

Communication Training for Children with Autism Spectrum Disorder in the Community Environment: A Brief Review

Tana A. Watson¹
M.Ed.

K. Mark Derby²
Ph. D. Full Professor

T. F. McLaughlin³
Ph. D. Full Professor

Department of Special Education
Gonzaga University

Author Notes

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Abstract: *Persons with autism spectrum disorder (ASD) often display difficulties interacting with their peers and care providers. In fact, social deficits are an essential diagnostic feature of ASD. Functional Communication Training (FCT) is one of the most common and effective treatments for communication and behavioral needs of children with developmental disabilities. Its application to children with ASD is robust. An essential feature of FCT is that it has been shown to result in generalized effects. That is, positive social interactive behaviors have been shown to increase in occurrence. The essential feature of FCT is that differential reinforcement contingencies are applied to increase a desired social response if problem behaviors are placed on an extinction schedule. Specifically, more appropriate forms of communication are consequated using identified functional reinforcers. To date, there are several treatments to increase social behaviors in children with ASD, which utilize differential reinforcement as an essential component including picture exchange communication system (PECS), pivotal response therapy (PRT) and FCT. In addition, there are a number of procedures that, although commonly used, lack empirical support in the recent literature. The purpose of this review is to examine the treatment effectiveness of differential reinforcement based treatments designed to increase communication and social skills of children with ASD. In addition, we will provide a review of two commonly used procedures, Relationship Development Intervention (RDI) and DIR/Floortime™ that lack empirical support in the recent literature. Nevertheless, due to their widespread use, the utility of the application procedures will be discussed.*

Keywords: Functional Communication Treatment, Functional Communication Training, FCT, home setting, student research, Autism Spectrum Disorder, ASD, differential reinforcement, generalization

Autism spectrum disorder (ASD) is a developmental disability that affects the lives of thousands of children, their families and the educators that work with them (Heward, 2013). According to the Centers for Disease Control and Prevention, the Autism and Development Disabilities Monitoring Network's most recent estimates have identified the prevalence of ASD as approximately 1 in 68 children (CDC, 2014). ASDs are reported to occur across all racial, ethnic, and socioeconomic groups; however, the disability is almost five times more likely to occur among boys (1 in 42) than among girls (1 in 189). (CDC, 2014)

According to the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5), autism spectrum disorder is characterized by persistent deficits in social communication and social interaction across multiple contexts with manifestations of restricted, repetitive patterns of behavior, interests or activities. Communication deficits exist in about 33 to 50 percent of individuals with ASD to an extent that their daily communication needs are not met (Noens, Berckelaer-Onnes, Verpoorten, & Van Duijn, 2006). These deficits can be apparent in the first year of a child's life and might include delayed onset of babbling and diminished responsiveness. Many learners with ASD are less likely to make requests or share their own experiences, or will repeat the words of others (echolalia) in a non-functional way. Common social communication deficits include poor social-emotional reciprocity, which can range from an abnormal social approach to an inability to maintain normal back-and-forth conversation; a reduced sharing of interests, emotions, or affect; and a failure to initiate or respond to social interactions. Social deficits in nonverbal communicative behaviors typically used in social interaction are also prevalent. These deficits typically range from poorly integrated verbal and nonverbal communication; to abnormalities in eye contact, body language, and use of gestures; to a complete lack of facial expressions and nonverbal communication. Deficits in developing, maintaining, and understanding relationships, often include difficulties adjusting behavior to various social contexts, difficulties in imaginative play or making friends and an absence of interest in peers. As social demands on individuals with ASD increase, limited capacities in social skills can cause clinically significant impairments in social, occupational, and other important areas of development and functioning (Autism Speaks, 2014a).

The prevalence of social skills deficits differentiates ASD from other developmental disorders. Individuals with autism frequently lack the ability to distinguish the subtle social cues that neurotypical individuals are easily able to discern. Unusual social development may become apparent in early childhood. Infants with autism tend to make less eye contact with others, are less likely to respond to their own name, smile less often, and are often resistant to being held or cuddled (CDC, 2014). Children with ASD are less likely to exhibit imitative behavior, participate in joint-attention activities, and communicate non-verbally. Overall, children and

adults with autism perform worse than their non-autistic peers on tests of facial emotion recognition (Sigman, Spence, & Wang, 2006). Thus, despite the common belief that individuals with autism prefer to be alone, making and maintaining friendships and isolation occur as a direct result of these deficits (Burgess & Gutstein, 2007).

It is common for children with autism to show deficits and delays in joint-attention skills (Charman et al., 1997; Mundy & Markus, 1997). Joint-attention is defined as consciously focusing one's attention on the same event or object as another person (Buron & Wolfberg, 2008). Joint-attention skills begin to develop in the first year of a child's life and are demonstrated through social referencing skills such as pointing, gaze-following, following another's pointing, checking-in and generally sharing visual attention. Joint-attention can be thought of as a "meeting-of-the-minds" that occurs when two people are not merely looking at the same thing simultaneously, but share the *understanding* that they are looking at the same thing (Call & Tomasello, 2005). These developmental deficits are hallmarks of ASD and may be some of the earliest observable symptoms of ASD in children (Naber et al., 2007). The importance of joint-attention is critical for the development of functional language in all individuals and is frequently delayed or absent for individuals with ASD.

Numerous studies show that children diagnosed with communication problems are more likely to present with behavioral and social emotional problems both in childhood and as adults. Difficulties in communication can result in failure to bond with peers, which can result in negative psychosocial health effects later in life (Schoon et al., 2010). Several researchers have examined communication deficits and their co-occurrence with challenging behaviors (Carr & Durand, 1985; Derby et al., 1997; Durand & Merges, 2001; Wacker et al.; 2005; Sigafos, 2000). Sigafos hypothesized that impaired communication skills can be the root cause of challenging behaviors (Sigafos, J., 2000). Frequently caregivers and teachers cannot determine the reason for a child's specific behaviors; such as tantrums, screaming, hitting, biting, or even self-injurious behavior because of the individual's communication deficits. The increasing rates of autism and the concomitant increase in the number of children with communication deficits, highlight a rapidly growing problem in the areas of communication impairments and behavior disorders. Relatively little current evidence-based research exists addressing the communication and behavioral needs of individuals with autism. This dearth of existing research demands that the field of behavior specialists respond with evidence-based research to address the needs of these individuals.

In the current review, effective behavioral interventions designed to teach communication and social interactive behavior skills to children with ASD are explored. The review focuses on procedures with a rich history of data based efficacy as well as commonly used, but non-empirically validated procedures. The procedures chosen have been broken down into three main categories: (a) non-function based procedures that utilize differential reinforcement, (b)

commonly used non-empirically validated procedures, and (c) function-based procedures that utilize differential reinforcement. The efficacy and social validity of the procedures reviewed will be discussed. The following procedures were reviewed: (a) Picture Exchange Communication System (PECS), (b) pivotal response therapy (PRT), (c) Relationship Development Intervention (RDI), (d) Development, Individual-differences, Relationship-based Floortime (DIR/Floortime™), and (e) functional communication training (FCT). Both empirically validated and non-empirically validated procedures are examined to allow the reader to explore a sample of procedures typically used in the community (i.e. home and school) settings. Probable salient behavioral principles of non-empirically validated procedures that support their use are proposed.

Non-Function Based Procedures

Picture Exchange Communication System

The Picture Exchange Communication System (PECS) is a communication system that was developed by Lori Frost and Andy Bondy at the Delaware Autism Program in 1985 (Bondy, & Frost, 1994). It is an augmentative and alternative communication system developed for individuals with autism; however, it has been employed with learners identified with a wide variety of communication challenges. The system utilizes representational picture symbols in an exchange modality. PECS differ from previous communication methods such as sign language, speech imitation and picture-point systems in that the learner is required to initiate the communicative interaction. This emphasis on spontaneous interaction is designed to teach functional communication skills that enable learners to communicate their relevant wants and needs.

The PECS is widely used in a variety of settings including the school, classroom, community and the home, which enables learners of all ages to communicate within various social contexts. The training protocol is based on the principles of applied behavior analysis. The system begins by teaching a learner to exchange a picture of a desired item or activity with a teacher or communicative partner, who immediately honors the request. The protocol begins with a reinforcer inventory followed by six subsequent phases of treatment.

During phase 1, the learner is taught to initiate social communication with a communicative partner. During phase 2, the learner is taught to persevere with the communicative exchange over greater distances and when the communicative partner does not respond immediately. Generalization is taught across different settings, with different communicative partners, and with differing types of reinforcing items.

During phase 3, discrimination between differing symbols is taught. During phase 4, the learner is taught to use sentence structure in order to make requests by using expressions such as “I want ____.” or “I need ____.” In phase 5, the learner is taught to respond to the prompt,

“What do you want?” and encouraged to provide descriptive adjectives in order to communicate preferences among differing reinforcers (e.g. I want the blue ball). During the 6th and final phase, the learner is encouraged to make responsive and spontaneous comments in an effort to further develop functional communication skills (Frost & Bondy, 2002). Thus, an essential feature of the procedure is matching the PECS prompt to a desired item or activity, which effectively equates to the differential reinforcement of touching the PECS visual prompt.

The consensus among most practitioners is that most students with communication disorders easily learn PECS. “PECS is recommended as an evidence-based intervention for enhancing functional communication skills of individuals with ASD,” (Tien, 2008). Charlop-Christy, Carpenter, Le, LeBlanc, and Kellet (2002) determined in their research that children who met the learning criterion for PECS also show a concomitant increase in verbal speech. These ancillary gains were associated with increases in social-communicative behaviors and decreases in problem behaviors.

In a 2010 meta-analysis by Hart and Banda, a systematic review of 13 published single-subject studies was conducted to examine the effectiveness of PECS on speech and problem behaviors, generalization beyond training conditions, and the social validity of employing PECS. Their results indicated that PECS yielded increases in functional communication skills in all but 1 participant. Additionally, PECS decreased problem behaviors and increased speech in some individuals.

Pivotal Response Therapy

Another widely accepted behavioral intervention treatment for individuals with ASD is known as pivotal response therapy (PRT), also referred to as pivotal response treatment, or pivotal response training (Koegel, Koegel, Harrower, & Carter, 1999). This treatment model is derived from the principles of applied behavior analysis and targets pivotal areas of a learner’s development, such as: motivation, social initiation, self-management, and responsivity to multiple cues (Koegel, Camarata, Valdez-Menchaca, & Koegel, 1997; Koegel & Egel, 1979; Schreibman, Charlop, & Koegel, 1982). The clinician identifies a specific context in which the learner can be taught a class of positive behaviors. For example, when teaching social interactions the clinician will identify a context of particular interest to the target child, which requires interaction with peers or caregivers such as playing on the playground engaged in a preferred game or activity. The target child is then provided with reinforcement for engaging in any prompted or spontaneous behaviors within the class of behaviors previously identified as social interaction. Thus, as with PECS the essential behavioral intervention in place is differential reinforcement of appropriate behavior. However, the clinician targets classes of behavior to reinforce rather than a single isolated behavior (Koegel & Koegel, 2006; Stokes & Baer, 1977, 2003; Stokes & Osnes, 1988).

Thus, PRT targets specific areas of development including motivation, responsivity to multiple cues, self-management and social initiations. The treatment purports that by focusing on these critical, or pivotal areas, widespread collateral improvements in other social, communicative, and behavioral areas will result. PRT uses natural learning opportunities to target and thus modify key behaviors in young children with autism. The goal of PRT is a concomitant positive influence on communication, behavior, and social skills. This treatment focuses on a direct parental involvement role in the intervention. PRT strategies include (a) improving children's academic performance; (b) advancing children's communication and language skills; (c) fostering social interactions and friendships with typically developing peers; (d) reducing disruptive behaviors; (e) focusing on early identification and intervention; and (f) reducing ritualistic behaviors in an effort to broaden children's interests. PRT focuses upon the individual's current motivation and stresses functional communication over rote learning (Koegel & Koegel, 2006; Pierce & Schreibman, 1995).

Non-Empirically Validated Procedures

Relationship Development Intervention

Relationship Development Intervention (RDI) is a treatment for ASD based upon a model developed by Dr. Steven Gutstein (Gutstein, 2000). It is based upon his research in developmental psychology and competency in emotional relationships. Developmental psychology examines issues such as human development through gradual accumulation of knowledge versus distinct stage-like development. It also examines the extent to which children are born with innate mental structures, versus learning through experience. The focus of this treatment is on early parent-infant interactions, which later predict an individual's language abilities, as well as cognitive and social development (Gutstein, 2000).

Gutstein hypothesized that neural underconnectivity prevents individuals with ASD from being able to think flexibly, cope with change, process information simultaneously, take different perspectives, or simply take into account multiple factors when making decisions (Gutstein & Sheely, 2002). The RDI method is designed to help families and caregivers build relationships with individuals with ASD by teaching children to reference the adult and share emotions using experience-sharing language. The goal of this treatment is to foster motivation and provide the tools necessary for successful social interaction by correcting deficits that are thought to be common to individuals with autism. Currently, however, no *independent* study of this method is available and limited supporting research exists (Gutstein, Burgess, & Montfort, 2007). Nevertheless, this intervention contains the following six objectives: 1) emotional referencing, 2) social coordination, 3) declarative language, 4) flexible language, 5) relational information processing, and 6) foresight and hindsight. (Autism Speaks, 2014b).

When reviewing the above objectives, it appears that the essential feature of RDI is to teach the caregiver to become aware of the social behaviors of the child. Once aware of the behaviors, the caregiver is encouraged to provide social support to the child through verbal and physical acknowledgement of the child's behavior. Thus, as with PECS and PRT, the essential behavior principle of RDI is based on the behavioral contingency of differential reinforcement of appropriate behaviors; however, RDI relies on teaching the parent the specific behaviors that require parental responding. In a 2007 study, Gutstein, Burgess and Montfort reviewed files of 16 children ranging from 2 to 8 years of age. Within 30 months of treatment, the children with ASD showed improvement in Autism Diagnostic Observation Schedule (ADOS) ratings, appropriate flexibility and mainstream educational placements. However, this investigation had methodological problems; specifically, it was a one group pretest-posttest design that lacked proof of treatment implementation and measurement reliability (Association for Science in Autism Treatment, 2014).

Development, Individual-differences, Relationship-based (DIR/Floortime™)

An intervention based upon social relationships that is frequently used within the home setting with individuals with ASD is Development, Individual-differences, Relationship-based Floortime. This is commonly referred to as DIR/Floortime™, or simply Floortime. This treatment was developed by Stanley Greenspan, a child psychologist, on the premise that a child with a disability will increase social interaction if the adult caregiver understands the child's current developmental level and subsequently builds upon the child's strengths. The intervention is called DIR/Floortime™, because the adult physically gets down on the floor and engages the child at his or her level.

The goal of DIR/Floortime™, is to assist the child in progressing through six developmental levels typically reached by the age of five. The intervention proposes that each of these levels must be mastered for emotional and intellectual growth to occur. These proposed developmental milestones are: (stage one) self-regulation and interest in the world; (stage two) engagement and relating to another person, while distinguishing inanimate objects from people; (stage three) fostering two-way intentional communication; (stage four) continuous problem solving with caregiver interaction; (stage five) symbolic play and intentional communication; and (stage six) bridging ideas via logic, reasoning, and emotional thinking. Through mutual engagement, the parent follows the child's lead in activities, but is instructed as to how to move the child toward increasingly complex interactions. The treatment is designed to be performed by parents under the supervision of a psychologist.

One pilot study was performed to test the efficacy of adding a home-based DIR/Floortime™ intervention to the routine care of preschool children with autistic spectrum disorder (Pajareya & Nopmaneejumrulers, 2011). Measures of functional emotional development and symptom severity were taken and gains were noted among the participants in

this investigation, which was conducted in Thailand. After the parents added a home-based DIR/Floortime™ intervention at an average of 15.2 hours/week for three months, the intervention group made significantly greater gains in all three measures employed in the study. The measures specifically included were Functional Emotional Assessment Scale (FEAS), Childhood Autism Rating Scale, and the Functional Emotional Questionnaires.

The essential features of DIR/Floortime™ are similar to RDI. Its focus is on caregiver training to increase awareness of the child's deficits and normal development. The trained clinician teaches the caregiver how to develop an effective learning situation that provides the child with highly motivating activities that are free of demands. Within this context, the caregivers develop an increased awareness of the child's needs and will hopefully respond appropriately to the child's social behaviors. As seen with RDI, the essential behavioral variable for a successful outcome is differential reinforcement of an alternative behavior. Specifically, differential reinforcement contingencies are applied to increase a desired social response and problem behaviors are placed on extinction.

Empirically Validated Function-Based Procedures

Functional Communication Training

Functional Communication Training (FCT) utilizes empirically validated procedures to positively impact and expand the communication skills of individuals with communication disabilities (Carr & Durand, 1985). This procedure was developed in the mid-1980s and has prevailed as a common treatment for individuals with ASD and other disabilities for the past three decades in both clinical and home settings (Carr & Durand, 1985; Derby et al., 1997; Durand & Merges, 2001; Wacker et al., 1990).

FCT is a behavioral approach that initially assesses the function of a specific behavior via a functional assessment and then teaches an alternative communicative response as a replacement behavior. Socially-acceptable communicative behavior that serves the same function as a previously employed nonverbal or undesirable behavior is of particular interest to those who work with individuals with ASD. FCT focuses on using appropriate communication to reduce challenging behavior by assessing the variables that are maintaining the unwanted behavior and providing the same consequences for a more desirable behavior (Durand & Merges, 2001). Thus, the goal of the practitioner then becomes allowing the individual to gain access to the desired consequence more efficiently by using the new response while reducing the use of the undesirable response via an extinction schedule.

While functional communication-based treatments in the clinical setting have been the subject of numerous studies, investigations of FCT in the *home* setting are less pervasive. Derby et al. performed the first in-home investigation in 1997, when they measured the long-term effects of FCT maintenance and generalization within the home environment. They utilized a

four-phase study to examine the effects of FCT for up to 27 months for 4 young children who exhibited aberrant behavior.

During phase one, a descriptive assessment (Touchette, MacDonald, & Langer, 1985) and an antecedent analysis were performed followed by a functional analysis to determine the function of aberrant behavior. Phase two began by providing parents with a written description of the treatment contingencies recommended. They were also provided with a 1-hour training videotape of the training session for future reference. In phase three, the home intervention consisted of instructing the parents to complete 10- to 30-minute daily training sessions and to reinforce manding outside of training. Treatment efficacy was evaluated via weekly to monthly probe home visits. The home visits were gradually faded to a 3-month and eventual 6-month schedule as the frequency of aberrant behavior decreased. During phase four, follow-up, functional analysis conditions were monitored using the contingency reversal conditions described by Northup et al. (1991).

Derby and his colleagues found that FCT was an effective intervention. In addition to a decrease in problem behavior, every child's use of social communication increased. That is, Derby et al. (1997) observed an increased level of verbal and non-verbal communication of the children. They hypothesized that these findings were consistent with Keogel and Koegel's (1988) definition of pivotal responding. In their view, manding functioned as a pivotal response that was correlated with multiple topographies of positive social behavior. Their positive social behaviors were, in turn, maintained by the same reinforcement contingencies used to initially increase manding. Derby et al. (1997) established effective procedures to apply FCT to home settings using parents as therapists. Importantly, both maintenance and generalization of communication skills were observed. However, there were several questions that remained unanswered. For example, the children evaluated by Derby et al. (1997), were either attention or escape maintained; thus, FCT for children automatically or tangibly maintained was not evaluated.

Mancil, Conroy, Nakao, and Alter (2006b) extended the earlier work of Derby et al. (1997) by applying FCT procedures to tangibly maintained children in the home setting. These authors elucidated the dilemma of transient behavior saliency often seen with behaviors maintained by tangibles. The purpose of this study was to determine the effectiveness and efficiency of FCT on decreasing aberrant behaviors (i.e. tantrums), increasing communication of manding, and increasing spontaneous communication with a child with ASD in the home environment. The intervention utilized a standard functional analysis via a multi-element design (Kazdin, 2011). A unique feature to this intervention was a daily preference assessment conducted during the first 5 minutes of each treatment day. This was done because the child's mother indicated in the parent interview that the child satiated quickly on tangible items.

To identify preferred tangible items for the purpose of teaching mands, a preference assessment based on the procedures described by Roane et al. (1998) was conducted. Based upon a parental interview, the top seven tangible items were chosen for the assessment. These items were arranged in a circle on the floor and the child was allowed to play with any of the items. The item chosen was used for the first mand and the two subsequently chosen items for the subsequent mands.

FCT was conducted using a multiple baseline design across four mands. The conditions consisted of baseline, a verbal mand phase, a spontaneous communications phase, and a distracter phase. The verbal mand phase required that the practitioner play with a toy and then state to the child, "If you want the toy, then give me the card." Once three successful sessions of manding were achieved, the child progressed to the next phase. During the spontaneous communication phase, the researcher played with the toy without immediately providing a verbal mand. The final distracter phase was provided to teach discrimination between cards because the subject now had a greater repertoire of cards. During this phase the child learned to discriminate between various cards. Although a unique tangible toy was used for the first three mands in this study, the tangible item of interest in the fourth mand was a movie. During this session, the mother would pause the movie every 30 seconds while watching a cartoon. The child was then required to mand in order to continue viewing the movie. This study also measured unprompted communication and the child's dependence on prompts. The natural setting led to an increase in unprompted communication and a decreased dependence on prompts.

Further expansion of FCT within the home utilizing contingencies similar to those used by Derby et al. (1997) was conducted by Moes and Frea (2002). This investigation identified contexts specific to the family routines and set-up naturally occurring opportunities for differential reinforcement of communication to occur. Specifically, this study focused on ways of modifying conventional FCT to fit each family's unique routine. They hypothesized that a "lack of fit" existed from prescribed measures of FCT to an adherence to the family routine. The research design featured a contextualized (i.e. individualized) design, which allowed for the opportunity to repeatedly evaluate the effect of introducing contextual adaptations to the standard protocol.

Unique to this study was its inclusion of a parent support plan survey. Parents completed a 20-item self-report plan questionnaire that was used to evaluate the compatibility of the treatment package to their unique family context. From this questionnaire, an index of sustainability for the intervention was generated specifically for the purpose of measuring "contextual fit." Family members utilized a 5-point Likert scale to assess the relationship between family environment and the varying aspects of the treatment package. The survey measured participant responses to questions related to family resources and constraints; consistency with beliefs, values, and goals; and congruence with the abilities and needs of family members. Concerns cited were similar among families. For example the primary caregiver's

need to obtain assistance with daily routine was most common. The contextualized FCT placed a focus on improving social interaction through the course of daily routines.

In the Moes and Frea (2002) investigation, the initial FCT treatment did not generalize to other daily routines; however, generalization probes assessed *after* the contextualized FCT implementation revealed increases in functional communication and reductions in problem behavior. The study employed a follow-up phase where follow-up probes were conducted at 2-month intervals.

In spite of the fact that most practitioners have the goal of working closely with families during the FCT process, most fail to articulate how they move from the rigidity of functional analysis protocols to a more collaborative working relationship with caregivers and their families. The modified FCT condition described in this investigation emphasizes the valuable role parents and siblings can provide as interventionists in implementing in-home treatment. The study utilized a parent interview index of sustainability during the intervention, specifically for the purpose of measuring “contextual fit” or likelihood of future adaptability. This investigation has implications for practitioners who could modify traditional FCT protocols to be more responsive to varying family routines and contexts.

Mancil expanded his own work on the problem of transient reinforcer saliency in 2009 (Mancil, Conroy, & Hayden, 2009). In this investigation, Mancil established differential reinforcement contingencies within the context of modified milieu therapy. Milieu therapy focuses on teaching children new communication skills in their natural environment (Hester, Kaiser, Alpert & Whiteman, 1995). Although this study also utilized parents as change agents in the home environment, only a tangible condition was used because they did not want to expose the children to the adverse effects of a demand condition. The intervention provided parental training in the form of visual cues during a highly structured toy play session with parent and child. Verbal, gestural, and physical, hand-over-hand prompts were gradually faded in a series of 5-second time delays, which allowed the child quicker access to the toy if a picture exchange card was immediately used. This condition was continued two to three times per week until the latency of the child’s response occurred consistently within the first 5-second time delay and decreased levels of aberrant behavior were indicated.

Introducing individuals to natural contingencies may improve the likelihood of generalization to other settings over time (Stokes & Baer, 1977, 2003). However, this measurement is seldom taken in most FCT research in spite of the fact that the implications for children and their families are significant. In the Mancil study, generalization to novel individuals in a classroom setting was also measured. For every four sessions of training in the home, at least one generalization data session was conducted. At least three generalization probes were used for each participant to determine if communication generalized from the home

environment to the school environment. At the conclusion of the study, aberrant behavior rates for each of the participants leveled to and stabilized at zero during generalization.

In this study, the parents, teachers and an expert in the field of ASD completed Likert-type rating scales to determine the social validity of the intervention process and outcomes. The results indicated that the participants all communicated more appropriately, decreased their levels of aberrant behavior, communicated more frequently, and improved overall functioning in communication.

The findings of Derby et al. (1997) were replicated in studies by Wacker et al. (2005) and Schieltz et al. (2011). The Schieltz study targeted 10 pre-school age children with a variety of developmental disabilities, while the Wacker study conducted functional communication training of 23 young children in home settings over a four-year period.

In the investigation by Schieltz et al. (2011), three of the participants were diagnosed with ASD and the purpose of the study was to measure the indirect effects of FCT on non-targeted disruptive behavior. While only destructive behavior (e.g. self-injury) was targeted for measurement, data were also collected on other disruptive behaviors (e.g. stereotypy). During the treatment non-targeted disruptive behavior received no programmed consequences. As in Derby et al. (1997), this study suggested that FCT impacted behaviors that were correlated with the target behavior, even though these behaviors were not directly treated. Demand fading was also a unique feature of this study. During FCT, the number of instructions the children were required to complete prior to being presented with the micro switch was gradually increased after stable levels of destructive behavior were observed. Overall a 95% reduction in destructive behavior and an 84% reduction in disruptive behavior were observed when compared to the original baseline. This study extends and replicates the findings of Derby et al. (1997) and suggests that FCT can produce substantial response and stimulus generalization. One possible explanation for these effects is that non-targeted disruptive behavior may have been occurring within the same response class or as part of a continuous response chain.

In the current review various methods used to increase the social interaction (i.e. communication skills) of persons with ASD in the home setting were explored. Consistent among all procedures reviewed was the need to increase social interactions between the person with ASD and another human being. The review categorized the procedures into three groups: non-function based, non-empirically based, and function-based interventions. The non-function based with empirically supported procedures consisted of PECS and PRT. Common across both of these procedures was the common basis in the principles of applied behavior analysis, specifically, differential reinforcement of a specific response or class of responses.

PECS exchange systems require differential reinforcement of the picture matched to a desired item or activity. Conversely, PRT requires differential reinforcement of a specific class of responses. Specifically, those responses deemed to be appropriate social behavior.

The non-empirically based procedures, RDI and DIR/Floortime™, have widespread acceptance in clinical contexts (Autism Speaks, 2014b). Unique to each of these procedures is the underlying mechanism hypothesized to result in positive outcomes and changes in the quality of the relationship that results. Although the procedures are widely accepted, it does not appear that the procedures used are well delivered. For example, DIR/Floortime™ is hypothesized to be effective because parents are educated on specific stages of learning development of the child and trained to interact appropriately. Without specific procedural guidelines, the possibilities for these interventions to provide future empirical support is minimal at best.

Functional communication training is the most robust procedure for increasing the communication skills of persons with ASD (Carr & Durand, 1985; Durand & Carr, 1991; Carr & Durand, 1990, 1995; Derby et al., 1997; Durand & Merges, 2001; Durand, 2001; Wacker et al., 1990, 2005). In view of the importance of communication as a developmental skill, it is surprising that relatively few FCT studies in the natural setting have been performed and published since Derby et al. (1997). In a 2006 review of the literature, Mancil concluded that the majority of FCT research studies are conducted in the analog environment of a clinical setting in spite of the need for more research in natural environments (Mancil et al., 2006b).

The current review was limited to only those completed with care providers closest to the child; that is, caregivers in the home setting. Unlike the non-functional and non-empirical interventions described above, FCT is based on the results of an a priori functional analysis. As such, specific classes of functional reinforcement (i.e. positive, negative, and automatic) are identified and matched to a specific alternative communicative response within a differential reinforcement of alternative behavior contingency. As shown by Derby et al. (1997), FCT can result in long-term reductions in aberrant behavior with a concomitant increase in communication and social behavior. To date, the use of FCT in home settings has been expanded to include tangible reinforcement (Mancil et al., 2006b; Mancil et al., 2009), milieu therapy (Mancil et al., 2009), generalization for broad communication across response classes (Moes & Frea, 2002), and replication through additional research (Schieltz et al., 2011; Wacker et al., 2005).

The need to extend the use of evidence-based practices such as FCT in the natural setting remains apparent for families with children with ASD. The studies within this review indicate that parents or caregivers with little background knowledge can implement effective FCT training and obtain impressive results in the home setting. Providing training in the natural environment greatly increases the possibility of generalization to other settings (e.g. school, classroom), people (e.g. parents, siblings, and teachers) and daily routines. In-home treatments

frequently contain sufficient exemplars to generalize to untrained stimulus conditions and untrained responses. Parents are also more likely to continue using the strategies learned at home in other environments, which has life-long implications for families with children with ASDs.

The high prevalence and increased incidence of autism spectrum disorder combined with the demonstrated effective results of FCT, compels a response from researchers in the field of applied behavior analysis. Much of the research remains similar to that of Carr and Durand (1985) in that it follows similar protocols and is conducted in clinical contexts (Mancil, 2006a). While the incidence of professionals working in the home with children with ASDs has become prevalent, academic researchers are providing very little in the way of evidenced-based results in this setting. Opportunities for home-based research currently abound. These opportunities would allow future practitioners to thoroughly address the all-important issue of communication generalization while continuing to measure data across time.

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