exchange Communication System Behaviors across Settings, Persons, and Stimulus Classes with Three Students with Autism, *Education and Training in Autism and Developmental Disabilities, 45*, 216-229.

Abstract: A brief narrative description of the journal article, document, or resource. This study examined the acquisition and generalization of requesting behaviors learned through PECS with three children with autism. A single-subject multiple baseline across participants design was used to determine the effects of PECS. Results indicated that all three participants acquired PECS skills for requesting and generalized the skills across settings and persons. However, only two of the three participants met criterion on the generalization across stimulus class probes. Implications and suggestions for future research are discussed. This study provides preliminary data on generalization of PECS across stimulus classes by persons with autism.

31. Dooley, P., Wilczenski, F. & Torem, C. (2009). Using an activity schedule to smooth school transitions. *Journal of Positive Behavioral Interventions, 3*, 57-61.

Abstract: Functional assessment of a preschool child's aggressive and disruptive behaviors identified antecedent conditions associated with difficulties during transitions from one activity to another at school. Antecedent conditions and functional communication were addressed in the behavior plan using a schedule board based on the Picture Exchange Communication System. A dramatic decrease in aggression and increase in cooperative behavior in the classroom was observed.

32. Dyer, K., Sulzer-Azaroff, B., & Bondy, A. (May, 2006). Teaching Picture Discrimination to Children with Autism: "Traditional Match-to-Sample" Training vs. "Naturalistic PECS" Training. Poster presented at the 32nd annual Association for Behavior Analysis convention, Atlanta, GA.

Abstract: Picture discrimination, essential to any picture-based communication program, often is taught through "match-to-sample" (MTS) requests for object-picture pairings. We compared that method to the match-to-sample approach inherent in the Picture Exchange Communication System (PECS). In the traditional MTS condition, we showed the children a picture and asked them to match it to one of a set of objects. Correct matches were rewarded with an item preferred by the child, but unrelated to the sample stimulus; errors were followed with an error correction procedure. In the "naturalistic PECS" condition, a child-preferred and a non-preferred item were displayed. Next, s/he was shown two pictures, each of which corresponded to the items. When s/he handed one of the pictures to the therapist, s/he received the matching item. If the child chose a picture representing an item known to be non-preferred, an error correction procedure followed. Four of 5 children required fewer trials to criterion in the "naturalistic PECS" condition than the "MTS" training condition.

33. Fillipin, M., Reszka, S. & Watson, L. (2010). Effectiveness of the Picture Exchange Communication System (PECS) on communication and speech for children with autism spectrum disorders: A Metanalysis. *American Journal of Speech-Language Pathology*. (Online version).

Abstract: Purpose: The Picture Exchange Communication System (PECS) is a popular communication training program for young children with autism spectrum disorders (ASD). This metanalysis reviews the current empirical evidence for PECS in impacting communication and speech outcomes for children with ASD. Methods: A systematic review of the literature on PECS written between 1994 and June 2009 was conducted. Quality of scientific rigor was assessed and used as an inclusion criterion in computation of effect sizes. Effect sizes were aggregated separately for single subject and group studies for communication and speech outcomes. Results: Eight single-subject experiments (18 participants) and three group studies (95 PECS participants, 65 in other intervention/control) were included. Results indicated PECS is promising, but not as yet established evidenced-based intervention for facilitating communication for children with ASD ages 1–11 years. Small to moderate gains in communication were demonstrated following training. Gains in speech were small to negative. Conclusions: This metanalysis synthesizes gains in communication and relative lack of gains made in speech across the PECS literature for children with ASD. Concerns about maintenance and generalization are identified. Emerging evidence of potential pre-intervention child characteristics are discussed. Phase IV was identified as a possibly influential program characteristic for speech outcomes.

34. Finkel, A., Weber, K., & Derby, K. (2005). Use of a Braille Exchange Communication System to improve articulation and acquire mands with a legally blind and developmentally disabled female. *Journal of Developmental and Physical Disabilities*, 16, 321-336.

Abstract: This research examined the effectiveness of a Braille Exchange Communication System (BECS) on a legally blind adult with developmental disabilities to determine the effects on word articulation and acquisition of mands. The procedures used a multiple baseline design across four sets of words in a three-phase experiment. Phase one measured word articulation. Phase two measured acquisition of vocal mands. Phase three analyzed the exchange for communication component. Results for phases one and two showed that with verbal prompts and fading procedures, verbal responding increased dramatically. For phase three, using BECS was effective in improving communication

exchanges through the use of physical prompting with fading procedures. An additional unique feature of having a third person score IOA data was included to ensure vocal response integrity.

35. Frea, W., Arnold, C. & Vittimberga, G. (2001). A demonstration of the effects of augmentative communication on the extreme aggressive behavior of a child with autism within an integrated preschool setting. *Journal of Positive Behavior Intervention*, 3, 194-198.

Abstract: Research in the area of behavior support has repeatedly demonstrated the positive effects of learning more effective and efficient communication on the challenging behaviors of individuals with developmental disabilities. More recently, augmentative and alternative communication strategies have been receiving increased attention as primary teaching goals for young children with autism. Use of picture exchange and choice-making opportunities has been reported to facilitate speech acquisition and/or result in increased communicative attempts across daily routines. The case study discussed in this article examines the effects of picture exchange on the severe aggressive behavior of a preschooler with autism who was at risk of losing his integrated school placement. Picture exchange was introduced within two play routines in the classroom. The effects of picture exchange on the student's aggression were evaluated within a multiple baseline design. Results indicated that the student's aggressive behavior was eliminated in a brief amount of time when picture exchanges were in place. These findings are discussed in terms of integrating augmentative communication into behavioral support planning and future research in this area. (<http://www.proedinc.com>)

36. Frost, L. (2002). The Picture Exchange Communication System. *Perspectives on Language Learning and Education*, 9, 13-16.

37. Frost, L. & Bondy, A. (2003). Effective ways to use PECS with verbal children. *Autism/Asperger Digest*. 31, 24-25.

38. Frost, L. & Bondy, A. (2006). A common language: Using B.F. Skinner's *Verbal Behavior* for assessment and treatment of communication disabilities in SLP-ABA. *The Journal of Speech and Language Pathology - Applied Behavior Analysis*, 1, 103-110.

Abstract: Professionals in the field of speech-language pathology (SLP) and applied behavior analysis (ABA) share a common goal in the treatment of communication disorders. The two fields, however, do not share a common language. Skinner's definition of verbal behavior and his classification of verbal operants provide interventionists with a valuable tool for classifying verbal behavior based on controlling variables. An understanding of the primary verbal operants and operants under multiple control are essential for planning efficient verbal behavior intervention. This paper presents a primer on B.F. Skinner's 1957 publication, *Verbal Behavior*, a description of the primary verbal operants, verbal operants under multiple control, and a discussion of using this taxonomy for writing precise communication goals for effective intervention. (<http://www.behavior-analyst-today.com/SLP-ABA-VOL-1/SLP-ABA-1-2.pdf>)

39. Fujimoto, Y. & Isawa, S. (2007). The practical study on approach to secondary disorders in student with autistic disorder at school for children with mental retardation: Effect of individualized schedule and applied PECS, *Hattatsu Shinri Rinsyo Kenkyu*, 13, 129-135.

Abstract: The subjects in this study was a student (CA:17-0, DA:1-11, SA:2-5) with autistic disorder at school for children with mental retardation. He presented states such

as secondary disorders and "Persistence to opening or closing of a door" "sleeplessness" "overeating" from it was thought with an environmental change of department of high school from department of junior high school. The making the environmental that the student is easy to understand that he should perform "when" "what" "how long" and training mand based on applied PECS (The Picture Exchange Communication System) to express his demands were conducted. This study was aimed at examining the process and effect of that support. We discussed reason of the process of and effect and considered ideal method of support in department of school of children for mental retardation.

40. Ganz, J.B., Cook, K.E., Corbin-Newsome, J., Bourgeois, B., & Flores, M. (2005). Variations on the Use of a Pictorial Alternative Communication System with a Child with Autism and Developmental Delays. *TEACHING Exceptional Children Plus*, 1(6) Article 3.

Abstract: As aberrant behavior is often recognized as the number one form of communication, it becomes imperative that as parents, teachers, and educators we must address and systematically teach or provide all children with an effective means of communication. While many augmentative and alternative communication systems such as manual sign language and the Picture Exchange Communication System (Frost & Bondy, 1994) have shown tremendous success, some students with developmental disabilities students unique needs require more individually tailored communication training that necessitates empirical inquiry and use of collective expertise. Doing so may facilitate the acquisition of skills and behaviors that improve communication skills through independent appropriate means for meeting students' personal needs and desires. This article systematically provides a variation of the Picture Exchange Communication System (PECS) including materials, resources, and methodology necessary.

(<http://escholarship.bc.edu/education>)

41. Ganz, J., Heath, A., Rispoli, M. & Earles-Vollrath, T. (2010)., Impact of AAC versus verbal modeling on verbal imitation, picture discrimination, and related speech: A pilot investigation. *Journal of Developmental and Physical Disability*, 22, 179-196.

Abstract Delays in or lack of language development are a primary characteristic of autism. Thus, teachers, families and researchers face the challenge of determining which teaching strategies are most effective and efficient in addressing these communication deficits. This study attempts to add to the literature regarding this issue. A multi-treatment/multi-measure single-case design was used to compare the effects of the Picture Exchange Communication System (PECS) with a verbal modeling intervention on four communicative behaviors: (a) picture requests, (b) imitated verbalizations, (c) picture discrimination, and (d) any related speech for a 3 year old child with autism. Results indicated that the PECS training led to increases in picture requests and these results were maintained during the verbal modeling intervention phase. No change in imitated verbalizations was observed following either intervention. With respect to both picture discrimination and related speech, no significant results were achieved following PECS training or verbal modeling. However, during the verbal modeling phase the participant demonstrated a small increase in both picture discrimination and any related speech for both the PECS and verbal modeling item sets.

42. Ganz, J. & Simpson, R. (2004). Effects on communicative requesting and speech development of the Picture Exchange Communication System in children with characteristics of autism. *Journal of Autism and Developmental Disabilities*, 34, 395-409.

Abstract: Few studies on augmentative and alternative communication (AAC) systems have addressed the potential for such systems to impact word utterances in children with autism spectrum disorders (ASD). The Picture Exchange Communication System (PECS) is an AAC system designed specifically to minimize difficulties with communication skills experienced by individuals with ASD. The current study examined the role of PECS in improving the number of words spoken, increasing the complexity and length of phrases, and decreasing the non-word vocalizations of three young children with ASD and developmental delays (DD) with related characteristics. Participants were taught Phases 1–4 of PECS (i.e., picture exchange, increased distance, picture discrimination, and sentence construction). The results indicated that PECS was mastered rapidly by the participants and word utterances increased in number of words and complexity of grammar. (<http://www.springerlink.com>)

43. Ganz, J., Simpson, R. & Corbin-Newsome, J. (2008). The impact of the Picture Exchange Communication System on requesting and speech development in preschoolers with autism spectrum disorders and similar characteristics. *Research in Autism Spectrum Disorders, 2*, 157–169.

Abstract: By definition children with autism spectrum disorders (ASD) experience difficulty understanding and using language. Accordingly, visual and picture-based strategies such as the Picture Exchange Communication System (PECS) show promise in ameliorating speech and language deficits. This study reports the results of a multiple baseline across participants investigating the implementation of the PECS with three preschool children with characteristics of ASD. The first four phases of PECS were taught to the participants: basic picture exchange, increasing distance use of PECS, discriminating among a variety of pictures, and communicating in sentences composed of pictures. Relative to the impact of PECS's implementation in providing the participants with a functional communication system, word approximations, and intelligible word and phrase use, results indicated that two of the three participants mastered PECS. However, participants did not significantly increase in use of word approximations and intelligible words.

44. Ganz, J., Sigafos, J., Simpson, R., & Cook, K. (2008). Generalization of a picture alternative communication system across instructors and distance. *Augmentative and Alternative Communication, 24*, 89-99.

Abstract: Nonverbal individuals with autism spectrum disorders (ASD) often require the use of picture based, aided augmentative and alternative communication (AAC) systems. Such systems are used widely, but little research has investigated the generalization of these devices to a variety of communicative partners and under a variety of conditions. We investigated use of a modified Picture Exchange Communication System (PECS) protocol to teach AAC supported functional communication skills to a 12-year-old boy with autism. Results indicate that the participant was able to generalize his communication skills across a variety of instructors and to use functional non-verbal strategies to respond to communication obstacles.

45. Ganz, J., Parker, R. & Benson, J. (2009). Impact of the picture exchange communication system and collateral effects on maladaptive behavior. *Augmentative and Alternative Communication, 25*, 250-261.

Abstract: Many children with autism require intensive instruction in the use of augmentative or alternative communication systems, such as the Picture Exchange Communication System (PECS). This study investigated the use of PECS with three young boys with autism to determine the impact of PECS training on use of pictures for requesting, use of intelligible words, and maladaptive behaviors. A multiple baseline-probe design with a staggered start was implemented. Results indicated that all of the

participants quickly learned to make requests using pictures and that two used intelligible speech following PECS instruction; maladaptive behaviors were variable throughout baseline and intervention phases. Although all of the participants improved in at least one dependent variable, there remain questions regarding who is best suited for PECS and similar interventions.

46. Haramaki, S. & Bondy, A. (2007). Behavior analytic approach to Asperger Syndrome. *Nippon Rinsho*, 65, 516-21.

Abstract: We describe the behavior analytic approach to helping people with Asperger syndrome regarding social interaction and communication issues. In the behavior analytic approach, the cause of maladaptive behavior is not attributed to the disability itself. Maladaptive behaviors are viewed as a function of the interaction between an individual and the environment. Therefore, we assess these functional relationships and intervene by modifying aspects of the environment. Functional assessment is one of the most effective methods to evaluate the cause of problem behaviors and helps in the selection of an intervention strategy. We teach students functionally equivalent alternative behaviors that are socially appropriate and yet met the needs of the individual. Furthermore, we discuss the importance of teaching individuals with Asperger syndrome critical skills, including communication skills, self-management skills, and how to deal with anxiety.

47. Hart, S. & Banda, D. (2009). Picture Exchange Communication System with individuals with developmental disabilities: A meta-analysis of single subject studies. *Remedial and Special Education (Online First)*, XX, 1-13.

Abstract: Picture Exchange Communication System (PECS) is a picture-based communication strategy used to teach communication skills to persons with developmental disabilities including autism. This article systematically reviews 13 published single subject studies to examine the effectiveness of PECS, the effects of PECS on speech and problem behaviors, generalization beyond training conditions, and social validity of the intervention. The authors also calculated percentage of non-overlapping data points for all participants to quantify, compare, and analyze results. Results indicate that PECS yielded increases in functional communication in all but 1 participant. Additionally, PECS decreased problem behaviors and increased speech in some individuals. A theoretical framework, analyses of methodologies, and implications for researchers and practitioners are discussed.

48. Heneker, S. & Page, L.M. (2003). Functional Communication: the impact of PECS. *Speech & Language Therapy in Practice*, 12-14.

Abstract: The Picture Exchange Communication System (PECS™) aims to teach individual users to initiate communication. The effectiveness of introducing this approach to whole classes within a school for autistic spectrum disordered children was investigated in two groups. Class staff and parents attended a formal PECS training course and the impact on the amount, functions and method of communication and the level of adult support required were recorded. Observations were carried out in four different contexts: free play, snack, swimming and structured teaching. For group 1 children, aged 6 to 8, the amount of communication increased in all activities apart from swimming. Requesting was the most frequent function at both base-line and follow-up. The most frequently used method of communication at base-line was by symbols. At follow-up symbols was the main method for snack and structured teaching and physical communication was predominant for free-play and swimming. The presence of an object/event was the main level of stimulus to which children responded for all activities. For Group 2 children, aged 9-10 years, total communicative acts increased for all activities apart from structured teaching, where the decrease may have been due to their

being taught more independent skills of commenting for the first time. Requesting remained the most frequent function of communication, and more formal means of communication were observed. The presence of an object/event remained the main stimulus for snack and swimming, but more independent responses were seen in free-play, with the presence of a listener becoming the level of cue required to initiate communication. At follow-up, children involved in the study appeared to show less frustration, were able to accept that their requests might not always be met, and could wait patiently for adult attention. (<http://www.speechmag.com>)

49. Howlin, P., Gordon, R.K., Pasco, G., Wade, A. & Charman, T. (2007). The effectiveness of Picture Exchange Communication System (PECS) training for teachers of children with autism: a pragmatic, group randomised controlled trial. *Journal of Child Psychology and Psychiatry*, 48, 473-481.

Abstract: Objective: To assess the effectiveness of expert training and consultancy for teachers of children with autism spectrum disorder in the use of the Picture Exchange Communication System (PECS). Method: Design: Group randomised, controlled trial (3 groups: immediate treatment, delayed treatment, no treatment). Participants: 84 elementary school children, mean age 6.8 years. Treatment: A 2-day PECS workshop for teachers plus 6 half-day, school-based training sessions with expert consultants over 5 months. Outcome measures: Rates of: communicative initiations, use of PECS, and speech in the classroom; Autism Diagnostic Observation Schedule-Generic (ADOS-G) domain scores for Communication and Reciprocal Social Interaction; scores on formal language tests. Results: Controlling for baseline age, developmental quotient (DQ) and language; rates of initiations and PECS usage increased significantly immediately post-treatment (Odds Ratio (OR) of being in a higher ordinal rate category 2.72, 95% confidence interval 1.22–6.09, $p < .05$ and OR 3.90 (95%CI 1.75–8.68), $p < .001$, respectively). There were no increases in frequency of speech, or improvements in ADOS-G ratings or language test scores. Conclusions: The results indicate modest effectiveness of PECS teacher training/consultancy. Rates of pupils' initiations and use of symbols in the classroom increased, although there was no evidence of improvement in other areas of communication.

50. Isshiki, M., Ishiyama, A., Yoshida, S., Hisatake, Y., & Terada, S. (2008). A complex effect of PECS and cognition intervention for autism spectrum disorder, *Bulletin of the Faculty of Education, Kochi University*, 68, 73-82.

Abstract: We introduced interventions of both the Picture Exchange Communication System (PECS) and the cognition to four participants with autism Spectrum disorder who use few words and have poor communication skills. As a result, the participants improved in each phases of the PECS, and acquired a spontaneous demand skill to use the PECS in the intervention setting. We also improved the PECS intervention to their daily lives, therefore they showed a spontaneous demand skill in a non-structured setting in the daily living. Simultaneously, we taught cognitive tasks to the participants. We found that the levels of cognitive tasks correspond to the PECS phases. Accordingly, it was suggested that the psychological operation acquired by the cognitive intervention, work as the base for the necessary operation in the PECS intervention.

51. Jurgens, A., Anderson, A. & Moore, D. (2009). The effect of teaching PECS to a child with autism verbal behaviour, play, and social functioning. *Behaviour Change*, 26, 66-81.

Abstract: The Picture Exchange Communication System (PECS) is a widely used intervention strategy designed to teach communication skills to children with developmental delays, including autism. The Picture Exchange Communication System

incorporates the teaching of mand initiations that are thought to be pivotal response behaviours, and have been demonstrated to lead to generalised improvements in other nontargeted behaviours. The aim of the present study was to assess the acquisition of PECS with a 3-year-old boy with autism using the established PECS training program, and to evaluate concomitant changes in spoken language, social-communicative behaviours, and functional play. Results indicated that the participant rapidly acquired the criterion behaviours for Phases 1 to 3 of the PECS program. Although PECS exchanges were rarely observed in the generalization settings, clear increases were evident in verbal mands and other initiations in both home and kindergarten generalisation settings. Increases in spoken vocabulary and in the length of comprehensible spoken utterances in free-play were observed, as were gains in time spent in developmentally appropriate play. Implications of these results and directions for future research are discussed.

52. Kern, L., Gallagher, P., Starosta, K., Hickman, W. & George, M. (2006). Longitudinal outcomes of functional behavioral assessment-based intervention, *Journal of Positive Behavior Interventions*, 8, 67-78.

Abstract: A critical measure of intervention effectiveness is durability over time. Still, few studies have examined the long-term outcomes of support derived from a functional behavioral assessment as well as enablers and barriers that contribute to or impede successful outcomes. In the current study, a functional behavioral assessment was conducted with a 10-year-old boy with developmental disabilities who engaged in high-rate aggression. Based on the assessment results, a comprehensive support plan was developed and implemented, which resulted in a decrease in aggression and increase in activity engagement. His subsequent progress was followed for 3 consecutive school years. This longitudinal follow-up indicated that components of the plan remained effective; however, illness and implementation lapses resulted in decrements in progress.

53. Koita, H. & Sonoyama, S. (2004). Communication training using the Picture Exchange Communication System (PECS): Case study of a child with autistic disorder. *Japanese Journal of Behavior Analysis*, 19, 161-174.

Abstract: The purpose of this study was to examine the effect of training with the Picture Exchange Communication System (PECS) on the acquisition of functional communication skills. Participants were a child with autism who did not speak, and his mother. Intervention was conducted with the changing conditioning design, including 6 phases and follow up. The PECS training was implemented by the participant's mother in his home. In the home, intervention was implemented using backward chaining and other methods, the child's mother taught him to give her icons in order to make requests and answer questions. Measures were the percentage of correct responses in the PECS training, the frequency of spontaneous requesting with using the PECS, and the form and the initial time of speech after the intervention has begun. As a result, the boy learned the PECS in a comparatively short period, and spontaneous requesting using the PECS increased. After the intervention, some speech appeared, but its frequency was low. Although the PECS training could be effectively implemented by the mother in home, the procedures for commenting need to be examine further.

54. Koita, H., Sonoyama, S., & Takeuchi, K. (2003). Communication Training With the Picture Exchange Communication System (PECS) for Children With Autistic Disorder: The Training Program and Current and Future Research. *Japanese Journal of Behavior Analysis*, 18, 120-130. (Japanese)

Abstract: This review article would be one of the first studies to be published in Japan on the PECS. The PECS was developed by Frost and Bondy as a means to teach children with autistic disorder and related developmental disabilities a self-initiating, functional communication system that could be rapidly acquired. Its theoretical roots combine

principles from applied behavior analysis and guidelines established within the field of augmentative and alternative communication. The PECS training manual was first published in 1994, and revised in 2002. In the PECS training protocol, children are taught to exchange a picture for a desired item and eventually learn to construct picture-based sentences and use a variety of attributes in their requests. The system emphasizes developing the request function prior to developing responding to simple questions and commenting. In the present article, we described the PECS procedure, summarize effects of communication training by PECS, and comment on the future of PECS.

55. Kravits, T. R., Kamps, D.M., & Kemmerer, K. (2002). Brief report: Increasing communication skills for an elementary-aged student with autism using the picture exchange communication system. *Journal of Autism and Developmental Disorders*, 32, 225-230.

Abstract: Communication and interactions with others are a few of the hardest tasks for an autistic child. This study showed how the gap may be bridged by using a system called the Picture Exchange Communication System (PECS). A 6-year-old girl named Molly showed much improvement in both her verbalizations and socialization skills using this method which gives promise to execution of these programs.
(<http://www.springerlink.com/content/104757>)

56. Kuma, H., Takeuchi, Y., Hara, Y., Naoi, N., Yamamoto, J., Takahashi, K., Iijima, K., Saito, U., Watanabe, S., Haramaki, S., & Bondy, A. (2009). On Current Research and Practice on Autism and Communication in Japan, *Japanese Journal of Behavior Analysis*, 24, 82-101.

Abstract: The present symposium was conducted at a seminar on and communication held on July 12, 2008, at Hosei University in Tokyo. First, a comprehensive program for teaching communication skills to autistic children at Keio University was presented. Second, a family-support program provided by the University of Tsukuba to teach an autistic child using PECS at home was introduced. Third, a family and school support program based on functional communication training provided by a private clinic (TASUC Ltd.) was described. Finally, the discussant, Bondy, commented on each presentation on the basis of his expertise in providing communication training for teachers and parents working with children with autism.

57. Kuramitsu, A. Tyou, K. & Sonoyama, S. (2008). Shaping Mand Behavior by Home-based Communication Training Using PECS for a Child with Pervasive Developmental Disorder. *Japanese Journal of Disability Science*, 32, 159-171.

Abstract: In this study, we conducted Picture Exchange Communication System (PECS) training for one non-speaking child with pervasive developmental disorder, and examined the effect of the acquisition and expansion of functional communication skills. An ecological assessment was implemented to establish a training environment so as to encourage the child as regards mand behaviors. The mother carried out the PECS training for the child as a home trainer. For the training procedure, a series of actions required in daily life were grouped into a set of tasks by using PECS. A task analysis was conducted with mand behavior using a picture card and a sentence seat view to making each task group easy for the child to acquire. As a result the child quickly acquired mand skills with PECS. In addition, the mand skills using PECS were demonstrated to the child's father who was not a trainer, or in a non-training setting at home. It was suggested that an issue will remain related to an examination of the generalization of mand skills by PECS in a setting other than meal times at home.

58. Lancioni, G., O'Reilly, M., Cuvo, A., Singh, N., Sigafoos, J. & Didden, R. (2007). PECS and VOCAs to enable students with developmental disabilities to make requests: An overview of the literature. *Research in Developmental Disabilities*, 28, pp. 468-488.

Abstract: This paper provides an overview of the literature dealing with the use of the Picture Exchange Communication System (PECS) and voice output communication aids (VOCAs) for promoting the performance of requests by students with developmental disabilities. Computerized and manual searches were carried out to identify the studies published during the last 15 years (i.e., the period between 1992 and 2006 during which PECS and VOCA approaches became popular). Thirty-seven studies were identified and then divided into three groups concerning the use of the PECS or equivalents, the use of VOCAs or equivalents, and the comparison of both these approaches, respectively. Of the 173 students involved in studies using the PECS or equivalents only three could be considered failures, while a fourth one did not progress in the program due to illness. Similarly, of the 39 students who used VOCAs or equivalents only three could be considered failures, while one was partly successful. Finally, of the 11 students involved in the comparisons between PECS and VOCAs none could be classified as a failure. The results are very encouraging but methodological concerns and the relatively limited use of the systems in terms of request items and request opportunities suggest caution. Caution may also be needed in interpreting the reported similarities between the two systems in usability and effectiveness.

59. Lerna, A., Esposito, D., Russo, L. & Massagli, A. (2009). The efficacy of the PECS for improving the communicative, relational and social skills in children with autistic disorder: Preliminary results. *European Psychiatry*, 24, Supplement 1.

Abstract: The aim in the current study was to investigate the efficacy of the PECS (Picture Exchange Communication System) in a sample of children with Autistic Disorder (AD) in the development of the communication, alternating gaze and pointing in children with Autistic Disorder (AD). The sample included 5 children diagnosed with AD (DSM-IV-TR), no verbal language, followed by the team of the Rehabilitation Centre belonging to Scientific Institute "E. Medea", Association "La Nostra Famiglia" Branch of Ostuni (Italy). The children were tested on their ability with neuropsychiatric, psycholinguistics and psychological assessment at the pre and post of the trial. The treatment PECS has gone on for two years with a frequency of three times a week (45 minutes each one). The results show a significant increase in the number of spontaneous requests, in the capacity of alternating gaze, pointing, vocalizing and verbalizing on imitation. Finally the PECS seems to allow not only to develop a functional communication in AD, but also to increase social communicative behaviors of children with AD. Nevertheless further studies are necessary.

60. Liddle, K. (2001). Implementing the Picture Exchange Communication System (PECS). *International Journal of Language and Communication Disorders*, 36, 391-395.

Abstract: PECS was developed in Delaware, USA over 10 years ago by Bondy and Frost (1994a). Over the last two years PECS has been introduced to this country and has raised a great deal of interest in people working in the field of autistic spectrum disorders (ASD). This paper will address some of the issues that arose during the establishment of PECS in one special school. Changes seen in 21 children with severe learning difficulties who have been taught to use PECS are reported and the use of PECS with children who do not have an ASD is discussed. (<http://www.tandf.co.uk/journals>)

61. Lund, S.K. & Troha, J.M. (2007). Teaching Young People who are Blind and have Autism to Make Requests Using a Variation on the Picture Exchange Communication System with Tactile Symbols: A Preliminary Investigation. *Journal of Autism Developmental Disorders*, 38, 719-730.

Abstract: This study used a single-subject multiple baseline across participants design to evaluate the effectiveness of a modified picture exchange communication system (PECS) teaching protocol with tactile symbols. Three students (two male, one female) aged 12-17 years who had autism and were blind participated in the study. The instructional program involved three phases. First, each participant learned to exchange a tactile symbol with his/her communication partner to request a preferred item/activity. Second, the distance between the communication partner and the participant was increased. Third, the participants were required to discriminate between two dissimilar tactile symbols. One out of three participants completed all phases of the instructional program. Although the other two participants did not complete the program, they demonstrated improvement from baseline responding rates. This study provided preliminary results that using tactile symbols with strategies from PECS may be an effective method to teach requesting to youth who are blind and have autism.

62. Magiati, I. & Howlin, P. (2003). A pilot evaluation study of the Picture Exchange Communication System (PECS) for children with autistic spectrum disorders, *The International Journal of Autism*, 7(3): 297-320.

Abstract: A pilot study was conducted to evaluate the effects of training teachers of children with autistic spectrum disorders (ASDs) in the use of the Picture Exchange Communication System (PECS). Thirty-four children with ASDs (29 boys and 5 girls) were selected from eight specialist schools. Teaching staff attended a 2 day PECS workshop and received six half-day visits from PECS consultants. Data on the children's use of PECS, spontaneous communication, and adaptive behaviour were collected before the study and at set times following the workshop. Significant, rapid increases were recorded in the level of PECS attained by the children, in their PECS vocabulary, and in their frequency of PECS use over time. Improvements in children's general level of communication were slower to occur. The majority of participants showed improvements in their ability to use PECS. The results are discussed in relation to the methodological and practical difficulties that arose during the project.
(<http://www.sagepub.co.uk/home.nav>)

63. Marckel, J.M, Neef, N.A. & Ferreri, S.J. (2006). A preliminary analysis of teaching improvisation with the picture exchange communication system to children with autism. *Journal of Applied Behavior Analysis*, 39, 109-115.

Abstract: Two young boys with autism who used the picture exchange communication system were taught to solve problems (improvise) by using descriptors (functions, colors, and shapes) to request desired items for which specific pictures were unavailable. The results of a multiple baseline across descriptors showed that training increased the number of improvised requests, and that these skills generalized to novel items, and across settings and listeners in the natural environment.

64. Mirenda, P. (2003). Toward functional augmentative and alternative communication for students with autism: Manual signs, graphic symbols, and voice output communication aids. *Language, Speech, and Hearing Services in Schools*, 34, 203-216.

Abstract: Many individuals with autism are candidates for augmentative and alternative communication (AAC) systems, either to supplement (i.e., augment) their existing speech or to act as their primary (i.e., alternative) method of expressive communication. The

purpose of this article is to summarize research and directions for future research with regard to two questions related to the delivery of AAC supports to these individuals: (a) What AAC modality is preferable to use? And (b) What do we know about the use of voice output communication aids with people with autism? (<http://www.asha.org>)

65. Okalidou, A., & Malandraki, G. (2007). The application of PECS in children with autism and deafness: A case study. *Focus on Autism and Other Developmental Disabilities, 22*, 23-32.

Abstract: The subject of this study is a 10-year-old non-verbal Greek boy, who has been diagnosed with both bilateral sensory-neural profound hearing loss and autism. The Picture Exchange Communication System (PECS), with some modifications and extensions, was applied for a 4-month intensive intervention period. His original communication and behavioral status as well as the PECS application process are presented along with the communicative, language and psychosocial outcomes following the entire intervention program. In addition, follow-up data are presented six months post-intervention.

66. Ostryn, C., Wolfe, P. & Rusch, F. (2008). A Review and Analysis of the Picture Exchange Communication System (PECS) for Individuals With Autism Spectrum Disorders Using a Paradigm of Communication Competence, *Research & Practice for Persons with Severe Disabilities, 33*, 13–24.

Abstract: Research related to the use of the Picture Exchange Communication System (PECS) with individuals having autism spectrum disorders (ASDs) was examined using a communication competence paradigm detailed by J. C. Light (1988, 1989, 2003). Communication components were operationalized based on skills identified in ASD research. A review was conducted to examine general PECS outcomes and outcomes related to communication competence including generalized, spontaneous, and joint attention abilities, and maintenance. Results indicated that there were few empirical studies related to the PECS. Of note, the reported studies indicated generally positive outcomes for individuals with ASDs, particularly related to manding and generalization. When the communication competence paradigm was applied, results indicated that, in its present form, the PECS needs to be used as a part of a multimodal communication system. Results suggest that training related to the PECS includes joint attention and question asking. Recommendations for the use of PECS and future research with individuals having ASDs are outlined.

67. Park, J.H. (2009). The effects of mother-implemented Picture Exchange Communication System training on spontaneous communicative behaviors of young children with autism spectrum disorders. (Doctoral Dissertation, Ohio State University).

Abstract: The current study examined whether mothers could be taught to implement the picture exchange communication system (PECS) training with their child and investigated the effects of the mother-implemented PECS training on the spontaneous communication of young children with autism spectrum disorders. Three mothers were trained to teach their child PECS Phases 1 through 3B and subsequently were asked to train their child to use PECS as a way of requesting a preferred item or activity. Results on mother's accuracy of implementing PECS training showed that all three mothers taught their child PECS with high integrity. A changing criterion design was used to demonstrate the effects of mother-implemented PECS training on children. Results indicated that all three children successfully acquired independent picture exchanges along with the mother-implemented PECS training. Moreover, not only did all three children generalize PECS skills to an untrained communication partner, they also maintained the acquired skills over one month. Word vocalizations increased for one

child, though no or limited improvement was observed for the other two. These findings extend the existing evidence on PECS by training mothers as primary implementers of PECS training and provide practitioners with insight into the feasibility and necessity of parent-implemented PECS training.

68. Park, J.H., Alber-Morgan, S. & Cannella-Malone, H., (2011). Effects of Mother-Implemented Picture Exchange Communication System (PECS) Training on Independent Communicative Behaviors of Young Children With Autism Spectrum Disorders, *Topics in Early Childhood Special Education, 31, 37-47.*

Abstract: This study examined the effects of mother-implemented Picture Exchange Communication System (PECS) training on the independent communication of three young children with autism spectrum disorders. Three mothers were trained to teach their child PECS Phases 1 through 3B, which they did with high integrity. Moreover, all three children successfully acquired independent picture exchanges that were generalized to a different communication partner and maintained for at least 1 month. Vocalizations across participants showed limited or no improvement. These findings systematically extend previous PECS research by training mothers to be the primary implementers of PECS training. In addition, this research provides practitioners with insight into the feasibility and necessity of parent-implemented PECS training.

69. Parker, A.T. (2009). Measuring an adapted form of Picture Exchange Communication System (PECS) for young children with visual impairments and developmental disabilities. Doctoral Dissertation, Texas Tech University. <http://etd.lib.ttu.edu/theses/available/etd-06032009-203503>.

Abstract: The Picture Exchange Communication System (PECS) has been shown to build the expressive communication skills for students with autism and those with developmental disabilities. Traditional PECS teaching strategies rely upon an intact visual sense for accessing pictures, line drawings, gestures or other visual supports from a communication partner to request items, or make choices about desired objects in the environment. The use of 3-D parts of objects may be useful in adapting the PECS protocol for individuals with visual impairments and additional disabilities. This study examined the effects of an adapted form of PECS on the communication skills for three students with visual impairments and developmental delays. (<http://etd.lib.ttu.edu/theses/available/etd-06032009-203503>)

70. Peterson, S., Bondy, A., Glassberg, M. & Neef, N. (2002, May). The relationship of match-to-sample to visual discrimination skills utilized within PECS. Paper presented at the annual Association for Behavior Analysis convention, Toronto, CA.

71. Peterson, S., Glassberg, M., Neef, N. & Bondy, A. (2002, May). PECS acquisition: Patterns of skill development across four young children. Paper presented at the annual Association for Behavior Analysis convention, Toronto, CA.

72. Preissler, M.A. (2008). Associative learning of pictures and words by low-functioning children with autism. *Autism, 12, 231-248.*

Abstract: This research investigates whether children with autism learn picture, word and object relations as associative pairs or whether they understand such relations as referential. In Experiment 1, children were taught a new word (e.g. 'whisk') repeatedly paired with a novel picture. When given the picture and a previously unseen real whisk and asked to indicate a whisk, children with autism, unlike typically developing peers matched on receptive language, associated the word with the picture rather than the

object. Subsequent experiments respectively confirmed that neither a bias for selecting pictures nor perseverative responding accounted for these results. Taken together, these results suggest that children with autism with cognitive difficulties are learning picture–word and picture–object relations via an associative mechanism and have difficulty understanding the symbolic nature of pictures.

73. Preston, D, & Carter, M. (2009). A review of the efficacy of the Picture Exchange Communication System Intervention. *Journal of Autism and Developmental Disabilities, 39, 1471-1486.*

Abstract: The Picture Exchange Communication System (PECS) is a communication program that has become widely used, especially with children with autism. This paper reports the results of a review of the empirical literature on PECS. A descriptive review is provided of the 27 studies identified, which included randomized controlled trials (RCTs), other group designs and single subject studies. For 10 appropriate single subject designs the percentage of nonoverlapping data (PND) and percentage exceeding median (PEM) metrics were examined. While there are few RCTs, on balance, available research provides preliminary evidence that PECS is readily learned by most participants and provides a means of communication for individuals with little or no functional speech. Very limited data suggest some positive effect on both social communicative and challenging behaviors, while effects on speech development remain unclear. Directions for future research are discussed including the priority need for further well-conducted RCTs.

74. Rehfeldt, R. & Root, S. (2005). Establishing derived requesting skills in adults with severe developmental disabilities. *Journal of Applied Behavior Analysis, 38, 101-105.*

Abstract: This project examined whether a history of reinforced relational responding would result in derived requesting skills in three adults with disabilities. Participants were first taught to request preferred items using pictures [with PECS]; they were then taught conditional discriminations between pictures and their dictated names and dictated names and their corresponding text. Finally, requests for preferred items using corresponding text were evaluated. All three participants demonstrated derived requesting skills. (<http://seab.envmed.rochester.edu/jaba/>)

75. Rosales, R., Stone, K. & Rehfeldt, R. A. (2009) (in press). The effects of Behavioral Skills Training on the implementation of the Picture Exchange Communication System. *Journal of Applied Behavior Analysis, 42, 541-9.*

Abstract: The effectiveness of a behavioral skills training (BST) package to teach the implementation of the first three phases of the Picture Exchange Communication System (PECS) was evaluated with three adults who had no history teaching any functional communication system. A multiple baseline across participants design was used to evaluate the effectiveness of the training package, which consisted of a video, written and verbal instructions, modeling, rehearsal, and feedback. Results showed significant improvements relative to baseline in a short amount of training time, and that skills generalized to a learner with a severe developmental disability. Skills were maintained at one month follow-up for one participant.

76. Rosales, R. & Rehfeldt, R.A. (2007). Contriving transitive conditioned establishing operations to establish derived manding skills in adults with severe developmental disabilities. *Journal of Applied Behavior Analysis, 40, 105-121.*

Abstract: The purpose of this study was to demonstrate derived manding skills in 2 adults with severe developmental disabilities and language deficits by contriving

transitive conditioned establishing operations. Specifically, we evaluated whether a history of reinforced conditional discrimination learning would ultimately result in a derived mand repertoire, in which participants manded for items that were needed to complete chained tasks. After mastering the first three phases of the picture exchange communication system (PECS), participants were taught to mand for the needed items by exchanging pictures of the items for the items themselves. They were then taught to conditionally relate the dictated names of the items to the corresponding pictures of the items and to relate the dictated names to the corresponding printed words. We then tested, in the absence of reinforcement, whether participants would mand for the items needed to complete the chained tasks using text rather than pictures. Both participants showed the emergence of derived mands and some derived stimulus relations as a result of this instruction. Some of the derived relations were shown to be intact at 1-month follow-up, and scores on derived mand probes were higher at follow-up than before training. In addition, the 2 participants vocally requested the needed items on maintenance test probes, a skill that was never trained and was not previously in their repertoires. These results suggest that a history of reinforced relational responding may facilitate the expansion of a number of verbal skills and emphasize the possibility of a synthesis of Skinner's (1957) analysis of verbal behavior and derived stimulus relations into language-training efforts for persons with significant disabilities.

77. Schwartz, I. S., Garfinkle, A. N., & Bauer, J. (1998). Communicative outcomes for young children with disabilities. *Topics in Early Childhood Special Education, 18*, 144–159.

Abstract: The Picture Exchange Communication System (PECS) has become a widely known and used augmentative system for teaching functional communication skills and potentially providing a bridge to speech acquisition. Unfortunately, although there is a great deal of anecdotal clinical evidence about the PECS, there is little empirical information about its efficacy. We present two studies documenting the use of PECS for preschool children with severe disabilities. The first study analyzed the PECS acquisition data for 31 preschool children and demonstrated that young children with severe communication delays and disorders can learn to use PECS quickly and efficiently. The second study followed 18 preschool PECS users for a year. The results of language samples taken at snack time and during free-choice activities indicated that PECS use generalizes to untrained settings and may have concomitant effects on untrained language functions. Directions for future research are discussed.

<http://www.proedinc.com>

78. Schreibman, L. (2008). One Size Does Not Fit All: Developing individualized treatment protocols for children with autism. *The Association for Behavior Analysis Newsletter, 31* (3), 40-43.

79. Schwartz, J. & Nye, C. (2006). Improving Communication for Children with Autism: Does Sign Language Work? *Evidence Based Practice Briefs, 1*, 1-17.

Summary: This review spotlights the glaring shortage of high quality research needed to inform any discussion of the merits of teaching sign language to children with autism. In the intervening 18 years since Yoder and Layton (1988) called for experimental research on this topic, little appears to have been accomplished. Thus, clinicians' use of a sign language approach to enhance the communicative competence of children with autism must be considered in light of (a) the absence of conclusive group experimental design evidence to corroborate the single subject design findings, and (b) the absence of a discussion of intervention fidelity in all studies reviewed. From a programmatic and policy implementation point of view, the single subject research offers limited support for the

use of sign language for children with autism. Considering the overall quality of the available research we would suggest that there are insufficient data to advocate for the use of sign language either alone or in combination with oral language as a method for substantially improving communication in children with autism.

Evidence-Based Practice Recommendation: Evidence-based practice requires clinicians to integrate the scientific, objective, and quantifiable data available in the research literature into the clinical decision-making process. Evidence-based practice should allow professionals to consider a variety of sources of information in light of the client's needs and the situation of the individual being treated. In this review, the evidence on the use of sign language with children with autism provides limited support for its concentrated application for children with autism, as there is little compelling evidence that sign language provides substantial improvements in either oral or sign language communication. The modest effects reported by single subject studies coupled with the absence of even a few well controlled group studies only serves to suggest that either (a) the research community views this area of intervention as having limited usefulness, or (b) the clinical community has not found sign language to be of a substantial value so as to press for more and better research. This review indicates that there is a need for high quality primary research that will provide the scientific basis for the effective clinical application of sign language intervention for children with autism.

80. Sigafos, J., Ganz, J., O'Reilly, M., Lancioni, G., & Schlosser, R. (2007). Assessing correspondence following acquisition of an exchange-based communication system. *Research in Developmental Disabilities, 28, 71–83.*

Abstract: Two students with developmental disabilities were taught to request six snack items. Requesting involved giving a graphic symbol to the trainer in exchange for the matching snack item. Following acquisition, we assessed the correspondence between requests and subsequent item selections by requiring the student to select the previously requested snack item from an array containing all six items. The effects of acquisition training were evaluated in a multiple-probe across subjects design. Acquisition was achieved in from 9 to 29 trials per item. Following acquisition, Jason showed a high level of correspondence between requesting and selecting, but Ryan required additional training to achieve correspondence. These data support the use of exchange-based communication systems, but suggest that some students may require explicit correspondence training.

81. Sigafos, J., Green, V., Payne, D., Son, S., O'Reilly, M. & Lancioni, G. (2009). A comparison of picture exchange and speech-generating devices: acquisition, preference, and effects on social interaction. *Augmentative and Alternative Communication, 25, 99-109.*

Abstract: Augmentative and alternative communication (AAC) includes picture exchange (PE) and speech-generating devices (SGD), but these two systems have rarely been compared. We therefore conducted three studies comparing PE and SGD for an adolescent boy with a developmental disability. Study 1 compared acquisition of a PE- and SGD-based requesting response and monitored the effects on social interaction. For Study 2, both communication modes were made simultaneously available and the child could choose to use either PE or the SGD. For Study 3, only PE intervention continued, with the distance between the child and trainer systematically increased to prompt social interaction. The results showed equally rapid acquisition of the PE- and SGD-based requesting response, but only the distancing manipulation had any positive effect on social interaction. We conclude that PE and SGD are equally viable modes of communication, but acquisition of an initial PE- or SGD-based requesting response may not be sufficient to promote social interaction.

82. Simon, E., Whitehair, P., & Toll, D. (1996). A case study: Follow-up assessment of facilitated communication. *Journal of Autism & Developmental Disorders*, 26 (1), 9-18.

Abstract: A 6-month follow-up of an individual reported to engage in validated facilitated communication (FC) is presented. Three main issues are addressed: the current status of the individual's FC use, the effect of food reinforcers on his communicative ability, and a comparison of FC to the Picture Exchange Communication System (PECS). Results indicated that the individual did not engage in any validated FC, that performance was equivalent on food and nonfood trials, and that PECS was the preferred mode of communication, yielding 100% accuracy in a message-passing, object identification task. Implications of these findings are discussed in the context of an individual's right to communicate by objectively validated methods. (www.springerlink.com/content/104757)

83. Stahmer, A. & Ingersoll, B., (2004). Inclusive programming for toddlers with autism spectrum disorders: Outcomes from the Children's Toddler School. *Journal of Positive Behavior Interventions*, 6, 67-84.

Abstract: The passage of the Individuals with Disabilities Education Act of 1990 mandated the provision of interventions for young children with autism spectrum disorders (ASD) under the age of 3 years. Although Strain, McGee, and Kohler (2001) suggested that children with autism benefit from inclusive programming, inclusive early intervention programs are rare. In the current study, the authors used a quasi-experimental design to analyze the outcomes for 20 young children with ASD in an inclusive program for children under age 3. Both outcomes on standardized assessments and functional outcomes were compared at program entry and exit. Significant increases in standard scores were found for the standardized assessments from intake to exit, with 37% of the children functioning in the typical range at exit, compared to 11% at entry. Significant improvements in performance on functional measures were also seen. At intake, 50% of the study participants had no functional communication skills, whereas at exit, 90% used a functional communication system. Social and play behaviors also increased substantially. Use of augmentative communication systems and a combination of research-based programming are discussed. (NOTE: see pages 76-77 in particular re: PECS- "Two of the children on the PECS system began to use spoken language consistently, and they discontinued use of the PECS system. The use of an augmentative system thus did not appear to impair the acquisition of spoken language for these children, as has been previously suggested (McGee et al., 1999).")

84. Stoner, J., Beck, A., Bock, S., Hickey, K., Kosuwan, K., & Thompson, J. (2006). The effectiveness of the Picture Exchange Communication System with nonspeaking adults. *Remedial and Special Education*, 27, 154-165.

Abstract: *Picture Exchange Communication System* (PECS) training was implemented with 5 nonspeaking adults with mental retardation who were not currently using any type of functional communication system. A modified ABAB, single-subject design was used to assess the effectiveness of PECS in enhancing the functional communication skills of these individuals. Three individuals progressed through 4 PECS training phases relatively quickly and developed functional skills that they were able to display in home and community settings. Two other individuals demonstrated limited progress, and the PECS training did not meaningfully alter their level of communicative competence. Implications for teaching functional communication skills to nonspeaking adults are discussed, and recommendations for future research are provided.

85. Sulzer-Azaroff, B., Hoffman, A., Horton, C., Bondy, A., & Frost, L. (2009). The Picture Exchange Communication System (PECS): What Do the Data Say? *Focus on Autism*, 24, 89-103.

Abstract: Originally designed to enable young children with autism lacking functional communication to initiate requests and to describe what they observed, the Picture Exchange Communication System (PECS) has been the subject of an ever-expanding body of research and development. Thirty-four peer-reviewed published reports on PECS are analyzed in this article with documentation of research questions, methodology, and results. Findings suggest that PECS is providing people around the globe who have no or impaired speech with a functional means of communication. Refinements in methodology and additional questions that might be addressed in future research are discussed.

86. Tien, K-C. (2008). Effectiveness of the Picture Exchange Communication System as a functional communication intervention for individuals with Autism Spectrum Disorders: A practice-based research synthesis. *Education and Training in Developmental Disabilities, 43, 61-76.*

Abstract: This research synthesis verifies the effectiveness of the Picture Exchange Communication System (PECS) for improving the functional communication skills of individuals with autism spectrum disorders (ASD). The research synthesis was focused on the degree to which variations in PECS training are associated with variations in functional communication outcomes (Dunst, Trivette & Cutspec, 2002). The communication consequences of PECS were examined in 13 studies, which included 125 participants with ASD who had been identified as having limited or no functional communication skills. Claims that PECS is an effective intervention for improving functional communication skills appeared to be supported by the available research evidence.

87. Tincani, M. (2004). Comparing the Picture Exchange Communication System and sign language training for children with autism. *Focus on Autism and Other Developmental Studies, 19, 152-163.*

Abstract: This study compared the effects of Picture Exchange Communication System (PECS) and sign language training on the acquisition of mands (requests for preferred items) of students with autism. The study also examined the differential effects of each modality on students' acquisition of vocal behavior. Participants were two elementary school students with autism enrolled in a suburban public school. Training sessions involved presentations of preferred items, prompting and prompt fading procedures. Probes were conducted to evaluate the generalization of learned mands to classroom teachers. For one participant, sign language training produced a higher percentage of independent mands. PECS training produced a higher percentage of independent mands for the other participant. For both participants, sign language training produced a higher percentage of vocalizations during training. Mands learned with the experimenter generalized to classroom teachers. The results of the study suggest that acquisition of picture exchange and sign language may vary as a function of individual student characteristics, specifically, motor imitation skills prior to intervention. However, further research is needed to determine the optimal procedures for teaching both modalities to students with communication difficulties. (<http://www.proedinc.com>)

88. Tincani, M., Crozier, S. & Alazetta, L. (2006). The Picture Exchange Communication System: Effects on manding and speech development for school-aged children with autism. *Education and Training in Developmental Disabilities, 41, 177-184.*

Abstract: We examined the effects of the Picture Exchange Communication System (PECS; Frost & Bondy, 2002) on the manding (requesting) and speech development of school-aged children with autism. In study 1, two participants, Damian and Bob, were taught PECS within a delayed multiple baseline design. Both participants demonstrated

increased levels of manding after implementation of PECS. Only Damian demonstrated any measurable speech during study 1. His speech development occurred primarily during phase IV of PECS. Because of the positive relationship between Phase IV and increased speech for Damian, study 2 was conducted to confirm a functional relationship between phase IV procedures and speech development for an additional participant. Carl received phase IV training procedures in two conditions, administered in an ABAB design. In condition A, no reinforcement was provided for vocalization; in condition B, reinforcement was provided for vocalization after a delay of 3- to 5-s. The vocal reinforcement procedures in phase B differentially increased Carl's speech. Results are discussed in terms of research on augmentative and alternative communication and speech development for children with autism.

89. Tincani, M. & Devis, K. (2010). Quantitative synthesis and component analysis of single-participant studies on the Picture Exchange Communication System. *Remediation and Special Education (Online First)*, 1-13.

Abstract: The *Picture Exchange Communication System* (PECS) has emerged as the augmentative communication intervention of choice for individuals with autism spectrum disorder (ASD), with a supporting body of single-participant studies. This report describes a meta-analysis of 16 single-participant studies on PECS with percentage of nonoverlapping data (PND) as the metric of effect size. Results suggest that PECS was moderately effective in establishing mands (PND = 80.1) for 41 participants up to Phase IV of the system. Higher levels of manding were found when PECS was taught to individuals without ASD diagnoses versus those with ASD diagnoses and in single settings versus multiple settings; however, these differences were not statistically significant. For a smaller subset of participants for whom vocalizations were recorded, PECS appeared to facilitate speech, though considerable variability in speech acquisition was evident. While these results support PECS as an evidenced-based communication intervention, they indicate that more research is needed on speech with PECS, to establish the efficacy of PECS when implemented across settings and communicative partners, and to confirm efficacy of Phases IV, V, and VI.

90. Travis, J. & Geiger, M. (2010). The effectiveness of the Picture Exchange Communication System (PECS) for children with autism spectrum disorder (ASD): A South African pilot study. *Child Language Teaching and Therapy*, 26, 39-59.

Abstract: This study investigated the effects of introducing the Picture Exchange Communication System (PECS) on the frequency of requesting and commenting and the length of verbal utterances of two children with autism spectrum disorder (ASD) who presented with some spoken language, but limited use of language in communicative exchanges. A mixed research design was used, including a quantitative component — a single-subject multiple-baseline design (MBD) across three behaviours, repeated with two participants — and a qualitative component. Data was collected in the PECS pre-training, training, post-training and follow-up stages, in both structured and unstructured settings. The quantitative data was visually represented and analysed to determine the effectiveness of the PECS. The qualitative component investigated the impact of the PECS on other areas (e.g. communication profile, speech complexity and pragmatic skills), and included parent and educator perspectives. Both participants benefited from the introduction of PECS. The findings indicated highly effective treatment for requesting and mixed results for commenting and length of verbal utterances. There were considerable increases in intentional communicative acts (ICAs) for both participants, with marked increases in requesting (function) and the development of forms of communication (from augmentation of speech with pictures to speech only utterances). Clinical, educational and research implications were raised.

91. Webb, T. (1999). Look who's talking! *Special Children*, April/May.

Abstract: The author who is a teacher at Avalon Special School, Street, Somerset, introduced PECS to a class of 6, 4/5 year old children, with severe communication difficulties, and of whom 5 have autistic spectrum disorders. The work started mid-September 1998 and within weeks all children who were previously at a pre-verbal level, were verbalising, and now five months on are using spoken language to communicate spontaneously with and without the use of symbols/words.

92. Webb, T. (2000a) Can children with autism be taught to communicate using PECS? *Good Autism Practice (GAP)*, 1, 29-43.

Abstract: This paper reports one of the first studies to be conducted in the UK on the impact of PECS on children with an autism spectrum disorder and severe learning difficulties. Teresa Webb is a teacher at a special school for children with severe and multiple learning difficulties. In September 1998, she introduced PECS to a class of six children aged between 4 and 6 years. All, but one, had an ASD and all had severe communication difficulties. In her opinion, PECS has had a major effect on the children's skills and behaviour and has also influenced how staff work. The parents too report big improvements in their child's communication skills and visitors to the school have been impressed by what they see. Clearly, the conclusions that can be drawn from the study are limited in that there was no comparison group of children who did not receive PECS or who were engaged in a different intervention and so further research is required.

<http://www.corelearning.co.uk/gap/index.asp>

93. Webb T (2000b) The talking goes on - The Picture Exchange Communication System. *Special Children*, June/July 2000.

Abstract: This article reviews the progress of a group of children 19 months after being introduced to PECS which was reported in *Special Children* 1999. The group have progressed from using 3-5 word sentences incorporating attributes to spontaneously requesting and commenting both with and without PECS. As speech developed the teacher continued to use PECS as a framework for teaching further communicative functions and a range of curriculum subjects. The familiar framework enabled the assimilation of new concepts and ideas more easily, and they were able to ask and respond to a range of questions. They progressed to more advanced requesting and commenting lessons and used the conjunction 'and' and the indefinite article 'a' within 13 word sentences. There was increasing evidence of generalisation as the taught structures were used spontaneously at home, which underlines the importance of ensuring the same vocabulary is available in all environments. Gradually, the children were observed using commenting spontaneously both with and without PECS, and the skill extended into narrative and description. The author used PECS right across the day, which enabled language to be integrated with the social and environmental context and enabled the mapping of language onto experiences. The development of functional communication impacted on reducing contextually inappropriate behaviours. In fact it also raised the question of whose behaviour changed the most, the children's or the staff? Staff found that by using PECS they could eliminate prompts, allow time to observe, facilitate children to respond and self-correct, and as a result peer interaction and independence was able to develop.

94. Webb, T., Baker, S. & Bondy, A. (2005). Picture Exchange Communication System. In L. Wankoff (Ed.) *Innovative Methods in Language Intervention*. (pp. 111-139). Austin, TX: Pro-Ed Inc.

Abstract: Book chapter, based on work by Teresa Webb and Sue Baker in a class in the UK.

95. Wood, A. L. Luiselli, J. K. Harchik, A. E. (2007). Training Instructional Skills With Paraprofessional Service Providers at a Community-Based Habilitation Setting. *Behavior Modification*, 31, 847-855.

Abstract: The present study evaluates a training program with paraprofessional service providers at a community-based habilitation setting. Four staff were taught to implement alternative and augmentative communication instruction with an adult who had autism and mental retardation through a combination of instruction, demonstration, behavior rehearsal, and performance feedback. Training was conducted under natural conditions at the adult's group home residence. Three of the four staff were able to maintain near-100% instructional accuracy following initial training. The results add to the limited research literature concerning community-based training of direct-care personnel.

96. Yoder, P. & Lieberman, R. (2010). Brief Report: Randomized Test of the Efficacy of Picture Exchange Communication System on Highly Generalized Picture Exchanges in Children with ASD, *Journal of Autism and Developmental Disorder*, 40, 629-632.

Abstract: A randomized control trial comparing two social-communication interventions in young children with autism examined far-transfer of the use of picture exchange to communicate. Thirty-six children were randomly assigned to one of two treatment conditions, one of which was the Picture Exchange Communication System (PECS). All children had access to picture symbols during assessments. Post-treatment measurement of the number of picture exchanges in a far-transfer, assessment context favored the PECS intervention. These findings were interpreted as support for the hypothesis that the PECS curriculum can successfully teach a generalized means of showing coordinated attention to object and person without requiring eye contact to children with ASD.

97. Yoder, P. & Stone, W. (2006). Randomized comparison of two communication interventions for preschoolers with autism spectrum disorders. *Journal of Consulting and Clinical Psychology*, 74, 426-35.

Abstract: This randomized group experiment compared the efficacy of 2 communication interventions (Responsive Education and Prelinguistic Milieu Teaching [RPMT] and the Picture Exchange Communication System [PECS]) in 36 preschoolers with autism spectrum disorders. Each treatment was delivered 3 times per week, in 20-min sessions, for 6 months. The results revealed that the RPMT facilitated the frequency of generalized turn taking and generalized initiating joint attention more than did the PECS. The latter effect occurred only for children who began treatment with at least some initiating joint attention. In contrast, the PECS facilitated generalized requests more than the RPMT in children with very little initiating joint attention prior to treatment. These effect sizes were large.

98. Yoder, P. & Stone, W. (2006). Randomized comparison of the effect of two prelinguistic communication interventions on the acquisition of spoken communication in preschoolers With ASD. *Journal of Speech, Language, and Hearing Research*, 49, 698-711.

Abstract: This randomized group experiment compared the efficacy of 2 communication interventions (Responsive Education and Prelinguistic Milieu Teaching [RPMT] and the Picture Exchange Communication System [PECS]) on spoken communication in 36 preschoolers with autism spectrum disorders (ASD). Each treatment was delivered to

children for a maximum total of 24 hr over a 6-month period. Spoken communication was assessed in a rigorous test of generalization at pretreatment, post-treatment, and 6-month follow-up periods. PECS was more successful than RPMT in increasing the number of nonimitative spoken communication acts and the number of different nonimitative words used at the post-treatment period. Considering growth over all 3 measurement periods, an exploratory analysis showed that growth rate of the number of different nonimitative words was faster in the PECS group than in the RPMT group for children who began treatment with relatively high object exploration. In contrast, analogous slopes were steeper in the RPMT group than in the PECS group for children who began treatment with relatively low object exploration.

99. Yokoyama, K., Naoi, N., & Yamamoto, J. (2006). Teaching verbal behavior using the Picture Exchange Communication System (PECS) with children with autistic spectrum disorder. *Japanese Journal of Special Education, 43, 485-503.*

Abstract: The Picture Exchange Communication System (PECS) is widely used with non-verbal children with autistic disorders as an Augmentative and Alternative Communication (AAC). Most of the participants in prior research on that method, although referred to as non-verbal, had initial vocal repertoires of at least a few words. The purpose of the present study was to examine whether 3 elementary-school-age children with autistic disorders whose vocal repertoires were severely limited, such as only a few phonemes, could acquire elementary communication skills using PECS. The present study incorporated task analysis, in which a sequence of picture-exchanging behaviors was divided into 4 components. The results demonstrated that all 3 children acquired the basic components of PECS within a short period. Data from the task analysis revealed that, with increased use of PECS, their prior mode of communication (grabbing, reaching, or crying) was gradually replaced, thereby indicating the reinforcing value embedded in PECS. In addition, the present data suggest that PECS training produced collateral behavioral changes, such as an emergence of intelligible vocalization, even in students who had previously had severely limited vocal repertoires.

100. Ziomek, M. & Rehfeldt, R.A. (2008) Investigating the acquisition, generalization, and emergence of untrained verbal operants for mands acquired using the Picture Exchange Communication System in adults with severe developmental disabilities. *The Analysis of Verbal Behavior, 24, 15-30.*

Abstract: This study compared the total amount of training time and total number of trial blocks for individuals with severe developmental disabilities to acquire mands under control of unconditioned establishing operations and mands under control of transitive conditioned establishing operations for manual sign and for the Picture Exchange Communication System (PECS). Also examined was the generalization of mands across settings and communicative partners, as well as the emergence of untrained tacts and intraverbals for mands acquired using PECS. Mands for preferred items and for items needed to complete a chained task were acquired more rapidly and in fewer training blocks for PECS than for manual sign. Moreover, mands established using PECS generalized across settings and communicative partners. Finally, untrained tacts and intraverbals using PECS were shown to emerge for some of the participants following PECS training. These results suggest that PECS may be a viable alternative communication system for adults with severe developmental disabilities who have little or no history of systematic instruction and limited imitative repertoires.

See also:

Mirenda, P. (2003). Toward functional augmentative and alternative communication for students with autism: Manual signs, graphic symbols, and voice output communication aids. *Language, Speech, and Hearing Services in Schools, 34, 203-216.*

Abstract: Many individuals with autism are candidates for augmentative and alternative communication (AAC) systems, either to supplement (i.e., augment) their existing speech or to act as their primary (i.e., alternative) method of expressive communication. The purpose of this article is to summarize research and directions for future research with regard to two questions related to the delivery of AAC supports to these individuals: (a) What AAC modality is preferable to use? and (b) What do we know about the use of voice output communication aids with people with autism? (<http://www.asha.org>)