Empirical Support for Pivotal Response Treatment

Study	Design	Treatment	Dependent Variables	Treatment Outcome
INITIAL RESEARCH ON MOTIVATION AS A KEY FOR AUTISM INTERVENTION				
CORE PIVOTAL AREA OF MOTIVATION				
Koegel, R.L. & Egel, A.L. (1979). Motivating autistic children. *Journal of Abnormal Psychology, 88,* 4118-4126.	Multiple baseline design across subjects	Influence of correct versus incorrect task completion on children's motivation to respond to such tasks. Treatment procedures designed to prompt children to keep responding until they completed the tasks correctly.	· Proportion of time child attempted to complete tasks without engaging in non-related behavior · Enthusiasm level	Effective treatments were those that increased exposure to a response-reinforcement contingency for completing the tasks.
INITIAL RESEARCH USED IN THE DEVELOPMENT OF PRT				
A. CHILD CHOICE/ USE OF RITUALISTIC THEMES				
Koegel, R.L., Dyer, K., & Bell, L.K. (1987). The influence of child-preferred activities on autistic children's social behavior. *J Appl Behav Anal, 20,* 243-252.	3 studies: correlational analysis, repeated reversals design with 3 children, community setting	Manipulation of child-preferred and arbitrary activities	· Number of social avoidance behaviors (gaze aversion, closed eyes, etc.) · Subjective measures of social responsiveness	Child-preferred activities and social avoidance behaviors were significantly negatively correlated in terms of both objectively scored behavior and subjective ratings of social responsiveness in unmanipulated settings.

Study	Design	Treatment	Dependent Variables	Treatment Outcome
B. REINFORCING ATTEMPTS				
Koegel, R.L., O'Dell, M.C., & Dunlap, G. (1988). Producing speech use in non-verbal autistic children by reinforcing attempts. *J Autism Dev Disord, 18*(4), 525-538.	Within-subject repeated reversals design	Compared 2 different reinforcement conditions: · Successive motor approximates of speech sounds reinforced · "Motivation" condition in which attempts to produce speech sounds were reinforced; no motor shaping of speech	· Ratings of affect · Measures of improvement in speech production	While each condition produced some improvement in the children's speech, the data indicate that considerably more rapid and consistent progress occurred when the children were reinforced within the framework of a speech attempts contingency rather than when they were reinforced solely on the basis of their correct speech production
C. TASK VARIATION				
Dunlap, G. & Koegel, R.L. (1980). Motivating autistic children through stimulus variation. *J Appl Behav Anal, 13,* 619-627.	Within subject design, multiple baseline across participants	Varied task condition vs. constant task condition	· Number of correct unprompted responses to questions · Enthusiasm, happiness and interest	Declining trends in correct responding during the constant task condition, with substantially improved and stable responding during varied task condition. Children more enthusiastic, interested, and better behaved during the varied task sessions.
D. NATURAL REINFORCERS				

Study	Design	Treatment	Dependent Variables	Treatment Outcome
Williams, J.A., Koegel, R.L., and Egel, A.L. (1981). Response-reinforcer relationships and improved learning in autistic children. *J Appl Behav Anal, 14*, 53-60.	Multiple baseline design across participants	Changing arbitrary response-reinforcer relationships (while holding target behaviors and reinforcers constant) to make target behaviors functional	Percentage of correct unprompted responses	Arranging functional response-reinforcer relationships produced immediate improvement in learning, and resulted in rapid acquisition of criterion level responding.
Koegel, R.L., and Williams, J. (1980). Direct vs. indirect response-reinforcer relationships in teaching autistic children. *Journal of Abnormal Psychology, 4*, 537-547.	Multiple baseline design across participants	2 different response-reinforcer relationships: (1) target behaviors were a direct part of the response chain required to procure a reinforcer and (2) where target behavior was an indirect part of chain leading to reinforcer	Percentage of correct responses	Results showed rapid acquisition only when the target behavior was a direct part of the chain leading to the reinforcer
RESEARCH LEADING TO THE IDENTIFICATION OF THE CORE PIVOTAL AREAS OF INITIATION				
Koegel, L.K., Koegel, R.L., Green-Hopkins, I., & Barnes, C.C. (2010). Brief report: Question-asking and collateral language acquisition in children with autism. *J Autism Dev Disord, 40*(4), 509-515.	Multiple baseline design across participants	Taught children to use the question "Where is it?" using intrinsic reinforcers	· Language acquisition · # of unprompted "where" questions asked · Number of prepositions/ ordinal markers correctly produced	The children could rapidly acquire and generalize the query, and that there were collateral improvements in the children's use of language structures corresponding to the answers to the questions the children asked.

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Koegel, R.L., Vernon, T.W., & Koegel, L.K. (2009). Improving social initiations in young children with autism using reinforcers with embedded social interactions. *J Autism Dev Disord, 39*(9), 1240-1251.	ABAB design	Assessed whether embedding social interactions into reinforcers, delivered during language intervention, would lead to increased levels of child-initiated social behaviors	· Reinforcer strength · Self-initiated social engagement during communication · Nonverbal dyadic orienting · General child affect	Embedding social interactions into the reinforcers resulted in increases in child-initiated social engagement during communication, improved nonverbal dyadic orienting, and improvements in general child affect
Koegel, L.K., Carter, C.M., Koegel, R.L. (2003). Teaching children with autism self-initiations as a pivotal response. *Topics in language disorders, 23,* 134-145.	Multiple baseline design across participants	Assessed whether children with autism could be taught a child-initiated query as a pivotal response to facilitate the use of grammatical morphemes.	· Language · Use of morphemes	Both children learned the self-initiated strategy and both acquired and generalized the targeted morpheme. Additionally, generalized use of the self-initiation into other question forms and concomitant increases in mean length of utterance, verb acquisition, and diversity of verb use occurred for both children.
Koegel, L.K., Camarata, S.M., Valdez-Menchaca, M., & Koegel, R.L.(1998). Setting generalization of question-asking by children with autism. *American Journal on Mental Retardation, 102*(4) , 346-357.	Multiple baseline design across participants	Self-initiated question asking ("What's that?") using a PRT framework	· Spontaneous use of target question · Number of stimulus items labeled correctly	Children consistently and spontaneously initiated "What's that?" across treatment and generalization settings. Significant increase in vocabulary due to item label acquisition

Study	Design	Treatment	Dependent Variables	Treatment Outcome
RESEARCH SUGGESTING SELF-MANAGEMENT AS A CORE PIVOTAL AREA				
Koegel, L.K., Koegel, R.L., Hurley, C., & Frea, W.D. (1992). Improving social skills and disruptive behavior in children with autism through self-management. *J Appl Behav Anal*, *25*(2), 341-353.	Multiple baseline design across participants	Self-management used to improve responsiveness to verbal initiations from others in multiple settings without the presence of a treatment provider.	Responsiveness to verbal initiations	Collateral reductions in disruptive behavior occurred when the children's responsivity improved.
Koegel, R.L., and Koegel, L.K. (1990). Extended reductions in stereotypic behaviors through self-management in multiple community settings. *J Appl Behav Anal*, *1*, 119-127.	Multiple baseline design across participants	Assessed whether students with severe autistic disabilities could learn to use a self-management treatment package to reduce their stereotypic behavior	Stereotypic behavior	With the initiation of self-management procedures, rapid and substantial decreases in stereotypic behavior occurred, often to 0% for Students 1 and 2. For Students 3 and 4, percentages of intervals of stereotypic behavior were more variable, but also frequently reached 0% after the initiation of self-management.
EMPIRICAL VALIDATION FOR THE PRT PACKAGE				
Koegel, L.K., Singh, A.K., Koegel, R.L., Hollingsworth, J.R., Bradshaw, J.(2013). Assessing and Improving Early Social Engagement	Multiple baseline design across participants	Modified PRT was used to assess the feasibility of rapidly increasing infant motivation to engage in social interaction	· Percentage response to name ·Avoidance of eye contact · Affect (interest and happiness)	Results demonstrated that consistently low or erratic levels of social behavior were evident during baseline period, and these patterns could be improved with PRT. Social engagement

Study	Design	Treatment	Dependent Variables	Treatment Outcome
in Infants. Journal of Positive Behavior Interventions. [Epub ahead of print]			· Fidelity of implementation	immediately increased and social engagement remained at a stable and high level at follow-up.
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.* Vol. 42, 2702–2717	Multiple baseline design across participants	Parent delivered embedded social intervention	- Reinforcer strength - Total language opportunities - Child eye contact - Child verbal initiations - Child and parent positive affect - Synchronous engagement	The results indicate that the use of this parent delivered social intervention led to increases in all measured areas of social functioning, including child eye contact, verbal initiations, and directed positive affect. Parent positive affect and synchronous engagement was observed to increase.
Koegel, L.K., Kuriakose, S., Singh, A.K., & Koegel, R.L. (2012). Improving Generalization of Peer Socialization in Inclusive School Settings Using Initiations Training. *Behavior Modification*, Vol. 36, No. 3, 361-377.	Multiple baseline design across participants	Facilitated social play with initiations training ("Ask Brendon, can I play with you?") using a PRT framework	· Unprompted peer-directed initiations · Social engagement · Affect	When initiations were targeted during intervention for social play, the participants demonstrated generalized peer social engagement, increases in unprompted peer-directed initiations, and more positive affect during peer interactions.
Randolph, J. K., Stichter, J. P., Schmidt, C. T., & O'Connor, K. V. (2011). Fidelity and effectiveness of PRT implemented by caregivers without college degrees. *Focus on Autism*	Concurrent multiple baseline across participants	Caregivers without college degrees were provided training to implement PRT for a total of 10 training sessions	- Treatment fidelity of PRT - Child behaviors - Frequency of adult initiations to obtain percentage rates of	Results indicate that caregivers with limited education can be successful in implementing PRT with high level of fidelity which is seen in two out of the three families. Caregiver's level of education may not be as critical

Study	Design	Treatment	Dependent Variables	Treatment Outcome
and Other Developmental Disabilities, *26*(4), 230-238.			the children's responses	as other variables such as consistency of training sessions.
Baker-Ericzen, M.J., Stahmer, A.C., & Burns, A. (2007). Child demographics associated with outcomes in a community-based Pivotal Response Training program. *J Posit Behav Interv*, *9*(1), 52-60.	Clinical replication	Large-scale community-based 12-week parent education PRT intervention and examined whether child variables are associated with treatment outcome	· Communication · Daily living skills · Socialization · Motor skills · Adaptive behaviors	Following parent education in PRT, all children showed significant improvement in communication, daily living skills, socialization, motor skills, and Adaptive Behavior Composite domains of the *Vineland Adaptive Behavior Scales* regardless of gender, age, and race/ethnicity of the children/families.
Doggett, R.A., Krasno, A.M., Koegel, L.K., Koegel, R.L. (2013). Acquisition of Multiple Questions in the Context of Social Conversation in Children with Autism. Journal of Autism and Developmental Disorders. [Epub, ahead of print].	Non-concurrent multiple baseline across participants design	A self-management intervention package, which included concurrent teaching of three social wh- questions in the context of conversation	· Percent appropriate question use in conversation	Intervention resulted in increased levels of correct question use for both participants. Self-management during conversation also produced a sudden increase in appropriate question-asking. Gains were maintained long-term and generalized to new conversational partners.
Gillett, J.N., & LeBlanc, L.A. (2007). Parent-implemented natural language paradigm to increase language and	Non-concurrent multiple baseline design across participants	Parent-implemented PRT (called NLP*) to target language and play skills	· Frequency of vocalizations (spontaneous and prompted)	Increases in overall rate and spontaneity of utterances were found for all three children. Children also showed an increase in appropriate play. Parents rated

Study	Design	Treatment	Dependent Variables	Treatment Outcome
play in children with autism. *Research in Autism Spectrum Disorders, 1*(3), 247-255.			· Mean length of utterance · Appropriate and inappropriate play · Social validity questionnaire	the intervention simple to implement and endorsed continued use of PRT.
Harper, C.B., Symon, J.B.G., Frea, W.D. (2008). Recess is time-in: Using peers to improve social skills of children with autism. *J Autism Dev Disord, 38*, 815-826.	Concurrent multiple baseline design across participants	Peer-implemented PRT to increase social play	Attempts at: · Gaining peer's attention · Turn-taking · Initiating play with peers	Following peer implementation of PRT, both children increased social play initiations. Turn-taking play skills also increased across phases of the study for both children. The results were maintained during the generalization phase.
Koegel, L.K., Carter, C.M., Koegel, R.L. (2003). Teaching children with autism self-initiations as a pivotal response. *Topics in language disorders, 23,* 134-145.	Multiple baseline design across participants	Assessed whether children with autism could be taught a self-initiated query as a pivotal response to facilitate the use of grammatical morphemes	· Initiations · Morpheme acquisition and generalization · Related language gains	Both children learned the self-initiated strategy and both acquired and generalized the targeted morpheme. Additionally, generalized use of the self-initiation into other question forms and concomitant increases in mean length of utterance, verb acquisition, and diversity of verb use occurred for both children.
Koegel, L. K., Koegel, R. L., Shoshan, Y., McNerney, E. (1999). Pivotal Response Intervention II:	Retrospective analysis of archival data	· Examined treatment outcomes for children initiating social	· Number of initiations · Pragmatic ratings · Social/community functioning	Retrospective analysis of archival data showed that children who exhibited high levels of spontaneous initiations at pre-intervention had more favorable

Study	Design	Treatment	Dependent Variables	Treatment Outcome
Preliminary Long-term Outcomes Data. *Journal of the Association for Persons with Severe Handicaps, 24*(3): p. 186-198.		communication at high and low rates · Assessed an intervention to teach initiations	· Adaptive behavior scale scores	post-intervention outcomes. In addition, children who were taught to initiate social communication (when such initiating was low) showed highly favorable post-intervention outcomes.
Koegel, R.L., & Frea, W.D. (1993). Treatment of social behavior in autism through the modification of pivotal social skills. *J Appl Behav Anal, 26,* 369-377.	Multiple baseline design across participants and behaviors	Self-management targeting one or two social communicative behaviors	· Facial expression and affect · Non-verbal mannerisms · Perseveration of topic · Intensity of voice volume · Eye gaze · Subjective judgments of overall appropriateness	Social behaviors improved rapidly and generalized improvements in untreated social behaviors were found. These improvements were accompanied by increases in subjective ratings of the overall appropriateness of the children's social interactions.
Koegel, R.L., Koegel, L.K., & Surratt. (1992) Language intervention and disruptive behavior in preschool children with autism. *J Autism Dev*	Repeated reversals design	Traditional Discrete Trial vs. PRT (called Analogue Treatment* vs. NLP*)	· Expressive language ·Disruptive behavior	The PRT condition consistently produced lower levels of disruptive behavior both within and across children, as compared to the Analogue treatment. Children also produced more

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Disord, Vol. 22(2), 141-153.				correct language target behaviors in the PRT condition.
Koegel, O'Dell, & Koegel (1987). A natural language teaching paradigm for nonverbal autistic children. *J Autism Dev Disord, 17*(2), 187-200.	Multiple baseline design across participants	Traditional Discrete Trial vs. PRT (called Analogue Treatment* vs. NLP*)	· Imitative child utterances · Spontaneous child utterances · Generalization	Children produced more imitative and spontaneous utterances in the PRT condition. Generalization of treatment gains occurred only in the PRT condition.
Koegel, R. L., Symon, J. B., & Koegel, L. K. (2002). Parent education for families of children with autism living in geographically distant areas. *J Posit Behav Interv, 4*, 88-103.	Non-concurrent multiple baseline design across participants	Intensive, week-long, center-based PRT parent education program	· Parent implementation of PRT motivational techniques · Children's expressive verbal communication · Parents' composite affect score during parent-child interactions	Parents increased their use of PRT motivational techniques and showed more positive affect while interacting with their child. The children's expressive verbal production also increased. Improvements generalized to the families' home communities and maintained over time.
Laski, K. E., Charlop, M. H., & Schreibman, L. (1988). Training parents to use the Natural Language Paradigm to increase their autistic children's speech. *Journal*	Multiple baseline design across participants	Parent training in PRT (called NLP*) to increase their child's speech	· Parent requests for vocalizations from their child · Child vocalizations (imitations, answers to questions, and spontaneous speech)	Following training, parents increased the frequency with which they required their children to speak (i.e., modeled words and phrases, prompted answers to questions). Correspondingly, all children

Study	Design	Treatment	Dependent Variables	Treatment Outcome
of Applied Behavior Analysis, 21, 391–400.				increased the frequency of their verbalizations.
Pierce K, Schreibman L. (1995). Increasing complex social behaviors in children with autism: Effects of peer implemented pivotal response training. *Journal of Applied Behavior Analysis*. 1995; 28:285–295.	Multiple baseline design across participants	Peer-implemented PRT	· Maintenance of social interactions · Conversation initiations · Play initiations · Attention behaviors · Number of appropriate words spoken · Sentence length	After the intervention, both children with autism maintained prolonged interactions with the peer, initiated play and conversations, and increased engagement in language and joint attention behaviors. Teachers reported positive changes in social behavior. These effects showed generality and maintenance.
Pierce, K., & Schreibman, L. (1997). Multiple peer use of pivotal response training to increase social behaviors of classmates with autism: Results from trained and untrained peers. *Journal of Applied Behavior Analysis, 30,* 157–160.	Multiple baseline design across peer trainers and replicated across participants	Peer-implemented PRT	· Maintenance of social interactions · Conversation initiations · Play initiations	Posttreatment, the children with autism showed increases in maintenance of social interactions and social initiations.
Smith, A., & Camarata, S. (1999). Using teacher-implemented instruction to increase language intelligibility of children with autism. *Journal of Positive Behavior*	Non-concurrent multiple baseline across design across participants	Naturalistic language teaching procedures (based on PRT, called NLP*) conducted by the child's general education teacher in collaboration with	· Feasibility of implementation (rated by teacher) · Child's language intelligibility · Verbal response intervals	Result indicate that teachers found the naturalistic language teaching procedures highly feasible to implement in the school settings. All participants showed improved intelligibility of verbalizations as well as near typical levels of time intervals

Study	Design	Treatment	Dependent Variables	Treatment Outcome
Interventions, 1(3), 141–151.		the child's language clinician		engaged in speaking following intervention.
Stahmer, A. C. (1995). Teaching symbolic play skills to children with autism using pivotal response training. *Journal of Autism and Developmental Disorders*, *25*, 123–142.	Single subject multiple baseline design across participants	PRT to teach symbolic play skills	· Symbolic Play · Complexity of play behavior	Following training, all children with autism showed an increase in symbolic play and play complexity to levels similar to those of language-matched typical controls. In most cases the children generalized their play to new toys, environments, and play partners and maintained these skills at follow-up.
Thorp, D. M., Stahmer, A. C., & Schreibman, L. (1995). Effects of sociadramatic play training on children with autism. *Journal of Autism and Developmental Disorders, 25*, 265-21R2.	Single subject multiple baseline probe design across participants	PRT to teach sociodramatic play to children with autism	· Role playing · Make believe transformations · Persistence of play theme · Social behavior · Verbal communication	Positive changes were observed in all elements of sociodramatic play following training. These changes generalized across toys and settings.
Vismara, L.A., & Lyons, G.L. (2007). Using perseverative interests to elicit joint attention behaviors in young children with autism: Theoretical and clinical implications to understanding motivation. *J Posit Behav Interv, 9,* 214-228.	Within subject design with counterbalancing and alternating treatments in final phase	PRT involving child's perseverative interests vs. PRT not involving child's perseverative interests	· Number of joint attention initiations · Contingencies to joint attention initiations · Child-caregiver interaction measures	Using stimuli related to children's perseverative interests as natural reinforcers within the motivational procedures of PRT led to increases in joint attention initiations for social sharing.

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Voos, A.C., Pelphrey, K.A., Tirrell, J., Bolling, D.Z., Vander Wyk, B., Kaiser, M.D., McPartland, J.C., Volkmar, F.R., & Ventola, P. (2012). Neural mechanisms of improvements in social motivation after pivotal response treatment: Two case studies. *J Autism Dev Disord*, 2012 Oct 27 [Epub ahead of print].	Single case series	PRT targeting pivotal areas of development, including motivation, social initiation and responsivity in order to improve social and language functioning in both participants.	· Total Fixation Duration and percent of looking time at adult faces · Neural mechanisms supporting social perception · Skills in communication, daily living and socialization · Pragmatic skills · Number of on topic comments, questions, total narrative details, and conversations	PRT resulted in increased activation in regions recruited by typically developing children during social perception.
EMPIRICALLY VALIDATED SUGGESTED CONTEXTS FOR PRT DELIVERY				
A. PARENT EDUCATION				
Nefdt, N., Koegel, R.L., Singer, G., & Gerber, M. (2010). The use of a self-directed learning program to provide introductory training in pivotal	Randomized clinical trial	To evaluate whether the use of a self-directed learning program could result in changes in behavior for parents and their children with autism.	· Fidelity of implementation of PRT procedures · Language opportunities (parent measure) · Child's functional verbal utterances · Observed parent confidence	Results indicated significant differences between treatment and control groups at posttest on all of the dependent measures. Furthermore, all of the parents who completed the self-directed learning program reported high ratings of satisfaction.
Koegel, R. L., Symon, J. B., & Koegel, L. K.	Non-concurrent multiple baseline	Intensive, week-long, center-based	· Parent implementation of	Parents increased their use of PRT motivational techniques and

Study	Design	Treatment	Dependent Variables	Treatment Outcome
(2002). Parent education for families of children with autism living in geographically distant areas. *J Posit Behav Interv, 4*, 88-103. *	across participants design	PRT parent education program	PRT motivational techniques · Children's expressive verbal communication · Parents' composite affect score during parent-child interactions	showed more positive affect while interacting with their child. The children's expressive verbal production also increased. Improvements generalized to the families' home communities and maintained over time.
Koegel, R.L., Bimbela, A., Schreibman, L. (1996). Collateral effects of parent training on family interactions. *J Autism Dev Disord, 26*(3), 347-359.	Group design with random assignment	Trial vs. PRT (called Individual Target Behaviors* vs. PRT)	Ratings of · Happiness · Interest · Stress · Communication style	The Discrete Trial condition resulted in no significant influence on interactions, while PRT resulted in positive parent-child interactions
Schreibman, L., Kaneko, W.M., & Koegel, R.L. (1991) Positive affect of parents of autistic children: A comparison across two teaching techniques. *Behavior Therapy, 22*(4), 479-490.	Group design with random assignment	Traditional Discrete Trial vs. PRT (called Individual Target Behaviors* vs. PRT)	Parental affect	Parents in the PRT condition displayed significantly more positive affect than parents trained in Discrete Trial.
Coolican, J., Smith, I.M., Bryson, S.E. (2010). Brief parent training in pivotal response treatment for preschoolers with autism. *Journal of Child Psychology and*	Non-concurrent multiple baseline across-participants	To evaluate the efficacy of brief training in PRT for parents of preschoolers with autism, who were unable to access	· Functional utterances · Parent's fidelity in implementing PRT techniques	Brief parent training in PRT promises to provide an immediate, cost-effective intervention that would be adopted widely

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Psychiatry, 51(12), 1321-1330.		more comprehensive treatment		
Gillett, J.N., & LeBlanc, L.A. (2007). Parent-implemented natural language paradigm to increase language and play in children with autism. *Research in Autism Spectrum Disorders, 1*(3), 247-255.	Non-concurrent multiple baseline design across participants	Parent-implemented PRT (called NLP*) to target language and play skills	· Frequency of vocalizations (spontaneous and prompted) · Mean length of utterance · Appropriate and inappropriate play · Social validity Questionnaire	Increases in overall rate and spontaneity of utterances were found for all three children. Children also showed an increase in appropriate play. Parents rated the intervention simple to implement and endorsed continued use of PRT.
B. ACADEMIC SETTINGS				
Koegel, R. L., Kim, S., & Koegel, L. K. (2014). Training Paraprofessionals to Improve Socialization in Students with ASD. Journal of autism and developmental disorders, 1-12.	Multiple baseline design across participants	Training paraprofessionals to provide social interventions	· Social development in students with ASD in a group setting	Paraprofessionals who were not providing any social opportunities during baseline were able to meet fidelity of implementation following a brief training. The children with ASD increased their levels of engagement and rates of initiation with typically developing peers following intervention.
Koegel, L.K., Singh, A.K., & Koegel, R.L. (2010). Improving motivation for academics in children with autism. *J*	Multiple baseline design across participants	Specific motivational variables such as choice, interspersal of maintenance tasks, and natural reinforcers	Academics (writing and math performance)	For all children, disruptive behavior decreased immediately following implementation of the intervention and remained low throughout the intervention and post intervention phases.

Study	Design	Treatment	Dependent Variables	Treatment Outcome
Autism Dev Disord, 40(9), 1057-1066.		incorporated into academic tasks		
Koegel, L. K., Koegel, R. L., Frea, W., & Green-Hopkins, I. (2003). Priming as a method of coordinating educational services for students with autism. *Lang, Sp, and Hear Serv in Sch, 34*, 228-235.	A repeated reversals design was used to monitor student progress in 2 children.	Priming	· Academic performance · Problem behaviors	Decreases in problem behavior and increases in academic responding when priming sessions occurred.
Robinson, S. E. (2011). Teaching paraprofessionals of students with autism to implement *pivotal response treatment* in inclusive school settings using a brief video feedback training package. *Focus on Autism and Other Developmental Disabilities, 26*(2), 105-118.	Multiple baseline design across participants	The author investigated a training package consisting of modeling and video-based feedback as a means of enabling paraprofessionals to implement Pivotal Response Treatment (PRT) in the inclusive school setting	· Paraprofessional fidelity of affect · Paraprofessional levels of involvement · Focal students' target social communication goals · Student affect	The findings suggest that the training package was effective and efficient in improving paraprofessional PRT implementation and levels of involvement as well as social communication target behaviors of the students with autism.
C. INCLUSION/PEER MEDIATION				
Koegel, R., Fredeen, R., Kim, S., Danial, J., Rubinstein, D., Koegel, L.K. (2012). Using Perseverative Interests to	Repeated measures multiple-baseline across participants	Implementing socialization opportunities in the form of lunch clubs based around aspects	· Percentage of intervals that the students with ASD engaged with their	Results showed large increases in both social engagement and initiations.

Study	Design	Treatment	Dependent Variables	Treatment Outcome
Improve Interactions Between Adolescents With Autism and Their Typical Peers in School Settings. *Journal of Positive Behavior Interventions*, 1-9.	experimental design (with two reversals)	of the adolescent's perseverative interests	typically developing peers · Frequency of initiations by the student with ASD toward typically developing peers	
Koegel, R. L., Werner, G. A., Vismara, L. A., & Koegel, L. K. (2005). Contextually supported interactions between children with autism and typically developing peers. *Res Prac Pers with Sev Disab, 30*, 93- 102.	Multiple baseline design across participants	Using motivational strategies in play dates to improve the quality of social interactions between children with autism and their typically developing peers	· Synchronous reciprocal interaction · Child affect.	During play dates with contextual support, both children showed immediate increases in the percentage of intervals containing synchronous reciprocal interaction, ranging from 70% to 85 %.
Brookman, L., Boettcher, M., Klein, E., Openden, D., Koegel R. L., Koegel, L. K. (2003). Facilitating social interactions in a community summer camp setting for children with autism. *J Posit Behav Interv, 5*, 249-252.	Participants split into groups based on age; one child with autism per group	Priming, self - management, peer involvement in a full inclusion summer camp setting	· Social initiations · Participation · Problem behaviors	The children with autism, who had varying levels of functioning, were able to successfully participate in the camp activities with the support of their aides
Koegel, R.L., & Frea, W.D. (1993). Treatment of social behavior in autism through the modification of pivotal	Multiple baseline design across participants	Targeting one or two pivotal areas to improve social communicative behaviors	· Social communicative variables · Non-verbal mannerisms	Social behaviors improved rapidly and generalized changes in untreated social behaviors. These improvements were accompanied by increases in subjective ratings of the overall

Study	Design	Treatment	Dependent Variables	Treatment Outcome
social skills. *J Appl Behav Anal, 26*, 369-377.			· Perseveration of topic · Intensity of voice volume	appropriateness of the children's social interactions.
Harper, C.B., Symon, J.B.G., Frea, W.D. (2008). Using peers to improve social skills of children with autism. *J Autism Dev Disord, 38*, 815-826	Multiple baseline design across participants	Peer-Implemented PRT to increase social play	Attempts at · Gaining peer's attention · Turn taking · Interactions · Play initiations	Following peer implementation of PRT, both children increased initiations and turn-taking initiations. The results maintained during generalization
D. WIDE SCALE DISSEMINATION				
Bryson, S.E., Koegel, L. K., Koegel, R.L., Openden, D., Smith, I.M., & Nefdt, N. (2007). Large scale dissemination and community implementation of Pivotal Response Treatment: Program description and preliminary data. *Res Prac Pers with Sev Disab, 32*(2), 142-153.	Clinical Replication	Large scale community training in PRT for interventionists, clinical supervisors, clinical leaders, and parents	· Fidelity of implementation · Intervals with Functional Verbal Utterances	Treatment providers maintained fidelity of implementation across time and increased the functional verbal utterances of the participant children.
E. COMMUNITY IMPLEMENTATION				

Study	Design	Treatment	Dependent Variables	Treatment Outcome
Smith, I.M., Koegel, R.L., Koegel, L.K., Openden, D.A., Fossum, K.L., & Bryson, S.E. (2010). Effectiveness of a novel community-based early intervention model for children with autistic spectrum disorder. *Amer J on Intel and Dev Dis, 115*(6), 504-523.	53 preschool-age children (on the broad autism specrum), multiple measures over time, no control group.	PRT is the primary treatment modality, with positive behavior supports as supplementary strategies.	· Verbal communication · Functional communication · Adaptive behavior skills	Positive growth was evident not only in language and communication, the main focuses of intervention, but also on measures of cognitive, adaptive behavior, problem behavior, and autism symptoms.
Koegel, R.L., and Koegel, L.K. (1990). Extended reductions in stereotypic behaviors through self-management in multiple community settings. *J Appl Behav Anal, 1*, 119-127.	Multiple baseline design across participants	Assessed whether students with severe autistic disabilities could learn to use a self-management treatment package to reduce their stereotypic behavior	Stereotypic behavior	With the initiation of self-management procedures, rapid and substantial decreases in stereotypic behavior occurred, often to 0% for Students 1 and 2. For Students 3 and 4, percentages of intervals of stereotypic behavior were more variable, but also frequently reached 0% after the initiation of self-management.
F. INDIVIDUALIZED TREATMENT PROTOCOLS				
Koegel, R.L., Shirotova, L., & Koegel, L.K. (2009). Brief report: Using individualized orienting cues to facilitate	Non-concurrent multiple baseline design across participants	Whether individualized orienting cues could be identified, and whether their	· Verbalizations · Parent report of words produced	

Study	Design	Treatment	Dependent Variables	Treatment Outcome
first-word acquisition in non-responders with autism. *J Autism Dev Disord, 39*(11), 1587-1592.		presentation would result in the production of verbal expressive words		
Sherer, M.R. & Schreibman, L. (2005) Individual behavioral profiles and predictors of treatment effectiveness for children with autism. *Journal of Consulting and Clinical Psychology, 73*(3), 525-538.	Clinical replication	PRT administered to groups with two distinct profiles (predicted responders vs. non-responders	· Language (echolalia, cued speech, spontaneous speech · Play (functional, symbolic, and varied play measures) · Social measures (interaction, social initiations)	The results showed that this antecedent stimulus control procedure produced improvements in responding to verbal models in all of the children, and subsequent gains in speech for some of the children.
EMPIRICALLY VALIDATED OUTCOMES RELATED TO PRT DELIVERY				
A. LANGUAGE				
Koegel, L. K., Park, M. N., & Koegel, R. L. (2014). Using Self-Management to Improve the Reciprocal Social Conversation of Children with Autism Spectrum	Multiple baseline design	Self-management intervention	· On-topic responsiveness to a conversational partner; · Expansion of the conversational topic	Improved reciprocal social conversation through elaborated responses and on-topic question asking, which generalized and maintained

Study	Design	Treatment	Dependent Variables	Treatment Outcome
Disorder. Journal of autism and developmental disorders, 44(5), 1055-1063.			· On-topic question asking	
Koegel, R. L., Bradshaw, J. L., Ashbaugh, K., & Koegel, L. K. (2014). Improving Question-Asking Initiations in Young Children with Autism Using Pivotal Response Treatment. Journal of autism and developmental disorders, 44(4), 816-827.	Multiple baseline design	Motivational procedures of PRT; four questions taught during the course of intervention in a sequence consistent with the acquisition of wh- questions in typically developing 2–3 years old children	· Social question asking · Initiation of target questions · Initiation of untargeted questions	Participants initiated a greater number of targeted questions. All children exhibited increases in initiation of untargeted questions during social interaction in novel settings. Post intervention data revealed collateral gains in communication and adaptive behavior.
Doggett, R.A., Krasno, A.M., Koegel, L.K., Koegel, R.L. (2013). Acquisition of Multiple Questions in the Context of Social Conversation in Children with Autism. Journal of Autism and Developmental Disorders. [Epub, ahead of print].	Non-concurrent multiple baseline across participants design	A self-management intervention package, which included concurrent teaching of three social wh- questions in the context of conversation	· Percent appropriate question use in conversation	Intervention resulted in increased levels of correct question use for both participants. Self-management during conversation also produced a sudden increase in appropriate question-asking. Gains were maintained long-term and generalized to new conversational partners.
Koegel, L.K., Koegel, R.L., Green-Hopkins, I., & Barnes, C.C. (2010). Brief report: Question-asking and collateral	Multiple baseline design across participants	Taught children to use the question "Where is it?" using intrinsic reinforcers	· Language acquisition · # of unprompted "where" questions asked	The children could rapidly acquire and generalize the query, and that there were collateral improvements in the children's use of language structures

Study	Design	Treatment	Dependent Variables	Treatment Outcome
language acquisition in children with autism. *J Autism Dev Disord, 40*(4), 509-515.			· Number of prepositions/ ordinal markers correctly produced	corresponding to the answers to the questions the children asked.
Koegel, R.L., Shirotova, L., & Koegel, L.K. (2009). Brief report: Using individualized orienting cues to facilitate first-word acquisition in non-responders with autism. *J Autism Dev Disord, 39*(11), 1587-1592.	Non-concurrent multiple baseline design across participants	Whether individualized orienting cues could be identified, and whether their presentation would result in the production of verbal expressive words	· Verbalizations · Parent report of words produced	
Koegel, R. L., Camarata, S., Koegel, L. K., Ben-Tall, A., & Smith, A. E. (1998). Increasing speech intelligibility in children with autism. *J Autism Dev Disord, 28*, 241-251.	Within subject design – ABA with counterbalancing to control for order effects	Traditional Discrete Trial vs. PRT (called Analogue Treatment* vs. PRT) for teaching target sounds	· Correct production of target sounds in language samples · Intelligibility ratings	Higher levels of disruptive behaviors in the No Choice conditions, without exception, than in the Choice conditions. Only during a No Choice phase was it necessary to discontinue the condition due to repeated requests to leave the session and task across four continuous sessions; did not occur during the Choice condition sessions. Significant gains in correct production of target sounds and speech intelligibility during the PRT intervention
Koegel, R.L., Koegel, L.K., & Surratt. (1992)	Repeated reversals design	Traditional Discrete Trial vs. PRT (called	· Expressive language ·Disruptive behavior	The PRT condition consistently produced lower levels of

Study	Design	Treatment	Dependent Variables	Treatment Outcome
Language intervention and disruptive behavior in preschool children with autism. *J Autism Dev Disord, Vol. 22*(2), 141-153.		Analogue Treatment* vs. NLP*)		disruptive behavior both within and across children, as compared to the Analogue treatment. Children also produced more correct language target behaviors in the PRT condition.
Koegel, R.L., O'Dell, M.C., & Dunlap, G. (1988). Producing speech use in non-verbal autistic children by reinforcing attempts. *J Autism Dev Disord, 18*(4), 525-538.	Within-subject repeated reversals design	Compared 2 different reinforcement conditions: · Successive motor approximates of speech sounds reinforced · "Motivation" condition in which attempts to produce speech sounds were reinforced; no motor shaping of speech	· Ratings of affect · Measures of improvement in speech production	While each condition produced some improvement in the children's speech, the data indicate that considerably more rapid and consistent progress occurred when the children were reinforced within the framework of a speech attempts contingency rather than when they were reinforced solely on the basis of their correct speech production
B. JOINT ATTENTION				
Vismara, L.A., & Lyons, G.L. (2007). Using perseverative interests to elicit joint attention behaviors in young children with autism: Theoretical and clinical implications to understanding motivation.	Within subject design with counterbalancing and alternating treatments in final phase	PRT with child's perseverative interests vs. nonperseverative interests	· Number of joint attention initiations · Contingencies to joint attention initiations · Child affect ratings	Using the child's perseverative interests in a PRT model increased joint attention initiations

Study	Design	Treatment	Dependent Variables	Treatment Outcome
J Posit Behav Interv, 9, 214-228.				
C. ACADEMIC PERFORMANCE				
Koegel, L.K., Singh, A.K., & Koegel, R.L. (2010). Improving motivation for academics in children with autism. *J Autism Dev Disord, 40*(9), 1057-1066.	Multiple baseline design across participants	Specific motivational variables such as choice, interspersal of maintenance tasks, and natural reinforcers incorporated into academic tasks	Academics (writing and math performance)	For all children, disruptive behavior decreased immediately following implementation of the intervention and remained low throughout the intervention and post intervention phases.
Koegel, L. K., Koegel, R. L., Frea, W., & Green-Hopkins, I. (2003). Priming as a method of coordinating educational services for students with autism. *Lang, Sp, and Hear Serv in Sch, 34*, 228-235.	A repeated reversals design was used to monitor student progress in 2 children.	Priming	· Academic performance · Problem behaviors	Decreases in problem behavior and increases in academic responding when priming sessions occurred.
Koegel, L.K., Koegel, R.L., & Smith, A. (1997). Variables related to differences in standardized test outcomes for children with autism. *J Autism Dev Disord, 27*(3), 233-243.	Repeated reversals experimental design with condition order varied within and across children	Assessed whether manipulation of variables related to motivation and attention would influence performance on standardized tests.	Test performance/scores	Results showed consistent differences between the two conditions, suggesting that improving motivation and attention in children with autism may considerably influence test performance and interpretation.

Study	Design	Treatment	Dependent Variables	Treatment Outcome
D. REDUCTION IN DISRUPTIVE BEHAVIORS				
Koegel, L. K., Koegel, R. L., & Steibel, D. (1998). Reducing aggression in children with autism toward infant or toddler siblings. *Journal of The Association for Persons with Severe Handicaps, 23*, 111-118	Multiple baseline across 3 families	Parent-implemented intervention plans in home setting	Specific number of occurrences of aggressive behavior	Large reductions in the children's aggression toward their infant or toddler sibling, increases in parent and child happiness level, increases in strangers' level of comfort with respect to interacting with the family
Koegel, L.K., Koegel, R.L., Hurley, C., & Frea, W.D. (1992). Improving social skills and disruptive behavior in children with autism through self-management. *J Appl Behav Anal, 25*(2), 341-353.	Multiple baseline design across participants	Self-management used to improve responsiveness to verbal initiations from others in multiple settings without the presence of a treatment provider.	Responsiveness to verbal initiations	Collateral reductions in disruptive behavior occurred when the children's responsivity improved.

Study	Design	Treatment	Dependent Variables	Treatment Outcome
Koegel, R.L., Koegel, L.K., & Surratt. (1992) Language intervention and disruptive behavior in preschool children with autism. *J Autism Dev Disord, Vol. 22*(2), 141-153.	Repeated reversals design	Traditional Discrete Trial vs. PRT (called Analogue Treatment* vs. NLP*)	· Expressive language ·Disruptive behavior	The PRT condition consistently produced lower levels of disruptive behavior both within and across children, as compared to the Analogue treatment. Children also produced more correct language target behaviors in the PRT condition.
Koegel, R.L., and Koegel, L.K. (1990). Extended reductions in stereotypic behaviors through self-management in multiple community settings. *J Appl Behav Anal, 1*, 119-127.	Multiple baseline design across participants	Assessed whether students with severe autistic disabilities could learn to use a self-management treatment package to reduce their stereotypic behavior	Stereotypic behavior	With the initiation of self-management procedures, rapid and substantial decreases in stereotypic behavior occurred, often to 0% for Students 1 and 2. For Students 3 and 4, percentages of intervals of stereotypic behavior were more variable, but also frequently reached 0% after the initiation of self-management.

* Historically, various terms have been used synonymously in these empirical articles. For example, PRT has been called the Natural Language Paradigm (NLP) when intervention focuses on language. PRT has also been referred to as training in the pivotal areas of

motivation, self-initiations and self-management. Similarly, Discrete Trial Training has been labeled the Individual Target Behavior condition or the Analogue Treatment condition in some publications.