

Pivotal Teaching Interactions for Children with Autism

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Abstract: This article discusses effective teaching interactions in the treatment of autism with a focus on pivotal target behaviors. Specifically, in behaviorally oriented intervention approaches, our research suggests that several areas appear to be especially important. First, progress may be enhanced by defining "pivotal" target behaviors that affect wide areas of functioning so that school psychologists, teachers, and other practitioners may be able to have widespread impacts on children's overall functioning. Second, psychologists are now able to develop interventions that simultaneously lead to independence on the part of the child, are correlated with decreases in untreated problem behaviors, are maintained with the passage of time, and therefore result in a long-term improved prognosis.

Early Approaches, Their Growth and Change

Following the first attempts at diagnosing autism in 1943, the original theories of etiology focused largely upon a parental causation hypothesis. This led practitioners to develop interventions that typically separated the child from the parents and often provided intervention in residential settings in which children could express themselves free from the negative environment parents had supposedly created. Although there was no scientifically documented evidence that parents were responsible for their children's disabilities, this type of intervention persisted well into the 1960s.

Intervention procedures that were developed in the 1960s were based primarily on learning theory and children's ability to learn rather than on the parental causation hypothesis, and researchers began developing behavioral intervention techniques based on the principles of learning (cf. Bandura, 1969; Ferster, 1961; Lovaas, Berberich, Perloff, & Schaeffer, 1966; Risley & Wolf, 1967; Schopler, Mesibov, & Hearsey, 1995; Wolf, Risley, & Mees, 1964). By

1970 more than 100 behavioral treatment studies had appeared in the literature (Matson, Benavidez, Compton, Paclawskyj, & Baglio, 1996). This body of research hypothesized and demonstrated that regardless of the cause, children's behavioral excesses and deficits could be modified by environmental manipulations such as punishment, extinction, and reinforcement. Further, individual case studies using these approaches demonstrated remarkable gains, teaching many age-appropriate behaviors and eliminating stigmatizing symptoms of the disability (cf. Risley & Wolf, 1967).

These early behavioral efforts scientifically documented the fact that children with autism can make systematic gains and are considered to be a foundation for many of the behavioral techniques that are being used presently. Documented gains were reported in a number of areas, including the teaching of communication, which generally focused first on teaching in an analog context free of distractions. The general approach was to present a stimulus such as a question or command (e.g., "Look at me" or "Touch nose"). Following a correct response, with physical prompts if necessary, the behaviors were rewarded with

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edibles, stroking, exaggerated social approval, tokens, or other desired stimuli. In an attempt to strengthen social consequences, social reinforcers were paired with primary reinforcers, and the schedule of reinforcement was gradually thinned to more closely approximate the child's natural environment. Incorrect responses were punished with a loud "no," slaps, attention withdrawal, or other unpleasant consequences (Lovaas, 1977).

These early successful teaching programs usually had a separate component that related to disruptive behavior. When a child first began intervention, high levels of disruptive behavior often occurred, and therapists focused heavily upon reducing or attempting to eliminate the problem behaviors by presenting some type of aversive stimulation (e.g., electric shock, time out, physical punishment, depriving the child of lights, rewards, and the presence of others) contingent upon the aggressive, stereotypic, or other disruptive or interfering behavior (Hewett, 1965; R. L. Koegel, Firestone, Kramme, & Dunlap, 1974; Lovaas, 1977).

Almost all children made gains with this type of treatment, and many children showed considerable improvements; however, many researchers found the emphasis on punishment to be philosophically unacceptable and perhaps unnecessary (see Guess, Helmstetter, Turnbull, & Knowlton, 1987; Singer, Gert, & Koegel, 1999, for reviews). Furthermore, the teaching process of focusing on individual behaviors one at a time could often be laborious with gains slowly acquired. For example, Lovaas (1977, p. 46) reported that it could take as many as 90,000 trials to teach a nonverbal child with autism to express the first correct label of an object. Another concern was that the children often exhibited a general lack of spontaneity in their use of newly learned skills (Lovaas, 1977), and these behaviors often failed to be exhibited in other settings or in response to items that were not specifically taught. This led researchers to attempt to develop steps in their treatment programs to promote generalization. However, while this was deemed to be important theoretically and clinically, issues of generalization and maintenance tended to be considered as a second step *after* a new behavior had been instated in a controlled clinical setting (see Charlop, 1983; Dunlap, Koegel, Johnson, & O'Neill, 1987; Lovaas, Koegel, Simmons, & Long, 1973; Russo & Koegel, 1977; Schriebman & Carr, 1978).

The 1980s and beyond have been marked

by research designed to improve the breadth and clinical impact of behavioral strategies. Many of these studies have focused upon developing procedures that rely on positive behavioral support strategies to decrease the use of painful and aversive procedures and to develop techniques and environments that are conducive to broadly generalized intervention effects. In addition to a greater emphasis on techniques that include procedures such as differential reinforcement of behaviors incompatible with disruptive behavior, researchers began to analyze the function of problem behaviors, then teach appropriate, functionally equivalent replacement behaviors (Carr & Durand, 1985; Iwata, Dorsey, Sliker, Bauman, & Richman, 1982; Taylor & Bailey, 1996). In following such approaches, pivotal target behaviors began to be identified that produced broad improvements (such as decreases in problem behavior and increased generalization) in many non-targeted behaviors (e.g., R. L. Koegel, Koegel, & Surratt, 1992; Mundy, Sigman, & Kasari, 1990; Pierce & Schriebman, 1997).

Pivotal behaviors are defined as behaviors that are central to wide areas of functioning such that a change in the pivotal behavior will produce improvement across a number of behaviors. It should be noted that teaching pivotal behaviors still involves using a discrete trial format. That is, clear instructions are provided with consequences for responding, and prompts to help insure success. However, rather than working on individual target behaviors one at a time in an analog context, specific variables are altered within the teaching paradigm so that wider effects may be produced. Some pivotal behaviors previously identified and to be discussed in this article include motivation, responding to multiple cues, child self-initiations, and self-management. Although teaching pivotal behaviors involves a discrete trial format, there are differences between analog and pivotal teaching approaches. For example, while teaching individual target behaviors in an analog context relies on arbitrary reinforcement, the pivotal approach uses more natural reinforcement. Teaching individual target behaviors in an analog context typically relies on massed trials using adult-selected materials, while the pivotal approach relies on interspersing of mastery trials and the use of child-selected materials. In addition, teaching individual target behaviors in an analog context relies on adult-initiated interactions, while the pivotal approach

actively teaches child-initiated responses. Table 1 shows some comparisons and contrasts between these two (analog and pivotal) teaching approaches. Variables school psychologists can incorporate into IEP goals and intervention programs will be described.

Increasing Motivation as a Pivotal Response

One characteristic commonly associated with children with autism is a lack of motivation during teaching and social interactions (L. K. Koegel & Koegel, 1995; R. L. Koegel, Koegel, Frea, & Smith, 1995; R. L. Koegel & Mentis, 1985; Schreibman, 1988). The term *motivation*, as used in this article, refers to observable characteristics of a child responding such that an improvement in motivation is broadly defined as an increase in responsiveness to social and environmental stimuli (R. L. Koegel, Carter, & Koegel, 1998). While there is still an important need for researchers to define observable characteristics of motivation, some characteristics that have been measured include increases in the number of responses a child makes to teaching stimuli, decreases in response latency, and changes in

affect (e.g., interest, enthusiasm, happiness). While motivation in itself may be difficult to observe behaviorally, the effects of this process can be defined. For example, introducing child-choice is a process that appears to result in greater responsiveness to stimuli most likely because the reinforcing value of the stimulus materials has been increased. Some may conceptualize this as an antecedent or establishing operation that strengthens the reinforcing value of social and environmental stimuli so that the child is more responsive.

A pervasive lack of motivation can be so severe in children with autism that they may appear to be unresponsive to many everyday environmental stimuli (Sigman, 1994; Tager-Flusberg, 1994). This can be a challenge for school psychologists when designing meaningful intervention programs unless particular attention is paid to incorporating variables into the school environment that are designed to improve motivation. Motivational components incorporated into the curriculum have been shown to have widespread benefits across a number of academic and social behaviors, with concomitant decreases in disruptive behaviors (Dunlap, Kern-

Table 1
Differences Between the Analog and the Pivotal Response teaching approaches

	<i>Analog Discrete Trials</i>	<i>Pivotal/Motivation Trials</i>
Stimulus Items	a. Chosen by clinician b. Repeated until criterion is met c. Beginning step of target task stimuli, irrespective of whether they are functional in the natural environment	a. Chosen by child b. Varied every few trials c. Age-appropriate items that can be found in the child's natural environment
Interaction	Clinician holds up stimulus item; asks child to respond; stimulus item not functional within interaction.	Clinician and child play with stimulus item (i.e., stimulus item is functional within interaction and family routines)
Response	Correct responses or successive approximations reinforced.	Looser shaping contingencies so that attempts to respond (except self-stimulation) also are reinforced
Consequences	Edible reinforcers paired with social reinforcer.	Natural reinforcers (e.g., opportunity to play with item) paired with social reinforcers

Dunlap, Clarke, & Robbins, 1991; Kern & Dunlap, 1998; L. K. Koegel, Koegel, & Carter, 1998; R. L. Koegel, Koegel, & Schreibman, 1991; Schreibman, Stahmer, & Pierce, 1996). The following variables can be incorporated into the existing school environment.

Child Choice in Teaching Interactions

Child choice refers to using child-selected or child-preferred materials in everyday teaching tasks. Providing the opportunity for choice is important for a number of reasons. For example, it has been shown repeatedly that choice can decrease disruptive behaviors (Dunlap et al., 1991; Kern & Dunlap, 1998; Sigafos, 1998; Wacker, Berg, Asmus, Harding, & Cooper, 1998). Kern and Dunlap (1998) specifically showed that incorporating choice as a curricular intervention can decrease challenging behavior in the classroom. In addition, choice has been shown to increase adaptive behaviors such as task engagement (Moes, 1998; Dunlap et al., 1991; Dyer, Dunlap, & Winterling, 1990; Vaughn & Horner, 1997).

Some degree of choice can be incorporated in almost all activities or academic topics (Carter, Koegel, & Koegel, 1996; Hart & Risley, 1992; Kern & Dunlap, 1998; R. L. Koegel et al., 1998; L. K. Koegel & Koegel, 1995; R. L. Koegel, Dyer, & Bell, 1987; Warren & Kaiser, 1986b; Yoder, Kaiser, Alpert, & Fischer, 1993). In a classroom setting, this can be accomplished by allowing children to choose the stimulus materials for a mathematics or writing task. For example, the child may choose to write a postcard or to use certain writing implements while practicing penmanship or the child may choose the order of academic worksheets or choose desired items or candies to manipulate in a mathematics task. For younger or lower functioning children, choice may be provided by allowing selection of the book to be read during story time or the toy or game to be played with during free time or the color crayons and materials to be used during art or even by allowing the choice of where to sit during different classroom activities.

Additionally, school psychologists may suggest choice opportunities for parents whose children have difficulty completing homework. For instance, Moes (1998) showed that an increase in motivation to engage in and complete homework assignments and in concomitantly decreasing disruptive behavior can be ac-

complished by providing a variety of choices at home such as the order of completing homework tasks, the writing implements, the location in the house at which homework is conducted, and so on.

Task Variation and Interspersing Maintenance Tasks

It has been hypothesized that the lack of motivation evident in children with autism may be a result of the repeated failure at tasks (R. L. Koegel et al., 1989; L. K. Koegel et al., 1998; R. K. Koegel & Egel, 1979). Research has shown that children with autism will respond agreeably to introduction of new tasks when they have experienced some degree of repeated earlier success in tasks presented to them. This can be achieved if presentations of assignments are varied to include previously learned tasks (i.e., maintenance tasks) (Carr, Newsom, & Binkoff, 1980). Indeed, children with autism have been shown to respond with increased interest and enthusiasm when previously mastered tasks are interspersed randomly and frequently with acquisition trials on new tasks rather than when the children are presented with the same new target task in a massed series of trials (Dunlap, 1984). Further, it has been noted that other curricular modifications involving task presentation such as varying the task size or modifying the pacing of the task also may result in improved performance in the classroom by children with autism (Dunlap et al., 1991; Kern & Dunlap, 1998).

Reinforcing Attempts

Research has demonstrated that reinforcing all attempts, even if the child is not correct but it is clear that the child is actually trying, will improve a child's responsivity and learning during social and academic interactions (R. L. Koegel et al., 1998; R. L. Koegel & Egel, 1979; R. L. Koegel, O'Dell, & Dunlap, 1988). As such, the child will achieve increased reinforcement for responding, which, in turn, will increase the likelihood of future responding to tasks (Clark & Rutter, 1979; L. K. Koegel & Koegel, 1995; R. L. Koegel & Mentis, 1985). When combined with the interspersing of maintenance tasks as previously described, it can produce especially strong responding on even very difficult tasks.

Reinforcing attempts can be incorporated

easily into existing classroom activities. That is, teachers, school psychologists, and others may reinforce attempts in the classroom by praising all clear task-related responses to questions given in assignments or verbally, even if they are not entirely correct. For example, if the teacher asked a question requiring counting and the student attempted to answer, but answered incorrectly, the teacher might say enthusiastically, "That was a really good try! But it looks like there are four marbles in the box."

Natural Reinforcers

The use of natural and direct reinforcing consequences has been shown to be of benefit in social, language, and academic interactions. Providing natural, intrinsically reinforcing consequences rather than using arbitrary reinforcers, appears to increase motivation and rate of learning (R. L. Koegel et al., 1998; L. K. Koegel & Koegel, 1995; R. L. Koegel & Williams, 1980). A natural reinforcer can be defined as a reinforcer that is directly related to the task (Williams, Koegel, & Egel, 1981). In contrast, an arbitrary reinforcer is one that is not related to the task (cf. Skinner, 1979). For example, when teaching the word and concept of "open," a natural reinforcer would be to use a jar with something in it that can be opened to reveal and offer desired items (reinforcers) inside when the child provides the target response. In contrast, an arbitrary reinforcer would be to reward the child's use of the target word "open" with an external reinforcer such as a piece of candy that was not inside the jar. Thus, the use of natural reinforcers specifies the use of a stimulus that naturally provides a task-appropriate consequence.

Charlop and colleagues (Charlop, Schreibman, & Thibodeau, 1985) specified the importance of the use of direct consequences in an experimental study investigating expressive language teaching. Here, children with autism rapidly acquired meaningful speech by being taught to say "I want" + their desired object (e.g., cookie), using the desired object as a direct reinforcer immediately following the appropriate request (cf. L. K. Koegel, 1995; R. L. Koegel, O'Dell, & Koegel, 1987). Using such natural reinforcers may help children associate positive outcomes with their own responding (L. K. Koegel & Koegel, 1995), thereby increasing their motivation to respond.

Responding to Multiple Cues as a Pivotal Behavior

Another pivotal behavior of interest to those working with children with autism is responsivity to multiple cues. We classify responding to multiple cues as a pivotal behavior because it is a requirement for many types of learning. After about the age of one or two years, learning can be severely inhibited if a child does not respond to multiple cues in teaching situations (Lovaas, Koegel, & Schreibman, 1979). Considerable research during the years has identified a specific attentional feature called *overselectivity* that is evident in many children with autism (Allen & Fuqua, 1985; Prior, 1984; Schreibman, 1988). The term, *overselectivity*, refers to a problem in which children respond to an overly restricted portion of cues when learning to differentiate components of the environment (Dunlap, Koegel, & Burke, 1981; R. L. Koegel et al., 1995; Rosenblatt, Bloom, & Koegel, 1995; Schreibman, 1988; Schreibman et al., 1996). As such, children who demonstrate *overselective* responding fail to use all of the relevant cues in an educational setting (R. L. Koegel, Schreibman, Good, Cerniglia, Murphy, & Koegel, 1989; Rosenblatt et al., 1995). While typical children may initially respond to one salient characteristic when learning new objects (for example, all round objects are "balls"), they quickly learn to differentiate objects based on all distinguishing properties rather than one specific feature. However, children with autism often demonstrate *overselectivity* to a greater extent than typically developing children and to irrelevant components of objects (e.g., a torn out tab in a pop-up book as opposed to the picture itself), which seriously interferes with their learning. Children who demonstrate *overselectivity* have been shown to have difficulty generalizing acquired behaviors (Rincover & Koegel, 1975; Schreibman et al., 1996) due to selective responding to irrelevant stimuli in the original teaching situation (e.g., incidental hand movements) that may gain control of an acquired response (Dunlap et al., 1981).

Effective interventions for multiple cue teaching can be divided into two general approaches. One approach is called *within-stimulus prompting* (Schreibman, 1975). Within-stimulus prompts are exaggerations of relevant components of a stimulus (Rosenblatt et al., 1995), which are slowly faded throughout the learning exercise (Dunlap et al., 1981). For

example, consider a child learning to discriminate the letters, *p* and *b*. Here, the relevant component is the orientation of the stem of the letters, which at first are greatly elongated to show a clear difference in orientation. The length of the exaggerated stem is then slowly reduced until the child is able to successfully discriminate the appropriately sized letters (Dunlap et al., 1981). This procedure attempts to attract the child's attention to the relevant cues (cf. R. L. Koegel et al., 1995; Rosenblatt et al., 1995).

Another approach to multiple cue teaching is to structure the learning environment using *conditional discriminations* (Schreibman, 1988). A conditional discrimination is one that requires responding on the basis of multiple cues (R. L. Koegel & Schreibman, 1977; Schreibman et al., 1996). For example, asking a child to select a blue crayon when a variety of stimuli sharing the same cues are present (e.g., a blue pencil, a red crayon, a blue crayon, etc.) requires the child to make a conditional discrimination in that the child must respond to both color (blue) and object (crayon) (Schreibman et al., 1996). Additionally, the number of cues can gradually and systematically be increased as the child masters a certain number of cues (e.g., the blue crayon to the *big* blue crayon) (see R. L. Koegel et al., 1989; Schreibman, Charlop, & Koegel, 1982). Research has demonstrated that if a child is repeatedly exposed to this type of instruction as opposed to a single-cue instruction (e.g., crayon in which any crayon in the environment will do), the child eventually learns to respond to an increased number of cues (R. L. Koegel et al., 1989; Schreibman et al., 1982).

Teachers may easily include multiple cue teaching into various classroom activities. For example, during art activities, a number of different colors and types of materials could be furnished, and children may be asked exactly which of these items they would like to use (e.g., the blue paper, the purple crayon, the red scissors, etc.). During story time, questions about the story could be asked that require the children to respond using multiple cues (e.g., "Look at this man's funny outfit! Can you tell me what he is wearing?" "Oh yes, a blue coat and red shoes and yellow pants."). For classroom activities requiring the use of writing instruments such as mathematics assignments or practicing writing alphabet letters, a number of different writing utensils could be provided (e.g., a blue pen, a black pen, a blue pencil, and a black pencil, etc.), from which the

each child may request the instrument he or she would prefer.

Thus, teachers, school psychologists, parents, and others who have contact with a child with autism may need to—whenever possible and appropriate—choose tasks that encourage or require the child to respond on the basis of multiple cues in their everyday environments, both at school and at home. As children learn to respond on the basis of multiple cues in their environment, their attention appears to become more normalized, allowing more cues in their environment to become functional, thereby leading to enhanced learning and generalization.

Developing Self-initiated Learning Interactions as Pivotal Responses

While the previously described teaching procedures have been shown to be helpful in improving learning on teaching tasks when teachers provide antecedent instructions to respond, there can still be a pervasive lack of spontaneous, independent, child-initiated learning that interferes with adequate social and pragmatic development. It appears that successful overall functioning and social competence requires learning from the environment even when the teacher is not providing instructions and intervention. While typically developing children spend considerable time actively seeking social and learning opportunities, children with autism generally avoid such interactions (cf. Paul & Shiffer, 1991; Tager-Flusberg, 1994; Wetherby & Prutting, 1984). Because widespread learning for typical development may require self-initiated interactions, we classify the general skill of self-initiated learning as a pivotal response. The following section describes how motivational procedures also can be used to teach spontaneous child-initiated responses that result in improved learning.

In a preliminary study, we assessed whether children with autism could learn and generalize an important and early developing type of child-initiation, the child-initiated use of a question (L. K. Koegel, Camarata, Valdez-Menchaca, & Koegel, 1998). Studies have shown that children with autism lack spontaneous initiations, especially verbal initiations such as question-asking (Hung, 1977; L. K. Koegel, 1995; Taylor & Harris, 1995; Wetherby & Prutting, 1984). A number of researchers have stressed the importance of teaching children with disabilities to

use questions and have provided encouraging data to suggest the feasibility of teaching these skills (e.g., Hung, 1977; L. K. Koegel, 1995; Taylor & Harris, 1995; Warren, Baxter, Anderson, Marshall, & Baer, 1981). We examined whether motivational procedures could be incorporated into the teaching of question-asking, and if this would result in generalization of spontaneous question-asking. This study systematically assessed whether children with autism, who asked few or no questions, could learn to initiate spontaneously the question, "What's that?" and whether the spontaneous use of this question would generalize across stimuli, settings, and people not involved in the original teaching. Intervention consisted of placing child-choice (highly desired) items in an opaque bag and prompting the child to query about what was inside the bag. Following the prompted question, the child was shown what was inside the bag and allowed to play with (or otherwise interact with) the item. The prompt was then faded so that spontaneous question-asking occurred. In addition, child-desired items were gradually replaced with neutral items that the child could not label, and the bag also was faded.

After the treatment phase of this study, all of the children learned to use the question, "What's that?" in relation to items they had previously been unable to name, and all children demonstrated generalization of spontaneous child-initiated question-asking. Further, following the intervention, all of the children generalized the response and began to engage in such self-initiations with their mothers at home, and all learned expressive vocabulary labels as a result of these child-initiations.

Coinciding with this initial research on teaching initiations, our center also began looking at archival data that might suggest key indicators that were correlated with favorable outcomes for children with autism. Interestingly, the use of child-initiations was repeatedly identified as a key pivotal behavior. That is, independent of the academic competence level of the children, naive observers did not judge them as being pragmatically appropriate if they did not show initiations during unstructured interactions. Furthermore, the children who did not exhibit child-initiations early appeared to withdraw further into isolation as they matured. Thus, these two lines of research suggest that the children not only may need to exhibit initiations to be judged as socially appropriate, but importantly,

child-initiations can be taught and may be important intervention goals for school psychologists to increase children's learning opportunities.

Self-management as a Pivotal Behavior

The term, self-management, generally refers to a procedure in which individuals are taught to discriminate their own target behaviors and to record the occurrence or absence of that target behavior (self-monitoring). A large body of literature presents self-management as an effective procedure for promoting independence (L. K. Koegel & Koegel, 1995). A child with a disability must ultimately be capable of exhibiting a variety of appropriate behaviors in ever changing environments for extended periods of time with minimal or no feedback from others. We classify self-management as a pivotal behavior because the skill of self-management can facilitate generalization of an infinite number of behaviors, across an infinite number of environments and people, with minimal feedback from others, and in the absence of a trained intervention provider. While the degree of autonomy one would expect to see may vary according to the age and functioning level of the child (Stahmer & Schreibman, 1992), based upon the literature, targeting self-management as a pivotal behavior can result in broad improvements in many children (cf. R. L. Koegel & Frea, 1993).

Self-management has several advantages as a means of facilitating generalized and independent responding for children with autism. First, the procedures allow the child to take an active role in intervention, reducing the need for constant clinician vigilance (cf. Fowler, 1984; Newman, Tuntigian, Ryan, & Reinecke, 1997). This is particularly important for school psychologists, who have a limited number of hours with each child (L. K. Koegel, Harrower, & Koegel, 1999). Second, by teaching the child the "skill" of self-management as a pivotal behavior, an indefinite number of behaviors can be targeted in virtually any environment the child enters (L. K. Koegel & Koegel, 1995). Third, many factors that are included in self-management programs have previously been shown to be successful in promoting generalization, including the administration of delayed rewards (e.g., Dunlap et al., 1987). Fourth, the use of self-management techniques may initiate a favorable

cycle of steadily improving environmental interactions (Baer, Fowler, & Carden-Smith, 1984). For example, when a child uses a self-managed target behavior or attempts to self-recruit reinforcement in the natural environment, it may encourage other individuals in those settings to provide reinforcers for the occurrence or improvement of the target behavior outside of the intervention setting (cf. Todd, Horner, & Sugai, 1999).

Self-management procedures, initially discussed as an effective means of improvement with nondisabled populations (e.g. Glynn, Thomas, & Shee, 1973; O'Brien, Riner, & Budd, 1983), also have been used successfully with persons exhibiting mild to moderate mental retardation (Gardner, Cole, Berry, & Nowinski, 1983; Grace, Cowart, & Matson, 1988; Horner & Brigham, 1979; Knapczyk & Livingston, 1973; Litrownik, Freitas, & Franzini, 1978; Nelson, Lipinski, & Boykin, 1978; Sugai & Rowe, 1984). More recent research has applied self-management principles to intervention in inclusive school settings with children with severe disabilities, including autism (e.g., Frea & Hughes, 1997; Kern, Marder, Boyajian, Elliot, & McElhatten, 1997). Here, self-management has been shown to be effective for increasing on-task behavior, decreasing disruptive behavior, and eliminating time spent in time out for children with autism in full inclusion settings (L. K. Koegel et al., 1999; R. L. Koegel & Koegel, 1990; R. L. Koegel et al., 1992).

For example, R. L. Koegel and L. K. Koegel (1990) described a young boy with autism who exhibited disruptive behaviors in his full-inclusion classroom. A self-management program was implemented wherein the child self-evaluated periods of on-task behavior. Intervals, signaled by a repeat chronograph alarm function on a wristwatch he wore, were gradually increased. The program was effective in eliminating problem behaviors in his inclusive setting, and intervals with appropriate behavior generalized to class outings in the absence of a treatment provider.

The effects of self-management on children with autism in the classroom also have been investigated with regard to social interaction (L. K. Koegel, Koegel, Hurley, & Frea, 1992; Shearer, 1996). For example, a study by L. K. Koegel and her colleagues (1992) also investigated the effect of self-management on the social skills of children with autism. This study assessed

whether self-management could be used as a technique to produce extended improvement in the responsiveness of children with autism to verbal initiations from others in community, home, and school settings without the presence of a treatment provider. Children participating in the study were taught to record their correct responses to questions using a wrist counter. Correct responses were rewarded with reinforcers. Results suggested that children with autism who display severe deficits in social skills could learn to self-manage responsivity to others in multiple community settings, including the classroom, and that such improvements were associated with concomitant reductions in disruptive behavior without the need for special intervention. Similarly, Shearer (1996) investigated the social skills and activity engagement of children with autism and their typically developing classmates. In this study, children with autism included in a regular education classroom exhibited high levels of active engagement most often in a solitary fashion during pre-intervention (i.e., baseline), but they exhibited high engagement levels with their peers following self-monitoring modeling and instruction, and these interactions were maintained during follow-up.

The general procedure for teaching self-management includes several steps: (a) operationally define the target behaviors (this can be done with one individual behavior at a time or with groups of behavior such as "disruptive behavior" or "appropriate classroom behavior"); (b) identify functional reinforcers for the child to earn (reinforcers should be self-administered and child-selected so that they can be easily evolved into natural reinforcers occurring in the child's everyday settings); (c) design a self-monitoring method or device (the device will vary according to whether the recording is for responses or for intervals of time); (d) teach the child to use the self-monitoring device (the child will need to learn to discriminate between exhibiting desired and undesired behaviors, and then to record occurrence of the appropriate target behavior); (e) fade the use of the self-monitoring device (this can be accomplished by increasing the number of responses or the time interval required for a reinforcer to be delivered and by delaying and thinning the reinforcement schedule); and (f) validate whether the child is using the self-monitoring device in natural environments (general validation, such as asking a teacher or

parent if the child appeared to be using the device seems adequate to insure effective use of the device in desired settings).

While self-management seems to be relatively easy to teach to children who are more than five years of age and verbal, a few recent studies have attempted to teach self-management to low-functioning children. For example, Pierce and Schreibman (1994) investigated the use of pictorial self-management to teach daily living skills to 3 low-functioning boys with autism. In their study, children with autism were taught to use pictures to cue specific daily living tasks and activities. Results showed that all children were able to use successfully pictures to manage their behavior in the absence of a treatment provider and to generalize their behavior across settings and tasks. Moreover, behaviors were maintained at follow-up, and all children showed a substantial decrease in stereotypic behaviors when compared to baseline measures. When picture order was manipulated in stimulus control probes, children followed the new picture sequence, suggesting that the pictures were controlling their behavior, and that they were performing independently of adult supervision. Further, a savings effect was demonstrated: 2 of the 3 children reached criterion on second and third behaviors within less than 25% of original training time.

When combined with other motivational procedures previously described and functional analyses to determine appropriate replacement behaviors in the classroom, self-management can be especially effective in school settings. While initially a school psychologist or other special educator may need to be responsible for developing the program, the end goal is to have the program fit into the normal class routine with the classroom teacher responsible for evaluation and administration of rewards. For example, the regular transition times in the classroom day can be used to teach the child with autism to self-initiate recruitment of reinforcers for their successful classroom work (Kern et al., 1997). As the children become competent at self-managing and the interval or number of responses increases, the program also may be able to be coordinated with the child's parents so that reinforcers contingent upon appropriate academic, social, and other classroom behaviors are provided at home.

Teaching Under Natural Conditions

The basic premise of pivotal response

teaching procedures is to arrange the teaching environment to increase motivation and children's opportunities to respond to various stimuli in the child's natural environment or under conditions that approximate the natural environment (R. L. Koegel et al., 1998). Investigators repeatedly have shown that this type of approach produces more favorable outcomes across a number of areas as compared to outcomes following analog teaching approaches using interactions very dissimilar from those occurring in the natural environment (cf. Camarata & Nelson, 1992; Camarata, Nelson, & Camarata, 1994; Warren & Kaiser, 1986a; Yoder et al., 1995). An early study addressing this issue introduced a combined package of motivational teaching techniques, called the Natural Language Teaching Paradigm (NLP) (R. L. Koegel et al., 1987), and compared it with a traditional analog teaching format in an attempt to increase initial verbal responding in children with autism (i.e., to teach a first lexicon). The analog condition consisted of a speech clinician presenting instructions using picture cards, prompts, and social (e.g., "good") and edible (e.g., a raisin) reinforcers for correct approximations to the target response. The NLP condition incorporated the previously mentioned motivational teaching techniques in an approach that incorporated parameters of normal teaching interactions such as those that occur in natural environments, including the use of familiar and desired toys, objects and activities, variation of teaching stimuli, reinforcing the child with opportunities to access the desired materials or activity, and turn-taking within a dyadic interaction (R. L. Koegel et al., 1987). Results of the study indicated that the children displayed more correct responses in the NLP condition as opposed to the analog condition. Furthermore, the children demonstrated generalization to spontaneous utterances as well as better extra-clinic generalization with the naturalistic language teaching procedure.

Another area shown to be affected favorably by using the NLP teaching package is disruptive behavior. Disruptive behaviors are often displayed by children with autism and other severe disabilities during difficult teaching tasks (Kern & Dunlap, 1998). To investigate this problem, R. L. Koegel and his colleagues (1992) compared two teaching conditions with three preschool children with autism who exhibited extremely disruptive behavior during teaching interactions. Again, a traditional analog clinical format was

compared with a package of motivational teaching techniques in a naturalistic language teaching approach (R. L. Koegel et al., 1987; R. L. Koegel et al., 1992). The study found that all of the children demonstrated much lower levels of disruptive behavior in the naturalistic teaching condition when compared with the analog format. Moreover, the children produced more correct target behavior in the naturalistic condition than during the analog condition. This finding is extremely promising for school psychologists and teachers by showing that problem behaviors displayed at school during difficult teaching tasks may be reduced by using a set of techniques (previously described in this article) that increase children's motivation and responsiveness to participate in teaching interactions.

The benefits of using of pivotal, naturalistic techniques rather than employing analog procedures has likewise been shown to be effective in improving the intelligible use of speech sounds during conversation. A recent study investigating intelligible speech in children with autism (R. L. Koegel, Camarata, Koegel, Ben-Tall, & Smith, 1998) showed that when comparing an analog (using flash cards and beginning with sounds in isolation) versus a naturalistic teaching approach (using desired toys that contained the target sounds in functional interactions and beginning at the word level), generalization of intelligible isolated targeted speech sounds to natural conversation occurred to a far greater extent when naturalistic teaching procedures were employed (cf. Camarata, 1996).

The advantage of using naturalistic teaching approaches with children with autism has additionally been shown in extensions to child-initiations (L. K. Koegel, Camarata et al., 1998), diversity of language structures (Carter et al., 1996; Carter, Koegel, & Koegel, 1998), vocabulary development (L. K. Koegel, Camarata et al., 1998; Carter et al., 1996), and in social and behavioral gains such as compliance, initiating and maintaining play interactions, and appropriate turn taking (Carter et al., 1998; Pierce & Schreibman, 1997; Stahmer, 1995; Thorp, Stahmer, & Schreibman, 1995). Indeed, procedures incorporating pivotal and naturalistic procedures have been shown to result in positive language and behavioral change in varied populations of children with disabilities ranging from mild to severe (see Camarata, 1993, 1996; Kaiser & Hester, 1994) and have been extended to classroom applications (Yoder et al., 1995) in

contexts throughout the school day.

For instance, Yoder and his colleagues (1995), upon comparing two naturalistic language intervention methods (milieu teaching and responsive interaction), showed that classroom teachers could incorporate language teaching procedures into ongoing classroom activities following videotaped demonstration of procedures and suggestions about incorporating them. Furthermore, children made specific language gains from each language teaching method when the teachers implemented them naturally into their existing curriculum (for further discussion of these two procedures, see Hart & Rogers-Warren, 1978; Kaiser & Hester, 1994; Rogers, Herbison, Lewis, Pantone, & Reis, 1986).

Similarly, the naturalistic approach of incidental teaching in the classroom was found to be more effective in maintaining the expressive use of color adjectives to describe preferred toy and food items by children with autism when compared with traditional (discrete-trial) language teaching methods (Miranda-Linne & Melin, 1992). McGee and her colleagues (1985) also found incidental teaching to be preferable to traditional methods in teaching children with autism to use prepositions and have suggested that incidental teaching be included as a standard component of language development curricula for autistic and other developmentally delayed children in the classroom (see Hart & Risley, 1975; Hart & Risley, 1980; Kaiser, Yoder, & Keetz, 1992; MacDuff, Krantz, MacDuff, & McClannahan, 1988; Valdez-Menchaca & Whitehurst, 1988, for further discussion of incidental teaching of language). Moreover, classroom applications of incidental teaching have been shown to be of value in teaching social skills to children with autism and other developmental disabilities and in maximizing teaching time (see Gunter, Fox, & Brady, 1984; McGee, Almeida, Sulzer-Azaroff, & Feldman, 1992; School & Cooper, 1983).

In another application of incorporating naturalistic techniques into classroom environments, Kohler and his colleagues (1997) examined naturalistic teaching and peer-mediated tactics to address children's developmental skills. In this study, teachers used naturalistic teaching strategies with peer modeling and cooperation to address the Individualized Education Program (IEP) objectives of preschoolers with autism included in their regular education classrooms. Results showed that teacher-child and focal child-

peer interactions increased in length and served as the stimulus or context for further instructional episodes.

Other classroom applications include preschool early intervention education programs (McClannahan & Krantz, 1997; Strain, Kohler, & Goldsein, 1996) that provide intervention services in preschool and elementary school for children with autism. Effective components of such programs often include parent education and classroom-based interventions, and also may involve the training of peers to perform as teacher assistants (see Harris & Handleman, 1994, for a summary of 10 such programs for children with autism).

Future Directions

Parent-Professional Coordination

When one conducts interventions in children's natural environments, the issue of coordination of efforts in multiple everyday settings such as home and school emerges as an important topic. Studies have documented the fact that when similar, but slightly different, interventions are conducted in two environments (e.g., home and school), one may note a paradoxical deterioration in a child's behaviors in one environment while his/her behavior improves in the other environment. This phenomenon has been labeled "behavioral contrast" (R. L. Koegel, Egel, & Williams, 1980). Studies have shown that behavioral contrast can be eliminated if interventions are coordinated so that children may improve in both environments (Dunlap, Koegel, & Koegel, 1984; R. L. Koegel et al., 1980).

A number of procedures have proven to be effective in home-school coordination efforts. One such method, priming, involves providing parents with materials (e.g., stories, writing assignments, mathematics assignments, etc.), so that they may be presented to the child *prior to* the classroom activity (Wilde, Koegel, & Koegel, 1992). For example, the teacher may send home books, which will be read at storytime the following day, or worksheets the class will be assigned the following day. This procedure has been shown to result in increased academic performance as well as decreased disruptive behavior. Additionally, these procedures have been replicated in the area of social skills development. That is, priming also has been shown to improve social skills such as initiating,

responding, keeping an interaction going, greeting others, giving and accepting compliments, taking turns, asking for help and helping others, including others in activities, etc., when children are primed to exhibit these behaviors prior to social group interaction with nondisabled classroom peers (Kamps, Leonard, Vernon, Dugan, & Delquadri, 1992; Zanolli, Daggett, & Adams, 1996).

Teachers report one of the major advantages of this procedure is its ease of implementation. Further, it is a preventative procedure, and, as such, avoids time-consuming efforts necessary to remediate problem behaviors after they begin to occur. Priming is readily usable across a wide variety of age groups and disability types in preschool through high school settings. In addition, when parents assist with the priming, it can be cost effective for schools. While most parents are willing and able to help with such procedures, it is also easy for school psychologists, resource specialists, and other special education staff to implement the procedures directly, by working with the children briefly after school, in those situations in which parents are unavailable. Three aspects of priming are likely to be important: priming is conducted prior to the activity; the priming session is low demand; and the priming session is rich in potential sources of reinforcement (Zanolli et al., 1996).

Overall, priming, in addition to parent education programs, coordinating and developing IEP goals that fit with family routines, cultural values, and lifestyle that are likely to be taught and used in the home and other community environments in a way that is consistent with the child's overall educational plan, is likely to increase the likelihood of rapid acquisition, generalization and maintenance (L. K. Koegel, Koegel, Kellegrew, & Mullen, 1996).

Developing Communicative Competence in School Settings

Most children with autism have social-communicative goals in their IEPs, but there typically have been few instances throughout the day during which implementation of such interventions occur (cf. Peck, 1993). Recently, we have found that special education and regular education teachers can quickly and easily learn to carry over effective phonology and language intervention procedures on a continuing basis

throughout the school day (McNerney & Koegel, 1997; Smith & Camarata, 1999). This has been accomplished by having the teacher create opportunities for language use throughout the day by environmental manipulations that provide the child with opportunities to gain access to highly desired items through communicative means. In Smith and Camarata's (1999) study, a school psychologist worked with regular education teachers in full-inclusion classrooms so that the teachers learned to work on increasing intelligible speech pronunciation by modeling appropriate responses and then providing the child with access to desired items contingent upon the children's speech attempts or correct intelligible utterances. This coordinated effort resulted in improved communication on the children's part without any reported disruption of teachers' ongoing curriculum efforts. McNerney and Koegel (1997) demonstrated similar improvements in expressive language use for children in special and regular education classrooms when teachers were shown videotapes illustrating effective interventions in clinic settings. Specifically, the children who participated in this study attended parent education programs focusing upon the pivotal response interventions previously described, and were demonstrating improvements in expressive language with their mothers; however, these gains were not generalizing to the school setting. By showing videotaped instances of successful mother-child interactions in the clinic parent training sessions, teachers were able to extend and replicate these effects within their classroom settings, creating improved outcomes for the children. By coordinating these efforts across environments, the teachers were able to produce considerable communication gains that would have been unlikely to occur had the intervention not been intensive and constant across settings.

Improving Social Play During Recess and Lunch

Recent literature has defined a number of procedures designed to improve social play and interactions among children with autism and their nondisabled peers in school settings. For example, a recent study (Baker, Koegel, & Koegel, 1998) designed a social skills development program that capitalized on strengths shown by the children with autism so that the children with autism were viewed as a valued member of the peer group.

This was accomplished by incorporating obsession themes—topics upon which the children with autism perseverated—into socially appropriate games previously existing at the children's schools. Each game was designed for a group of children, and incorporated the common interests of the school group.

For example, one child with autism perseverated on facts concerning U.S. geography. This obsession theme was incorporated into a socially appropriate tag game that occurred on an existing giant outline drawing of a United States map painted on the school play yard. The game consisted of a "caller" who would yell out a state and how he/she wanted the children to travel there (i.e. hop, run, walk). The object of the game was for the children to travel to that state without being tagged by the "caller." Inherent in this game was the typical children's common interest in the game of tag as well as the child with autism's exceptional knowledge of state locations.

This intervention (replicated with other children and activities) resulted in increases in the child with autism's social play interactions and also in the children's positive affects, indicating that all of the children enjoyed the games and the interactions. The nondisabled peers frequently would seek the participation of the child with autism due to his or her extensive knowledge of the subject, and the children viewed the child with autism as a valued (and often necessary) participant in the game. Additionally, observations indicated that appropriate social interactions also generalized to other playground activities in which no intervention was implemented.

Thus, under the right conditions, a perseverative theme could be channeled into appropriate social games that would functionally increase a child's social play interactions by acting as both a motivator and natural reinforcer. Again, this resulted in the children with autism being considered as highly valued and necessary members of their groups, while also improving social interactions and general quality of play.

Conclusion

Overall, accumulating research has identified a variety of specific procedures that, when implemented in the school setting, can greatly improve academic and social performance of children with autism. School psychologists and other special educators can assume a critical role

in designing and coordinating comprehensive programs for these children. Table 2 provides a summary of some of the principles previously described with examples of how these principles may be incorporated into the classroom environment.

By improving teaching interactions so that they directly address important pivotal behaviors,

including motivation to respond to difficult social and academic tasks, self-management, responding to multiple cues, and child-initiations, there may be a greatly increased likelihood of improvement in the overall symptomatology of autism with improved prognosis and long-term positive gains.

Table 2
Summary of Principles Described with Suggestions for Their Use in the Classroom

Pivotal Response	Intervention	Examples
Motivation	Provide child choice.	Child chooses order of assignments. Child chooses writing instruments. Child chooses book to be read to class.
	Vary tasks and intersperse maintenance tasks.	Vary tasks often by following a short duration of reading with a short duration of art time. Vary task size by providing frequent breaks. Modify pacing of task by decreasing the interval of time between student's responses and presentation of the next instruction. Intersperse a learned task such as counting with a new task such as learning money.
	Reinforce attempts.	Provide verbal praise for all responses to questions asked. Provide written praise on homework papers and other assignments.
	Use natural reinforcers.	When learning to tell time, let the child learn the times of favorite activities. When teaching money, have the children purchase small favorite items.

Table 2 (continued)

Pivotal Response	Intervention	Examples
Multiple cues	Encourage multiple cue learning and responses.	<p>Furnish a number of different colors of construction paper, crayons, pencils, etc. during art time and have children ask for which they'd like.</p> <p>Ask questions during story time which require the children to respond using multiple cues.</p> <p>For mathematics assignments or practicing writing alphabet letters, provide a number of different writing utensils (e.g., a blue pen, a black pen, a yellow pencil, etc.), and have the children request the utensil they'd prefer.</p>
Self-initiated responses	Teach question asking.	<p>Teach information-seeking initiations such as questions about the name and location of items.</p> <p>Teach assistance-seeking initiations, such as asking for help.</p>
Self-management	Teach children to discriminate their own behaviors and to record the occurrence or absence of the behaviors.	Have child put a check mark on a piece of paper for every page turned during story time when sitting quietly. Have child use a repeat chronograph alarm wristwatch to self-evaluate periods of on-task behavior during in class mathematics or other assignments.

References

- Allen, K. D., & Fuqua, R. W. (1985). Eliminating selective stimulus control: A comparison of two procedures for teaching mentally retarded children to respond to compound stimuli. *Journal of Experimental Child Psychology, 39*, 55-71.
- Baer, M., Fowler, S. A., & Carden-Smith, L. (1984). Using reinforcement and independent-grading to promote and maintain task accuracy in a mainstreamed class. *Analysis and Intervention in Developmental Disabilities, 4*, 147-189.
- Baker, M. J., Koegel, R. L., & Koegel, L. K. (1998). Increasing the social behavior of young children with autism using their obsessions. *Journal of the Association for Persons with Severe Handicaps, 23*(4), 300-308.
- Bandura, A. (1969). *Principles of behavior modification*. New York: Holt, Rinehart, & Winston.
- Camarata, S. M. (1993). The application of naturalistic conversation training to speech production in children with speech disabilities. *Journal of Applied Behavior Analysis, 26*, 173-182.
- Camarata, S. M. (1996). On the importance of integrating naturalistic language, social intervention, and speech intelligibility training. In L. K. Koegel, R. L. Koegel, & G. Dunlap (Eds.), *Positive behavioral support: Including people with difficult behavior in the community* (pp. 333-351). Baltimore: Brookes.
- Camarata, S. M., & Nelson, K. E. (1992). Treatment efficiency as a function of target selection in the remediation of child language disorders. *Clinical Linguistics and Phonetics, 6*, 167-178.

- Camarata, S. M., Nelson, K. E., & Camarata, M. N. (1994). Comparison of conversational recasting and imitative procedures for training grammatical structures in children with specific language impairment. *Journal of Speech and Hearing Research, 37*, 144-1423.
- Carr, E. G., & Durand, V. M. (1985). Reducing behavior problems through functional communication training. *Journal of Applied Behavior Analysis, 18*, 111-126.
- Carr, E. G., Newsom, C. D., & Binkoff, J. A. (1980). Escape as a factor in the aggressive behavior of two retarded children. *Journal of Applied Behavior Analysis, 18*, 111-126.
- Carter, C. M., Koegel, L. K., & Koegel, R. L. (1996, May). *Generalized effects of question asking on acquisition of language structures*. Poster session presented at the annual meeting of the Association for Behavior Analysis, San Francisco, CA.
- Carter, C. M., Koegel, R. L., & Koegel, L. K. (1998, May). *Using child choice with interactive games to increase diversity of language structures in children with autism*. Poster session presented at the annual meeting of the Association for Behavior Analysis, Orlando, FL.
- Charlop, M. H. (1983). The effects of echolalia on acquisition and generalization of receptive labeling in autistic children. *Journal of Applied Behavior Analysis, 16*, 111-126.
- Charlop, M. H., Schreibman, L., & Thibodeau, M. G. (1985). Increasing spontaneous verbal responding in autistic children using a time-delay procedure. *Journal of Applied Behavior Analysis, 22*, 275-285.
- Clark, P., & Rutter, M. (1979). Task difficulty and task performance in autistic children. *Journal of Child Psychology and Psychiatry and Allied Disciplines, 20*, 271-285.
- Dunlap, G. (1984). The influence of task variation and maintenance tasks on the learning and affect of autistic children. *Journal of Experimental Child Psychology, 37*, 41-64.
- Dunlap, G., Kern-Dunlap, L., Clarke, S., & Robbins, F. R. (1991). Functional assessment, curricular revision, and severe behavior problems. *Journal of Applied Behavior Analysis, 24*, 387-397.
- Dunlap, G., Koegel, R. L., & Burke, J. C. (1981). Educational implications of stimulus overselectivity in autistic children. *Exceptional Education Quarterly, 20*, 37-49.
- Dunlap, G., Koegel, R. L., Johnson, J., & O'Neill, R. E. (1987). Maintaining performance of autistic clients in community settings with delayed contingencies. *Journal of Applied Behavior Analysis, 20*, 185-191.
- Dunlap, G., Koegel, R. L., & Koegel, L. K. (1984). Continuity of treatment: Toilet training in multiple community settings. *Journal of the Association for Persons with Severe Handicaps, 9*, 134-141.
- Dyer, K., Dunlap, G., & Winterling, V. (1990). Effects of choice making on the serious problem behaviors of students with severe handicaps. *Journal of Applied Behavior Analysis, 23*, 515-524.
- Ferster, C. B. (1961). Positive reinforcement and behavioral deficits of young children. *Child Development, 32*, 437-456.
- Fowler, S. A. (1984). Introductory comments: The pragmatics of self-management for the developmentally disabled. *Analysis and Intervention in Developmental Disabilities, 4*, 85-89.
- Frea, W. D., & Hughes, C. (1997). Functional analysis and treatment of social-communicative behavior of adolescents with developmental disabilities. *Journal of Applied Behavior Analysis, 30*, 701-704.
- Gardner, W. I., Cole, C. L., Berry, D. L., & Nowinski, J. M. (1983). Reduction of disruptive behaviors in mentally retarded adults. *Behavior Modification, 7*, 76-96.
- Glynn, E. L., Thomas, J. D., & Shee, S. M. (1973). Behavioral self-control of on-task behavior in an elementary classroom. *Journal of Applied Behavior Analysis, 6*, 105-113.
- Grace, N., Cowart, C., & Matson, J. L. (1988). Reinforcement and self-control for treating a chronic case of self-injury in Lesch-Nyhan Syndrome. *Journal of the Multihandicapped Person, 1*, 53-59.
- Guess, D., Helmstetter, E., Turnbull, H. R., & Knowlton, S. (1987). Use of aversive procedures with persons who are disabled: An historical review and critical analysis. *Monograph of the Association for Persons with Severe Handicaps, 2*(1).
- Gunter, P. L., Fox, J. J., & Brady, M. P. (1984). Social skills training of handicapped children in less restrictive environments: Research implications for classroom teachers. *Pointer, 29*, 8-10.
- Harris, S. L., & Handleman, J. S. (Eds.). (1994). *Preschool education programs for children with autism*. Austin, TX: PRO-ED.
- Hart, B. M., & Risley, T. R. (1975). Incidental teaching of language in the preschool. *Journal of Applied Behavior Analysis, 8*, 411-420.
- Hart, B. M., & Risley, T. R. (1980). In vivo language intervention: Unanticipated general effects. *Journal of Applied Behavior Analysis, 13*, 407-432.
- Hart, B. M., & Risley, T. R. (1992). American parenting of language-learning children: Persisting differences in family-child interactions observed in natural home environments. *Developmental Psychology, 28*, 1096-1105.
- Hart, B. M., & Rogers-Warren, A. K. (1978). A milieu approach to teaching language. In R. L. Schiefelbusch (Ed.), *Language intervention strategies* (Vol. 2, pp. 192-235). Baltimore: University Park Press.
- Hewett, F. M. (1965). Teaching speech to autistic children through operant conditioning. *American Journal of Orthopsychiatry, 34*, 927-936.
- Horner, R. H., & Brigham, T. A. (1979, February). The effects of self-management procedures on the study behavior of two retarded children. *Education and Training of the Mentally Retarded, 18*-24.
- Hung, D. W. (1977). Generalization of "curiosity" questioning behavior in autistic children. *Journal of Behavior Therapy and Experimental Psychiatry, 8*, 237-245.
- Iwata, B. A., Dorsey, M. F., Slifer, K. J., Bauman, K. E., & Richman, G. S. (1982). Toward a functional analysis of self-injury. *Analysis and Intervention in Developmental Disabilities, 2*, 3-20.
- Kaiser, A. P., & Hester, P. P. (1994). Generalized effects of enhanced milieu teaching. *Journal of Speech and Hearing Research, 37*, 1320-1340.
- Kaiser, A. P., Yoder, P. J., & Keetz, A. (1992). Evaluating milieu teaching. In S. F. Warren & J. Reichle (Eds.), *Causes and effects in communication and language intervention* (Vol. 1, pp. 9-47). Baltimore: Brookes.
- Kamps, D. M., Leonard, B. R., Vernon, S., Dugan, E. P., & Delquadri, J. C. (1992). Teaching social skills to students with autism to increase peer interactions in an integrated first grade classroom. *Journal of Applied Behavior*

- Analysis*, 25, 281-288.
- Kern, L., & Dunlap, G. (1998). Curricular modifications to promote desirable classroom behavior. In J. K. Luiselli & M. J. Cameron (Eds.), *Antecedent control: Innovative approaches to behavioral support* (pp. 289-307). Baltimore: Brookes.
- Kern, L., Marder, T. J., Boyajian, A. E., Elliot, C. M., & McElhatten, D. (1997). Augmenting the independence of self-management procedures by teaching self-initiation across settings and activities. *School Psychology Quarterly*, 12, 23-32.
- Knapczyk, D. R., & Livingston, G. (1973). Self-recording and student teacher supervision: Variables within a token economy structure. *Journal of Applied Behavior Analysis*, 6, 481-486.
- Koegel, L. K. (1995). Communication and language intervention. In R. L. Koegel & L. K. Koegel (Eds.), *Teaching children with autism: Strategies for initiating positive interactions and improving learning opportunities* (pp. 17-32). Baltimore: Brookes.
- 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, 346-357.
- Koegel, L. K., Harrower, J., & Koegel, R. L. (1999). Support for children with developmental disabilities participating in full-inclusion classrooms through self-management. *Journal of Positive Behavior Interventions*, 1, 26-34.
- Koegel, L. K., & Koegel, R. L. (1995). Motivating communication in children with autism. In E. Schopler & G. B. Mesibov (Eds.), *Learning and cognition in autism* (pp. 73-87). New York: Plenum.
- Koegel, L. K., Koegel, R. L., & Carter, C. M. (1998). Pivotal responses and the natural language teaching paradigm. *Seminars in Speech and Language*, 19(4), 355-372.
- 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. *Journal of Applied Behavior Analysis*, 25, 341-353.
- Koegel, L. K., Koegel, R. L., Kellegrew, D., & Mullen, K. (1996). Parent education for prevention and reduction of severe problem behaviors. In L. K. Koegel, R. L. Koegel, & G. Dunlap (Eds.), *Positive behavioral support: Including people with difficult behavior in the community* (pp. 3-30). Baltimore: Brookes.
- Koegel, R. L., Camarata, S. M., Koegel, L. K., Ben-Tall, A., & Smith, A. E. (1998). Increasing speech intelligibility in children with autism. *Journal of Autism and Developmental Disorders*, 28, 241-251.
- Koegel, R. L., Carter, C. M., & Koegel, L. K. (1998). Setting events to improve parent-teacher coordination and motivation for children with autism. In J. Luiselli & M. Cameron (Eds.), *Antecedent control: Innovative approaches to behavioral support* (pp. 167-186). Baltimore: Brookes.
- Koegel, R. L., Dyer, K., & Bell, L. (1987). The influence of child-preferred activities on autistic children's social behavior. *Journal of Applied Behavior Analysis*, 20, 243-252.
- Koegel, R. L., & Egel, A. L. (1979). Motivating autistic children. *Journal of Abnormal Child Psychology*, 8, 418-426.
- Koegel, R. L., Egel, A. L., & Williams, J. A. (1980). Behavioral contrast and generalization across settings in the treatment of autistic children. *Journal of Experimental Child Psychology*, 30, 422-437.
- Koegel, R. L., Firestone, P. B., Kramme, K. W., & Dunlap, G. (1974). Increasing spontaneous play by suppressing self-stimulation in autistic children. *Journal of Applied Behavior Analysis*, 7, 521-528.
- Koegel, R. L., & Frea, W. D. (1993). Treatment of social behavior in autism through the modification of pivotal social skills. *Journal of Applied Behavior Analysis*, 26, 369-377.
- Koegel, R. L., & Koegel, L. K. (1990). Extended reductions in stereotypic behavior of students with autism through a self-management treatment package. *Journal of Applied Behavior Analysis*, 23, 119-127.
- Koegel, R. L., Koegel, L. K., Frea, W. D., & Smith, A. E. (1995). Emerging interventions for children with autism: Longitudinal and lifestyle implications. In R. L. Koegel & L. K. Koegel (Eds.), *Teaching children with autism: Strategies for initiating positive interactions and improving learning opportunities* (pp. 1-15). Baltimore: Brookes.
- Koegel, R. L., Koegel, L. K., & Schreibman, L. (1991). Assessing and training parents in teaching pivotal behaviors. *Advances in Behavioral Assessment of Children and Families*, 5, 65-82.
- Koegel, R. L., Koegel, L. K., & Surratt, A. (1992). Language intervention and disruptive behavior in children with autism. *Journal of Autism and Developmental Disorders*, 22, 141-152.
- Koegel, R. L., & Mentis, M. (1985). Motivation in childhood autism: Can they or won't they? *Journal of Child Psychology and Psychiatry*, 26, 185-191.
- Koegel, R. L., O'Dell, M. C., & Dunlap, G. (1988). Producing speech use in nonverbal autistic children by reinforcing attempts. *Journal of Autism and Developmental Disorders*, 18, 525-538.
- Koegel, R. L., O'Dell, M. C., & Koegel, L. K. (1987). A natural language teaching paradigm for nonverbal autistic children. *Journal of Autism and Developmental Disabilities*, 17, 187-200.
- Koegel, R. L., & Schreibman, L. (1977). Teaching autistic children to use simultaneous multiple cues. *Journal of Abnormal Child Psychology*, 24, 299-311.
- Koegel, R. L., Schreibman, L., Good, A., Cerniglia, L., Murphy, C., & Koegel, L. K. (1989). *How to teach pivotal behaviors to children with autism: A training manual*. Santa Barbara, CA: University of California.
- Koegel, R. L., & Williams, J. (1980). Direct vs. indirect response-reinforcer relationships in teaching autistic children. *Journal of Abnormal Child Psychology*, 4, 537-547.
- Kohler, F. W., Strain, P. S., Hoyson, M., & Jamieson, B. (1997). Merging naturalistic teaching and peer-based strategies to address the IEP objectives of preschoolers with autism: An examination of structural and child behavior outcomes. *Focus on Autism & Other Developmental Disabilities*, 12, 196-206.
- Litrownik, A. J., Freitas, J. L., & Franzini, L. R. (1978). Self-regulation in mentally retarded children: Assessment and training of self-monitoring skills. *American Journal of Mental Deficiency*, 82, 499-506.
- Lovaas, O. I. (1977). *The autistic child: Language development through behavior modification*. New York: Irvington.
- Lovaas, O. I., Berberich, J. P., Perloff, B. F., & Schaeffer, B. (1966). Acquisition of imitative speech in schizophrenic children. *Science*, 151, 705-707.
- Lovaas, O. I., Koegel, R. L., & Schreibman, L. (1979). Stimulus overselectivity in autism: A review of research.

- Psychological Bulletin*, 86, 1236-1254.
- Lovaas, O. I., Koegel, R. L., Simmons, J. Q., & Long, J. (1973). Some generalization and follow-up measures on autistic children in behavior therapy. *Journal of Applied Behavior Analysis*, 6, 131-136.
- McClannahan, L. E., & Krantz, P. J. (1997). Princeton Child Development Institute. *Behavior & Social Issues*, 7, 65-68.
- MacDuff, G. S., Krantz, P. J., MacDuff, M. A., & McClannahan, L. E. (1988). Providing incidental teaching for autistic children: A rapid training procedure for therapists. *Education & Treatment of Children*, 11, 205-217.
- Matson, J. L., Benavidez, D. A., Compton, L. S., Paclawskyj, T., & Baglio, C. (1996). Behavioral treatment of autistic persons: A review of research from 1980 to the present. *Research in Developmental Disabilities*, 17, 433-465.
- McGee, G. G., Almeida, M. C., Sulzer-Azaroff, B., & Feldman, R. S. (1992). Promoting reciprocal interactions via peer incidental teaching [Special Issue: The education crisis: Issues, perspectives, solutions]. *Journal of Applied Behavior Analysis*, 25, 117-126.
- McGee, G. G., Krantz, P. J., & McClannahan, L. E. (1985). The facilitative effects of incidental teaching on preposition use by autistic children. *Journal of Applied Behavior Analysis*, 18, 17-31.
- McNerney, E. K., & Koegel, L. K. (1997, December). *Videotape coordination of teaching methods for children with autism*. Poster presented at the annual meeting of the Association for Persons with Severe Handicaps, Boston, MA.
- Miranda-Linne, F., & Melin, L. (1992). Acquisition, generalization, and spontaneous use of color adjectives: A comparison of incidental teaching and traditional discrete-trial procedures for children with autism. *Research in Developmental Disabilities*, 13, 191-210.
- Moes, D. (1998). Integrating choice-making opportunities within teacher-assigned academic tasks to facilitate the performance of children with autism. *Journal of the Association for Persons with Severe Handicaps*, 23, 319-328.
- Mundy, P., Sigman, M., & Kasari, C. (1990). A longitudinal study of joint attention and language development in autistic children. *Journal of Autism and Developmental Disorders*, 20, 115-128.
- Nelson, R. O., Lipinski, D. P., & Boykin, R. A. (1978). The effects of self recorders training and the obtrusiveness of the self-recording device on the accuracy and reactivity of self-monitoring. *Behavior Therapy*, 9, 200-208.
- Newman, B., Tuntigian, L., Ryan, C. S., & Reinecke, D. R. (1997). Self-management of a DRO procedure by three students with autism. *Behavioral Interventions*, 12, 149-156.
- O'Brien, T. P., Riner, L. S., & Budd, K. (1983). The effects of a child's self-evaluation program on compliance with parental instructions in the home. *Journal of Applied Behavior Analysis*, 16, 69-79.
- Paul, R., & Shiffer, M. E. (1991). Communicative initiations in normal and late-talking toddlers. *Applied Psycholinguistics*, 12, 419-431.
- Peck, C. A. (1985). Increasing opportunities for social control by children with autism and severe handicaps: Effects on student behavior and perceived classroom climate. *Journal of the Association for Persons with Severe Handicaps*, 10, 183-193.
- Peck, C. A. (1993). Ecological perspectives on the implementation of integrated early childhood programs. In C. A. Peck, S. L. Odom, & D. D. Bricker (Eds.), *Integrating young children with disabilities into community programs: Ecological perspectives on research and implementation* (pp. 3-16). Baltimore: Brookes.
- Pierce, K. L., & Schreibman, L. (1994). Teaching daily living skills to children with autism in unsupervised settings through pictorial self-management. *Journal of Applied Behavior Analysis*, 27, 471-481.
- Pierce, K. L., & 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.
- Prior, M. (1984). Developing concepts of childhood autism: The influence of experimental cognitive research. *Journal of Counseling and Clinical Psychology*, 52, 4-16.
- Rincover, A., & Koegel, R. L. (1975). Setting generality and stimulus control in autistic children. *Journal of Applied Behavior Analysis*, 8, 235-246.
- Risley, T., & Wolf, M. (1967). Establishing functional speech in echolalic children. *Behaviour Research and Therapy*, 5, 73-88.
- Rogers, S., Herbison, J. M., Lewis, H. C., Pantone, J., & Reis, K. (1986). An approach for enhancing the symbolic, communicative, and interpersonal functioning of young children with autism or severe emotional handicaps. *Journal of the Division of Early Childhood*, 10, 135-148.
- Rosenblatt, J., Bloom, P., & Koegel, R. L. (1995). Overselective responding: Description, implications, and intervention. In R. L. Koegel & L. K. Koegel (Eds.), *Teaching children with autism: Strategies for initiating positive interactions and improving learning opportunities* (pp. 33-42). Baltimore: Brookes.
- Russo, D. C., & Koegel, R. L. (1977). A method of integrating an autistic child into a normal public school classroom. *Journal of Applied Behavior Analysis*, 10, 579-590.
- School, B. A., & Cooper, A. (1983). Incidental and accidental learning: Use them. *Academic Therapy*, 18, 583-591.
- Schopler, E., Mesibov, G. B., & Harsey, K. (1995). Structured teaching in the TEACCH system. In E. Schopler & G. B. Mesibov (Eds.), *Learning and cognition in autism* (pp. 243-268). New York: Plenum.
- Schreibman, L. (1975). Effects of within-stimulus and extra-stimulus prompting on discrimination learning in autistic children. *Journal of Applied Behavior Analysis*, 8, 91-112.
- Schreibman, L. (1988). *Autism*. Newbury Park, CA: Sage.
- Schreibman, L., & Carr, E. G. (1978). Elimination of echolalic responding to questions through the training of generalized verbal response. *Journal of Applied Behavior Analysis*, 11, 453-463.
- Schreibman, L., Charlop, M. H., & Koegel, R. L. (1982). Teaching autistic children to use extra stimulus prompts. *Journal of Experimental Child Psychology*, 33, 475-491.
- Schreibman, L., Stahmer, A. C., & Pierce, K. L. (1996). Alternative applications of pivotal response training: Teaching symbolic play and social interaction skills. In L. K. Koegel, R. L. Koegel, & G. Dunlap (Eds.), *Positive behavioral support: Including people with difficult behavior in the community* (pp. 353-371). Baltimore: Brookes.

- Shearer, D. D. (1996). Promoting independent interactions between preschoolers with autism and their nondisabled peers: An analysis of self-monitoring. *Early Education & Development, 7*, 205-220.
- Sigafoos, J. (1998). Choice making and personal selection strategies. In J. K. Luiselli & M. J. Cameron (Eds.), *Antecedent control: Innovative approaches to behavioral support* (pp. 187-221). Baltimore: Brookes.
- Sigman, M. (1994). What are the core deficits in autism? In S. H. Broman & J. Grafman (Eds.), *Atypical cognitive deficits in developmental disorders: Implications for brain function* (pp. 139-157). Hillsdale, NJ: Erlbaum.
- Singer, G., Gert, B., & Koegel, R. L. (1999). A moral framework for analyzing the controversy over aversive behavioral interventions for people with severe mental retardation. *Journal of Positive Behavior Interventions, 1*, 88-99.
- Skinner, B. F. (1979). Learned helplessness: Performance as a function of task significance. *Journal of Psychology, 103*, 77-82.
- Smith, A., & Camarata, S. M. (1999). Using teacher-implemented instruction to increase language intelligibility of children with autism. *Journal of Positive Behavior Interventions, 1*, 141-151.
- Stahmer, A. C. (1995). Teaching symbolic play skills to children with autism using pivotal response training. *Journal of Autism & Developmental Disorders, 25*, 123-141.
- Stahmer, A. C., & Schreibman, L. (1992). Teaching children with autism appropriate play in unsupervised environments using a self-management treatment package. *Journal of Applied Behavior Analysis, 25*, 447-459.
- Strain, P. S., Kohler, F. W., & Goldstein, H. (1996). Learning experiences . . . An alternative program: Peer-mediated interventions for young children with autism. In E. D. Hibbs & P. S. Jensen (Eds.), *Psychosocial treatments for child and adolescent disorders: Empirically based strategies for clinical practice* (pp. 573-587). Washington, DC: American Psychological Association.
- Sugai, G., & Rowe, D. (1984). The effect of self-recording on out-of-seat behavior of an EMR student. *Education and Training of the Mentally Retarded, 19*, 23-28.
- Tager-Flusberg, H. (1994). Dissociations in form and function in the acquisition of language by autistic children. In H. Tager-Flusberg (Ed.), *Constraints on language acquisition: Studies of atypical children* (pp. 175-194). Hillsdale, NJ: Erlbaum.
- Taylor, B. A., & Harris, S. L. (1995). Teaching children with autism to seek information: Acquisition of novel information and generalization of responding. *Journal of Applied Behavior Analysis, 28*, 3-14.
- Taylor, C. C., & Bailey, J. S. (1996). Reducing corporal punishment with elementary school students using behavioral diagnostic procedures. In L. K. Koegel, R. L. Koegel, & G. Dunlap (Eds.), *Positive behavioral support: Including people with difficult behavior in the community* (pp. 207-225). Baltimore: Brookes.
- Thorp, D. M., Stahmer, A. C., & Schreibman, L. (1995). Effects of sociodramatic play training on children with autism. *Journal of Autism & Developmental Disorders, 25*, 265-282.
- Todd, A. W., Horner, R. H., & Sugai, G. (1999). Self-monitoring and self-recruited praise: Effects on problem behavior, academic engagement, and work completion in a typical classroom. *Journal of Positive Behavior Interventions, 1*, 66-76.
- Valdez-Menchaca, M. C., & Whitehurst, G. J. (1988). The effects of incidental teaching on vocabulary acquisition by young children. *Child Development, 59*, 1451-1459.
- Vaughn, B. J., & Horner, R. H. (1997). Identifying instructional tasks that occasion problem behaviors and assessing the effects of student versus teacher choice among these tasks. *Journal of Applied Behavior Analysis, 30*, 299-312.
- Wacker, D. P., Berg, W. K., Asmus, J. M., Harding, J. W., & Cooper, L. J. (1998). Experimental analysis of antecedent influences on challenging behaviors. In J. K. Luiselli & M. J. Cameron (Eds.), *Antecedent control: Innovative approaches to behavioral support* (pp. 67-86). Baltimore: Brookes.
- Warren, S. F., Baxter, D. K., Anderson, S. R., Marshall, A., & Baer, D. M. (1981). Generalization of question-asking by severely retarded individuals. *Journal of the Association for Persons with Severe Handicaps, 6*, 15-22.
- Warren, S. F., & Kaiser, A. P. (1986a). Generalization of trained language by young language delayed children: Longitudinal analysis. *Journal of Speech and Hearing Disorders, 51*, 239-251.
- Warren, S. F., & Kaiser, A. P. (1986b). Incidental language teaching: A critical review. *Journal of Speech and Hearing Disorders, 51*, 291-299.
- Wetherby, A., & Prutting, C. (1984). Profiles of communicative and cognitive-social abilities in autistic children. *Journal of Speech and Hearing Research, 27*, 364-377.
- Wilde, L. D., Koegel, L. K., & Koegel, R. L. (1992). *Increasing success in school through priming: A training manual*. Unpublished manuscript, University of California, Santa Barbara.
- Williams, J. A., Koegel, R. L., & Egel, A. L. (1981). Response-reinforcer relationships and improved learning in autistic children. *Journal of Applied Behavior Analysis, 14*, 53-60.
- Wolf, M. M., Risley, T. R., & Mees, H. I. (1964). Application of operant conditioning procedures to the behavior problems of an autistic child: A follow-up and extension. *Behaviour Research and Therapy, 1*, 305-312.
- Yoder, P. J., Kaiser, A. P., Alpert, C., & Fischer, R. (1993). Following the child's lead when teaching nouns to preschoolers with mental retardation. *Journal of Speech and Hearing Research, 36*, 158-167.
- Yoder, P. J., Kaiser, A. P., Goldstein, H., Alpert, C., Moussetis, L., Kaczmarek, L., & Fischer, R. (1995). An exploratory comparison of milieu teaching and responsive interaction in classroom applications. *Journal of Early Intervention, 19*, 218-242.
- Zanolli, K., Daggett, J., & Adams, T. (1996). Teaching preschool age autistic children to make spontaneous initiations to peers using priming. *Journal of Autism and Developmental Disorders, 26*, 407-422.

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