

EBP *briefs*

A scholarly forum for guiding evidence-based practices in speech-language pathology

COMPARING EVIDENCE-BASED INTERVENTIONS
FOR TODDLERS WITH AUTISM SPECTRUM DISORDERS

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Structured Abstract

Clinical Question: Would a minimally verbal toddler with an autism spectrum disorder (ASD) benefit more from implementation of the *Picture Exchange Communication System*® (PECS®) or *Pivotal Response Treatment*® (PRT®) to increase communication initiations of his wants/needs?

Method: Literature review of evidence-based practice (EBP) Intervention Comparisons

Sources: ASHA National Center for Evidence-Based Practice (N-CEP) in Communication Disorders, National Professional Development Center on Autism Spectrum Disorders, Google Scholar

Search Terms: early intervention, PECS AND early intervention AND ASD; Pivotal Response Treatment AND early intervention AND ASD

Number of Studies Included: 7

Primary Results: PECS was identified as an emerging evidence-based practice on the N-CEP website and as an evidence-based practice on the National Professional Development Center on Autism Spectrum Disorders website. Implementation of PECS yielded significant increases in requests and/or initiations in two of the four studies.

PRT was identified as an evidence-based practice on the N-CEP and the National Professional Development Center on Autism Spectrum Disorders websites. Implementation of PRT resulted in significant increases in verbal initiations and/or functional verbal utterances in all three studies.

Conclusion: PECS and PRT are appropriate for increasing communication initiations in toddlers with ASD. Because PRT has been consistently categorized as an evidence-based practice and large effect sizes have been noted across research studies, it appears to be a more effective intervention than PECS for increasing initiations, requests, and/or functional verbal utterances in toddlers with ASD.

Comparing Evidence-Based Interventions for Toddlers with Autism Spectrum Disorders

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Clinical Scenario

Kathy is a seasoned speech-language pathologist who has worked extensively with preschool and school-age children who have autism spectrum disorders (ASD). She recently moved into a new position in which her caseload changed from only providing services to children in preschool to providing early intervention services to preschoolers and a small number of toddlers. One of the toddlers is Douglas, a 2-year 10-month-old boy with ASD who Kathy sees twice a week for 45 minutes (each session) in his home. Douglas' parents report that he has approximately 30 words in his expressive vocabulary that he uses inconsistently. For example, he spontaneously used the word "cat" to label the family cat a month ago, but has not used the word since. Douglas' main forms of communication are leading a person to desired objects or having a tantrum until he gets what he wants. His parents report that they rely on "playing a guessing game" in which they offer him objects until they get to the one that he seems to want. As a result, they have begun to try to anticipate his wants and needs. Douglas's parents report increased frustration with his inability to communicate his wants and needs, and that Douglas also appears to be increasingly frustrated as evidenced by an increase in problem behaviors such as tantrums. The speech and language goal in Douglas' Individualized Family Service Plan (IFSP) focuses on increasing his ability to communicate wants and needs to his parents.

Kathy has successfully used the *Picture Exchange Communication System*® (PECS®) with many of her preschool clients to increase communication initiations and decrease problem behaviors. She has not used the PECS program with a child as young as Douglas and is unsure if PECS or a treatment that targets spoken language development, such as *Pivotal Response Treatment*® (PRT®), would be more appropriate.

Background

ASD is a neurodevelopmental disability characterized by impairments in communication and social interaction in the presence of restricted, repetitive behaviors (American Psychological Association, 1994). The prevalence of ASD is reported to be approximately 1:50 for children ages of 6–17 years old, and occurs more often in boys than girls (Blumberg et al., 2013). Expressive language delays are commonly reported in young children with ASD (e.g., Ellis Weismer, Lord, & Esler, 2010; Paul, Chawarska, Cicchetti, & Volkmar, 2008). Parent report indicates that speech and language intervention is the one of the most commonly used interventions (Green et al., 2006). Early intensive behavioral intervention yields substantial improvements across multiple domains, including language, for a "large subset" of children with ASD (Dawson, 2008 p., 789). The National Research Council recommends that children with ASD receive a minimum of 25 hours per week of intensive intervention. Active family involvement also has been identified as a critical component of intervention (NRC, 2001).

A variety of interventions target early communication in children with ASD. Two interventions that focus on increasing communication initiations are PECS® and PRT®. Although other interventions that focus on early communication were options, Kathy chose to compare PECS and PRT because of the focus on initiations across treatments. PECS is used to teach children to use an alternative communication system (i.e., pictures) to communicate (Frost & Bondy, 1994), whereas PRT focuses on teaching children verbal language (Koegel & Koegel, 2006). Both treatments may be implemented by parents (Chaabane, Alber-Morgan, DeBar, 2009; Koegel et al., 1999; Park, Alber-Morgan, & Cannella-Malone, 2010), which enables them to be actively involved in the interventions. In addition to actively involving the family, parent implementations increase the intensity of the treatment, which should help maximize treatment outcomes.

PECS is a pictorial augmentative and alternative communication program that focuses on teaching children to initiate communication using natural reinforcers (Frost & Bondy, 1994). PECS targets the social-communication skills of individuals with ASD by providing a communication system that is “analogous” to spoken communication. Individuals with ASD learn to request desired items (e.g., cookies) by presenting an icon of the desired item (e.g., a picture of cookies) to their communication partner. The communication partner may use gestures and words in reference to the desired object to support communication development. Through PECS training children learn that they can exchange symbols for desired items, thus teaching children to initiate goal-directed nonverbal communication. Providing children with a communication system influences other communication behaviors. Researchers have reported increased vocalizations, increased social initiations, and decreased problem behaviors in individuals using PECS (for a review Simpson & Ganz, 2012). PECS consists of a six phase training program that begins with teaching the child to physically exchange the picture to request a desired item or event and ends with teaching the child to comment using the pictures. Although there is no formal assessment to determine for whom PECS training is appropriate, researchers have reported that “PECS® training is most suitable for an individual who lacks a functional communication system and/or has limited expressive language” (Simpson & Ganz, 2012, p. 257; Yoder & Stone, 2006).

PRT is designed to teach language to individuals with ASD by targeting pivotal areas including motivation, responding to multiple cues, self-management, and self-initiations. This intervention is based on the theoretical framework that targeting “pivotal” areas leads to changes in skills/domains that are not specifically targeted. PRT® creates opportunities for the child to learn and then practice target skills across routines that occur within the child’s environment. Parents are taught to provide communication opportunities around the child’s interests, respond to the child’s attempts, and use natural reinforcers that are directly related to the child’s communication. Tapping into the child’s interests increases the likelihood that he/she will engage in the teaching activity and communicate (Bruinsma & McNeerney, 2012). For example, if a child is interested in bubbles, the parent can blow bubbles and, after they have popped, wait for the

child to request more bubbles. Any reasonable attempt to initiate a request for more bubbles including gestures, vocalizations, or alternating eye gaze should be reinforced. The parent may add to the child’s request by using gestures and words to reference the item that the child has requested. Focusing on teaching self-initiation through motivating activities promotes the development of joint attention, gestures, language, social skills, and pragmatics (Koegel, Koegel, & McNeerney, 2001). Like PECS, there is no formal assessment available to determine the appropriateness of PRT. Researchers have reported that PRT worked well with children who had a moderate-to-high interest in toys, were able to tolerate another person nearby, and had low-to-moderate rates of nonverbal stereotype and moderate-to-high rates of verbal self-stimulatory behavior (Bruins & McNeerney, 2012, p., 281).

Clinical Question

Kathy used the PICO (population, intervention, comparison, and outcome) framework (adopted by the American Speech and Hearing Association) to develop the following clinical question:

- P**—Would a minimally verbal toddler with ASD
- I**—benefit more from implementation of the Picture Exchange Communication System (PECS)
- C**—or Pivotal Response Training (PRT)
- O**—to increase communication initiations of his wants/needs?

Search for Evidence

Kathy began her search with two high-yield resources: ASHA’s National Center for Evidence-Based Practice (N-CEP) in Communication Disorders and the National Professional Development Center on Autism Spectrum Disorders. The N-CEP summarizes and rates high-quality clinical practice guidelines and systematic reviews. Each treatment is categorized as emerging or established. The National Professional Development Center website provides EBP briefs that include an overview of the intervention, step-by-step instructions for implementation, an implementation checklist, and the evidence base, which provides a list of references and summarizes the evidence used by researchers to determine that a particular treatment met criteria for an evidence-based practice.

Kathy used the following inclusion/exclusion criteria in her search to limit articles to those most relevant to her clinical question:

- Research articles published in peer-reviewed journals that used experimental, quasi-experimental group, or single-subject research designs
- Studies with children less than 5 years old
- Intervention included PECS® or PRT®
- Outcomes measures included requesting, communication initiations, and/or functional verbal utterances

Because the N-CEP and the National Professional Development Center on Autism Spectrum Disorders reviewed articles prior to 2008, Kathy limited her database search to articles published after 2008. After completing her database search, she revisited the N-CEP and National Professional Development Center on Autism Spectrum Disorders websites to identify articles published prior to 2008 that were relevant to her clinical question. Using this search strategy, Kathy was able to optimize the limited time she had to spend looking through databases and to ensure that she identified all the articles relevant to her review.

Evaluating the Evidence

On the N-CEP website, PECS® was categorized as an emerging treatment and PRT® was categorized as an established intervention. According to the National Professional Development Center on Autism Spectrum Disorders, both interventions qualified as an evidence-based practice. In the studies that qualified as evidence for PECS, the youngest research participant was 3 years old. In the studies that qualified as evidence for PRT, the youngest participants were 2 years old.

Kathy used the Critical Appraisal of Treatment Evidence (CATE; Dollaghan, 2007) to evaluate the quality of the research articles. CATE is a structured set of questions that are used to guide critical appraisal of the articles. A variety of variables including the experimental design, whether coders were blind to condition, statistical significance, and the importance of the finding (effect size, social validity, maintenance) are considered. Kathy created a summary table to summarize the quality (see Table 1).

Seven studies published between 2006 and 2012 met criteria for inclusion. All the studies included children less than five years old who had been diagnosed with ASD or PDD-NOS. Four studies used PECS and three used PRT. Using a changing criterion single-subject research design, Jurgens, Anderson, & Moore (2009) investigated the use of PECS with a boy, 3;7. All of the intervention sessions were conducted in the home. The PECS intervention consisted of a 20-minute training session followed by a 15-minute free-play observation. The intervention was conducted three to five times per week for a total of 21 sessions. Requests made verbally or with PECS were measured at baseline and throughout the training period (post-treatment outcomes were not assessed for maintenance). The participant demonstrated increases in PECS and verbal requests, as measured during free-play. Kathy calculated the percentage of non-overlapping data (PND) to determine the effect size. His verbal request increased from 0 to 2.6 (PND = 5%). His PECS requests were variable starting at 0 and ending at 0 (PND = 0%). The PNDs reflect an unreliable treatment (Scruggs, Mastropieri, Cook, & Escobar, 1986).

The participants in the study by Lerna, Esposito, Conson, Russo and Massagli (2012), were children between 18 and 60 months old who had participated in a structured teaching program for 12 hours per week. All the intervention was implemented in the teaching program. Children were assigned to receive PECS (the first four phases were implemented) or conventional language therapy. Both interventions were provided for 30 minutes, three times a week over the course of 6 months, for a total of 72 sessions. Requests and initiations were coded during an unstructured free play session pre- and immediately post-intervention (post-intervention outcomes were not measured for maintenance). Raters achieved good reliability coding. At post-test, the children in the PECS group demonstrated significantly more requests and initiations than the children in the conventional language therapy group ($p < .05$).

Park, Alber-Morgan, and Cannella-Malone (2011) studied three children younger than 3 years old with ASD. The children's mothers were trained to implement PECS. The researchers used a changing criterion design, requiring the children to achieve an 80% criterion level for all of the steps in a training phase before starting the next one. Independent vocalizations were coded at baseline and post-treatment. The study reported high inter-observer agreement levels. All of the children started

at 0% at baseline and were independently making requests via PECS at least 97.5% of the time. Visual analysis indicated that the children maintained these levels of requesting after treatment ended. The PND for child two was 85%, which reflects a fairly effective treatment, and was 100% for child one and child three, which reflects a highly effective treatment (Scruggs et al., 1986).

Yoder and Stone (2006) used a randomized control-trial study to compare the efficacy of PECS and Responsive Education and Prelinguistic Milieu Teaching. All 36 participants had a diagnosis of ASD or PDD-NOS, were between 18–60 months old, and used fewer than 10 words. Children were seen three times a week for 20 minutes over the course of 6 months, for a total of 72 sessions. The interventionists regularly met with the parents to “demonstrate and discuss ways for promoting PECS use outside of the therapy room.” (p. 429). Requesting was coded during the Early Social Communication Scale, pre- and post-treatment. The PECS group did not demonstrate a significant increase in their requesting after adjusting for initial group differences. Because means and standard deviations at post-test were not provided, effect sizes could not be calculated.

Vernon, Koegel, Dauterman, and Stolen (2012) examined the effects of PRT on functional verbal utterances. Three children between 2 and 4 years old who had been diagnosed with ASD participated in the study. They compared the effect of PRT with embedded social consequences to baseline performance. Parents were trained on how to embed social interaction into “child-preferred non-social interests,” such as bouncing on the trampoline with the child when the child says “jump,” rather than having the child jump alone. High reliability was achieved for all of the coded variables. All three children demonstrated increases in verbal initiations with large effect sizes ($d > 1$).

Nefdt, Koegel, Singer, and Gerber (2009) used a randomized-control study to examine the effectiveness of PRT compared to a control group. All of the children had a diagnosis of ASD and were age 60 months or younger. Parents participated in a self-directed learning program designed to teach them key components of PRT. Although the researchers were focused on parent outcomes, they measured children’s functional verbal utterances pre-and post-treatment. Appropriate levels of inter-observer agreement were achieved. The children in the treatment group demonstrated significantly more

functional verbal utterances than the control group ($p < .01$) and the effect size was large ($d = .95$).

Coolican, Smith, and Bryson (2010) used a single-subject research design to examine the effectiveness of PRT. There were eight participants in total. Each child had a diagnosis of ASD and was under the age of five. Parents were seen for three individual training sessions that lasted for two hours. Functional verbal utterances were assessed pre- and post-treatment and maintenance was assessed 2 to 4 months post-treatment. High levels of inter-observer agreement were achieved. Overall, there was a significant increase in functional verbal utterances ($p < .05$), with a large effect size ($d = 1$). These changes were maintained post-treatment.

In each of the studies, the researchers clearly articulated the study rationale and used either a control group or control condition (baseline). Most aspects of the treatment including the participants and intervention implementation were clearly defined, and studies measured either generalization and/or maintenance. Kathy examined the effect sizes to determine the effectiveness of the intervention. Overall, Kathy concluded that her search yielded moderate- to high-quality research that would be appropriate to use in making her clinical decision.

The Evidence-Based Decision

Kathy undertook this review to determine if a toddler with ASD would demonstrate greater improvement in communication initiations by using PECS or PRT. The seven studies that Kathy examined contained outcome measures for requests, initiations, or functional verbal utterances. The evidence suggests that both interventions may increase initiations in young children with ASD. The N-CEP and the National Professional Development Center on Autism Spectrum Disorders categorized PECS as an emerging evidence-based practice. Two of the four studies that investigated the efficacy of PECS demonstrated an increase in requesting (Lerna et al., 2012; Park et al., 2011). For one single-subject research design study, the PND reflected an unreliable treatment (Jurgens et al., 2009) and for the randomized control trial there was not a significant increase in requesting for the PECS group (Yoder & Stone, 2006). PRT was categorized as an evidence-based practice by N-CEP and the National Professional Development Center on Autism Spectrum Disorders. The three studies that met Kathy’s criteria

comprised two single-subject research designs and one randomized control trial. Significant increases in initiations and functional verbal utterances were reported across all three studies. These changes were further substantiated by large effect sizes.

After reviewing the evidence, Kathy concluded that both treatments may increase initiations, requests, and/or functional verbal utterances. The majority of studies were primarily single-subject research designs, which limited her ability to generalize findings among the larger ASD population, and more specifically, to her client. However, Kathy concluded that the evidence documenting the effectiveness of PRT was more substantial than PECS. She based her conclusion on the findings that PRT was categorized as evidence-based across both N-CEP and the National Professional Development Center on Autism Spectrum Disorders. PRT also consistently yielded significant increases in functional verbal utterances or requests with large effect sizes across research studies (Coolican et al., 2010; Nefdt et al., 2010; Vernon et al., 2012). Based on the evidence, Kathy concluded that PRT would be the intervention of choice for the client.

References

- American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4th ed., Rev.). Washington DC: Author.
- American Speech-Language-Hearing Association (n.d.). *Evidence-based practice* (EBP). Retrieved from <http://www.asha.org/members/ebp/>.
- Blumberg, S. J., Bramlett, M. D., Kogan, M. D., Schieve, L. A., Jones, J. R., & Lu, M. C. (2013). Changes in prevalence of reported autism spectrum disorder in school-aged U.S. children: 2007 to 2011-2012. *National Health Statistics Report*, 65, 1–11.
- Bondy, A. S., & Frost, L. A. (1994). The picture exchange communication system. *Focus on Autism and Other Developmental Disabilities*, 9, 1–19.
- Bruinsma, Y., & McNerney, E. K. (2012). Pivotal Response Treatment. In R. McCauley, M. Fey, A. Kahmi, & E. Carter (Eds.) *Treatment of autism spectrum disorders: Evidence-based intervention strategies for communication and social interactions* (pp. 281–312). Baltimore, MD: Paul H. Brooks.
- Coolican, J., Smith, I. M., & Bryson, S. E. (2010). Brief parent training in pivotal response treatment for preschoolers with autism. *The Journal of Child Psychology and Psychiatry*, 51, 1321–1330.
- Dawson, G. (2008). Early behavioral intervention, brain plasticity, and the prevention of autism spectrum disorder. *Development and Psychopathology*, 20, 775–803.
- Dollaghan, C. (2007). *The handbook for evidence-based practice in communication disorders*. Baltimore, MD: Paul H. Brooks.
- Ellis Weismer, S., Lord, C., & Esler, A. (2010). Early language patterns of toddlers on the autism spectrum compared to toddlers with developmental delay. *Journal of Autism and Developmental Disorders*, 40, 1259–1273.
- Green, V., Pituch, K. A., Itchon, J., Choi, A., O'Reilly, M., & Sigafoos, J. (2006). Internet survey of treatments used by parents of children with autism. *Research in Developmental Disabilities*, 27, 70–84.
- Jurgens, A., Anderson, A., & Moore, D. W. (2009). The effect of teaching PECS to a child with autism on verbal behavior, play, and social functioning. *Behavior Change*, 26, 68–81.
- Koegel, R. L., & Koegel, L. K. (2006). *Pivotal response treatments for autism: Communication, social, and academic development*. Baltimore, MD: Paul H. Brookes.
- Koegel, R. L., Koegel, L. K., & McNerney, E. (2001). Pivotal areas in intervention for autism. *Journal of Clinical and Child Psychology*, 30, 19–32.
- Lerna, A., Esposito, E., Consont, M., Russo, L., & Massagli, A. (2012). Social-communicative effects of the Picture Communication Exchange System (PECS) in autism spectrum disorders. *International Journal of Language and Communication Disorders*, 47, 609–617.
- Nefdt, N., Koegel, R., Singer, G., & Gerber, M. (2010). The use of a self-directed learning program to provide introductory training in pivotal response treatment to parents of children with autism. *Journal of Positive Behavior Intervention*, 12, 23–32.

Park, J. H., Alber-Morgan, S. R., & 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.

Paul, R., Chawarska, K., Cicchetti, D., & Volkmar, F. (2008). Language outcomes of toddlers with autism spectrum disorders: a two year follow-up. *Autism Research, 1*, 97–107. doi: 10.1002/aur.12

Plavnick, J. B., Ferreri, S. J., Mannes, T. J., Maupin, A. N., Stewart, L. S., Goforth, A. N., Palmer, D., Sportsman, E. L., Carlson, J. S., & Oka, E. R. (2011). Experimental comparison of brief behavioral and developmental language training for a young child with autism. *Journal of Speech-Language Pathology and Applied Behavior Analysis, 5*, 35–41.

Park, J. H., Alber-Morgan, S. R., & 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.

Scruggs, T. E., Mastropieri, M. A., Cook, S. B., & Escobar, C. (1986). Early intervention for children with conduct disorders: A quantitative synthesis of single-subject research. *Behavioral Disorders, 11*, 260–271.

Simpson, R. L., & Ganz, J. B. (2012). Picture exchange communication system. In R. McCauley, M. Fey, A. Kahmi, & E. Carter (Eds.), *Treatment of autism spectrum disorders: Evidence-based intervention strategies for communication and social interactions* (pp. 255–280). Baltimore, MD: Paul H. Brookes.

Vernon, T. W., Koegel, R. L., Dauterman, H., & Stolen, K. (2012). An early social engagement intervention for young children with autism and their parents. *Journal of Autism and Developmental Disorders, 42*, 2702–2717.

Yoder, P. & Stone, W. L. (2006). Randomized comparison of two communication interventions for preschoolers with autism spectrum disorders. *Journal of Consulting and Clinical Psychology, 74*, 426–435.

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Allison Bean Ellawadi is an assistant professor at The Ohio State University. She received her bachelor of arts from Iona College (New York) and her master of science from New York Medical College in Speech-Language Pathology. During her clinical fellowship year at Westchester Institute for Human Development, Allison participated in the Leadership in Education and Neurodevelopmental Disabilities (LEND) training program. She completed her doctorate in Communication Sciences and Disorders at the University of Iowa in 2010, followed by a year of training at the University of Wisconsin–Madison. Allison teaches courses on Autism Spectrum Disorders, Introduction to Communication and Its Disorders, and Research Methods. Her research focuses on language development in individuals with autism spectrum disorders and the role of domain-general processes in language development. She has presented her work at national and international conferences.

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Figure 1. Search for Evidence

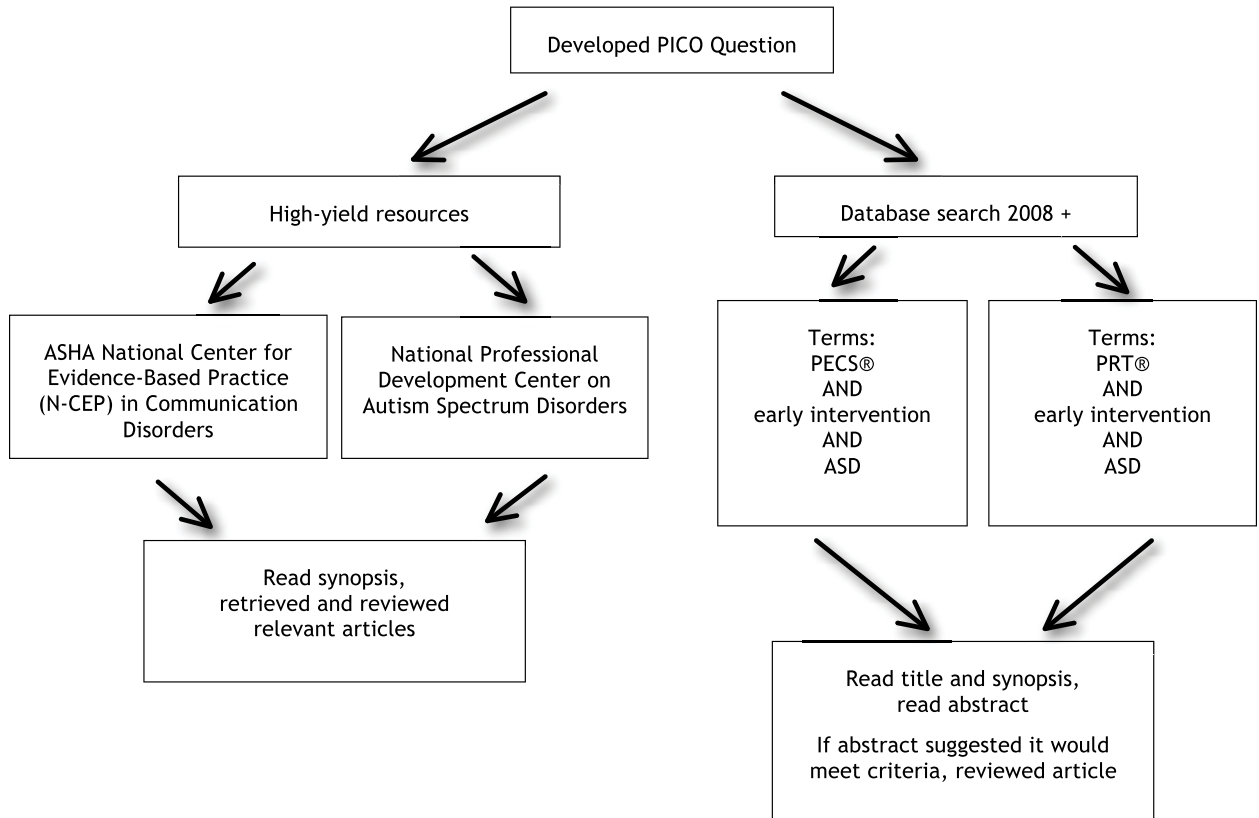


Table 1. Summary of articles included in review

Article	Study Design	Target Treatment	Comparison Treatment Or Condition	Participant Characteristics	Outcome Measures	Results	Effect Size
Jurgens, Anderson, & Moore (2009)	SSRD <i>N</i> = 1	PECS [®]	Baseline	Child 3:7 diagnosed with ASD	PECS requests, verbal requests	Verbal requests increased from baseline of 0 to 2.6 PECS requests were variable, started at baseline of 0 and remained at 0	PND = 5% PND = 0%
Lerna, Esposito, Conson, Russo, & Massagli (2012).	Semi-RCT (children assigned to intervention based on location) <i>N</i> = 18	PECS	Conventional language therapy	Children 18–60 months diagnosed with ASD, fewer than 5 words in expressive vocabulary	Requests, initiations	PECS demonstrated significantly more request and initiations	Requests $\eta_p = .23$ Initiations $\eta_p = .32$
Park, Alber-Morgan, & Cannella-Malone (2011)	SSRD <i>N</i> = 3	PECS	Baseline	Children 2:5–2:7 diagnosed with ASD or PDD-NOS	Independent picture exchanges, vocalizations	Large increase in independent picture exchanges. One child increased vocalizations to two words	Children 1 and 3 PND = 100% Child 2 PND = 85%
Yoder & Stone (2006)	RCT <i>N</i> = 36	PECS	Responsive Education and Prelinguistic Milieu Training	Children 18–60 mos. diagnosed with ASD or PDD-NOS, less than 10 words in expressive vocabulary	Requesting	PECS group did not demonstrate significant increases in requesting during the ESCS	Could not be calculated
Coolican, Smith, & Bryson (2010)	SSD <i>N</i> = 8	PRT [®]	Baseline	Children 2:4–4:8 diagnosed with ASD or PDD-NOS	Functional verbal utterances	Significant increase in functional verbal utterances after training	<i>d</i> = 1
Nefdt, Koegel, Singer, & Gerber (2010)	RCT <i>N</i> = 27	PRT	Wait-list control	Children < 60 mos. diagnosed with ASD, less than 20 functional words	Functional verbal utterances	Treatment group demonstrated significantly more functional verbal utterances than the control group	<i>d</i> = .95
Vernon, Keogel, Dauterman, & Stolen (2012)	SSRD <i>N</i> = 3	PRT–non social consequence	Baseline	Children 2:4–4:3 diagnosed with ASD	Verbal initiations	Large effect sizes reported for each child when initiations pre- and post-intervention were compared	<i>d</i> > 1

Note. ESCS = Early Social Communication Scale, PECS[®] = Picture Exchange Communication System[®], PND = Percentage of Non-Overlapping Data, PRT[®] = Pivotal Response Treatment[®], RCT = Randomized Control Trial, SSRD = Single-Subject Research Design