A Review of Communication Intervention Research for Young Children with Autism Spectrum Disorder

Abstract

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Very few empirical studies have addressed the effectiveness of communication interventions for young children with Autism Spectrum Disorder (ASD) in the last three decades. This systematic review synthesized 23 single-subject design (SSD) studies on communication interventions for young children with ASD from 1975 to 2007. Eighty-three percent of the (SSD) studies reported indirect and direct observations as their primary data collection method. Fifty-two percent of the (SSD) studies utilized multiple baseline design across subjects, target behaviours, responses, and descriptions. Fifty-eight percent of the (SSD) studies implemented reinforcements, thirty percent of the studies employed communication interventions, and sixty one percent of the studies used alternative interventions. Recommendations for future research include the use of treatment fidelity measures and documentation of the frequency and intensity of the intervention in its description and implementation procedures.

This paper provides a critical review of the effectiveness of communication intervention research in young children with autism spectrum disorder (ASD). ASD is a term that normally refers to the three most common pervasive developmental disorders (PDDs)—autism (autistic disorder), pervasive developmental disorder-not otherwise specified (PDD-NOS), and Asperger syndrome (Bertrand, Mars, Boyle, Bove, Yeargin-Allsopp & Decoufle, 2001; National Research Council, 2001). (The term PDD refers to a group of five disorders characterized by delays in the development of multiple basic functions including socialization and communication. In addition to the ASDs, PDDs include Rett syndrome and childhood disintegrative disorder.)

According to recent studies, the prevalence of autism may approach 1% of school age children (Bertrand et al., 2001; Gillberg & Wing, 1999; Wing & Gould, 1979; Wing & Potter, 2002). This is a dramatic difference compared to previously published occurrence rates of 4-5 per 10,000 (Lotter, 1966). ASD is three to four times more prevalent in boys than girls and knows no racial, ethnic, and social boundaries (Autism Society of America [ASA], n.d.). Reasons for the increased rates are multiple and may include increased awareness, commitment to early diagnosis and intervention, and other unknown etiologies. Research has shown that siblings of children with ASD have a 3% to 8% chance of being diagnosed within the spectrum (Autism Society of America [ASA], n.d.).

Children with ASD have marked deficits in the following key areas: (a) communication (i.e., both verbal and non-verbal, including pointing, eye contact and smiling); (b) reciprocal social interactions (i.e., sharing emotions, understanding others' feelings, and holding a conversation); and (c) routines and behaviours (i.e., repeating words or actions, following routines or schedules obsessively, and playing in repetitive ways) (American Psychiatric Association, 2000; National Institute of Child Health, 2007). Deficits in each of these areas are tightly interwoven and interdependent and have a significant effect on the quality and kinds of social interactions between children with ASD and their typical peers in general and special education classrooms. Individually and collectively, these deficits may hinder children with ASD in their long-term development of social communicative behaviours and increase the developmental gap between these children and their typical peers across the lifespan (McGee, Morrier, & Daly, 1999). Therefore, the acquisition of communication skills and the design of appropriate interventions are essential for children with ASD to develop academic learning, independence, personal responsibility, and generalization of skills across multiple environments (Meyers, 2007).

Researchers have identified the importance of early intervention programs for children with ASD (Birnbrauer & Leach, 1993; Bondy & Frost, 1995; Harris, Handelman, Gordon, Kristoff, & Fuentes, 1991; Koegel & Koegel, 1995; Laski, Charlop, & Schreibman, 1988; Lovaas, 1987; Odom, Horner, Snell, & Blacher, 2009; Rogers, 1996; Sheinkopf & Siegel, in press). Tager-Flusberg, Rogers, and Cooper (2009) noted that:

> …language development can be positively affected by early treatment has tremendous potential significance, because the emergence of spoken language is one of the most important variables predicting better outcomes in later childhood and adulthood. Thus, given the role of language acquisition in shaping long term outcomes, it has become important to identify the most successful strategies for facilitating language acquisition in young children with ASD, who uniformly demonstrate significant delays in at least some aspects of language and communicative development, especially in the domain of pragmatics.

> In the extant literature, there are a number of interventions designed to facilitate the communication skills for young children with ASD, however, estimates have shown that roughly 50% of children with ASD failed to develop appropriate communication skills … (p. 1)

More recently, systematic reviews of the literature and meta-analyses of empirically-based group design studies have been conducted with young children with ASD. For example, Spreckley and Boyd (2009) performed a meta-analysis using selected group design studies in order to assess the efficacy of applied behaviour analysis interventions on intellectual (i.e., language, communication skills, adaptive behaviour) and behavioural outcomes of young children with ASD. Four randomized or quasi-randomized studies using experimental and control groups were reviewed. A methodological review of the results of these studies revealed that the (a) theoretical constructs, (b) program content, and (c) ages of the children involved varied substantially. In addition, the comparison groups received some form of intervention, including applied behaviour analysis at reduced intensity as compared to the intervention groups.

A 20-year comprehensive review of the empirical literature on communication interventions (e.g., speech and language) with children with autism was conducted by Goldstein (2002). The criteria for evaluating the literature consisted of (a) individuals with autism, aged 2 to 36 years old; (b) peer-reviewed research articles published between the years of 1982 and 2002; and (c) case studies using experimental designs. This review of literature evaluated the effectiveness of 60 communication intervention strategies in which 6 child communication approaches were identified: (1) sign language, (2) milieu language training, (3) discrete trial, (4) parent and child training programs focused on language development, (5) social and scripted interaction studies focused on language, and (6) the relationship between problem behaviours and communication skills. The conclusions from this review indicated that: (a) further specification is needed to delineate what treatment components are planned as part of a treatment program; (b) treatment fidelity measures (measures of how accurately or faithfully a program or intervention is reproduced from a manual,

protocol or model) must be included in the research to determine the extent to which the treatment components are in fact implemented as part of a treatment program; (c) treatment effects must be evaluated through component analyses; (d) documentation evaluating the effects of delivering communication interventions with varying frequency or intensity must be included in its description and implementation; and, (e) procedures must be used to show that treatment effects are not attributable to the effects of participants enrolled in a treatment study, to the effects of repeated testing or measurement, or other threats to internal validity.

One critical point addressed by Goldstein (2002) was the lack of specificity in descriptive information about the participants in the studies reviewed. The level of detail and nature of participants' descriptions varied across studies thus making it difficult to provide brief summaries of developmental levels and severity of impairments of participants with confidence. Unfortunately, it was not clear if the participants in these studies were children with autism and/or children with ASD.

As in the Goldstein (2002) review, this paper reviewed communication intervention research using experimental design procedures. The major differences in the present paper, as compared to the Goldstein review, are (a) participants' age levels (i.e., less than 8 years old), (b) children diagnosed with ASD, (c) research articles published in the past three decades (1975-2007), and (d) single subject experimental designs.

Given the impairments in communication (e.g., development of spoken language and gestures and ability to initiate or maintain conversation) of young children with ASD and the controversies surrounding the use of effective communication interventions, the purposes of this paper were to (a) review and synthesize existing studies on communication interventions for young children with ASD; (b) examine the effectiveness of communication interventions for individuals with ASD; and, (c) provide future directions for communication intervention research for this population.

There is not uniform consensus among researchers, practitioners, and scholars on what consti-

tutes improvements for individuals with ASD. Some researchers are more optimistic in what is possible and others see even small improvements in communicative ability of subjects as important goals. For these reason, there are no homogeneous goals in bringing improvement to the study participants with similar communication abilities let alone various levels of verbal and nonverbal skills. All studies, however, showed some form of improvement in individuals with ASD.

To identify possible factors that might relate to differences in treatment effects across studies, the articles in the present review were analyzed according to the following variables: (a) participant characteristics, (b) settings, (c) training methods, and (d) results. To determine durability of treatment across studies, generalization and follow-up effects are reported across settings, persons, and stimuli. Methodological factors examined include types of measures and experimental designs.

Method

Criteria for Inclusion

There were a number of criteria specified for this review, including the following: (a) articles were empirically-based investigations; (b) communication skills were the major dependent outcomes measured; (c) individuals involved in the study were diagnosed with ASD characteristics; (d) individuals were under eight years of age; (e) selected peer-review articles were published in the last three decades (1975–2007); (f) studies involved treatments using single subject designs; and (g) articles were written in English.

Search Procedures

The selection of studies was conducted using two procedures. The first procedure was a broad search using a computer-assisted bibliographic search using various combination and derivative of the following key words: communication, intervention, autism, young and language, etc. The Psychological Abstracts (PsycINFO), Educational Resources Information Center (ERIC) database, Expanded Academic

ASAP, and Wilson OmniFile were the primary information databases searched for relevant studies. The second procedure was a manual hand search through peer reviewed journals: A Multidisciplinary Journal, American Journal on Mental Retardation, Analysis and Intervention in Developmental Disabilities, Education and Treatment of Children, Focus on Autism and Other Developmental Disabilities, Journal of Applied Behavior Analysis, Journal of Autism and Developmental Disorders. Approximately 200 articles were reviewed for this synthesis.

Results

Based upon the above-mentioned criteria, a total of twenty-three studies with 83 participants were included in the synthesis. Each study includes one experimental study except for one study; Goldstein & Brown (1989), which included two experimental studies denoted by superscripts 1 and 2, respectively. Table 1 describes the participants' characteristics (i.e., sample size, gender, age, language level, intellectual level, autism characteristics, and diagnostic criteria). Table 2 lists the research designs (i.e., data collection source, instrument, follow-up, and reliability). Table 3 summarizes characteristics of the interventions (i.e., interventionist, setting, intervention type, number of sessions, duration, and fidelity). Table 4 describes primary findings through the synthesis. The four tables are provided as appendices after the Reference section.

Participants' Characteristics (see Table 1)

In this synthesis, a total of 83 children were diagnosed under the broad category of ASD. More specifically, 76 children were identified as having autism. Of these, two children were diagnosed with PDD-NOS, one with PDD, four with developmental delay, and one with Down syndrome (DS). Of the 83, 9 were female, 63 were male, and in 11 cases the gender was not reported. The participants' age levels ranged between 1 year, 8 months and 7 years, 9 months (M = 5.0 years).

Ten participants were diagnosed according to the Diagnostic and Statistical Manual of Mental Disorders, Third Edition Revision (DSM-III-R; American Psychiatric Association, 1987), 16 according to the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV; American Psychiatric Association, 1994), and 5 according to the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition-Text Revision (DSM-IV-TR; American Psychiatric Association, 2000). Fourteen studies involving 46 participants did not report diagnostic criteria.

Three studies did not report the participants' language levels. In other cases, thirteen different standardized assessment instruments were used to measure the participants' language levels. These included: Speech/Language Impairment (SLI) and Speech/Language Therapy (SLT) (Ganz et al., 2004); Receptive-Expressive Emergent Language Scale (REEL-2) (Keen et al., 2001); and Vineland Adaptive Behaviour Scales (VABS) (Koegel et al., 1998a). Koegel et al. (1998b) used different instruments: Peabody Picture Vocabulary Test-Revised III (PPVT-R), the Expressive One Work Picture Vocabulary Test-Revised (EOWPVT-R), and the Clinical Evaluation of Language Fundamentals-Revised (CELF), Test of Early Language Development (TELD). Goldstein and Brown (1989, 2004) adopted four different language instruments; Sequenced Inventory of Communication Development (SICD), Brigance Diagnostic Inventory of Early Development (BDIED), McCarthy Scale of Children's Ability (MSCA), and Learning Accomplishment Profile Diagnostic Edition (LAPDE).

To determine the intellectual levels of the participants, five of the studies used the Stanford-Binet Intelligence Test (Egel et al., 1984; Goldstein & Brown,[1] 1989; Goldstein & Brown,[2] 1989; Neef et al., 1984; Shafer et al., 1984). One study used the Kaufman Brief Intelligence Test (KBIT) (Chin & Bernard-Opitz, 2000). Ten studies used the Leiter Intelligence Performance Scale (Charlop & Milstein, 1989; Egel et al., 1984; Goldstein & Brown,[1] 1989; Goldstein & Brown,[2] 1989; Ingersoll et al., 2005; Koegel et al., 1987; Matson et al., 1993; Neef et al., 1984; Rogers et al., 2006 & Shafer et al., 1984). Two studies described the participants' intellectual levels as slightly delayed (Chin & Bernard-Opitz, 2000; Mancil et al., 2006). Eleven studies did not report the participants' intellectual levels

(Buffington et al., 1998; Chung et al., 2006; Ganz & Simpson, 2004; Handleman, 1979; Keen et al., 2001; Koegel et al., 1998a; Koegel et al., 1998b; McGee et al., 1992; Marckel et al., 2006; Schepis et al., 1998; Tiegerman & Primavera, 1984).

Settings

Ten studies were conducted in structural settings such as classrooms (Egel et al., 1984; Goldstein & Brown,[1] 1989; Goldstein & Brown,[2] 1989; Ganz & Simpson., 2006; Keen et al., 2001; McGee et al., 1992; Neff et al., 1984; Schepis et al., 1998; Shafer et al., 1984; Tiegerman & Primavera, 1984). Two studies were conducted in clinics (Ingersoll et al., 2005; Matson et al., 1992). One study was conducted in a conference room at a university (Chung et al., 2006). One study was conducted in a child development institute (Buffington et al., 1998). Three studies were conducted in only natural settings such as home (Chin & Bernard-Opitz, 2000; Mancil et al., 2006; Marckel et al., 2006). The remaining six studies were conducted across different settings (Charlop & Milstein, 1989; Handleman, 1979; Koegel et al., 1998a; Koegel et al., 1998b; Koegel et al., 1987; Rogers et al., 2006).

Measurement

Sixty percent of the studies (14 out of 23) reported using videotapes to collect data (Buffington et al., 1998; Charlop & Milstein, 1989; Chung et al., 2006; Chin & Bernard-Opitz, 2000; Ganz & Simpson., 2004; Ingersoll et al., 2005; Keen et al., 2001; Koegel, et al., 1998a ; Koegel et al., 1987; Mancil et al., 2006; McGee et al., 1992; Rogers et al., 2006; Schepis et al., 1998; Shafer et al., 1984). Additional methods used to collect data included (a) self-report from teachers, parents, caregivers, clinicians and paraprofessionals, and (b) interviews (approximately one-third) across different people (e.g., teachers, parents, clinicians and caregivers) to know the participants' level of communication skills (Marckel et al., 2006; Richmon et al., 2006; Rogers et al., 2006). Two investigators developed their own questionnaire (Chin & Bernard-Opitz, 2000; Rogers et al., 2006), and one investigator developed a checklist to determine the participants' preferred reinforcement items and activities (Ganz & Simpson, 2004).

Indirect and direct observations were conducted during pre- and post-treatment conditions. More than half (83%) of the selected studies (19 out of 23) reported observations as their primary data collection method (Charlop & Milstein, 1989; Chung, 2006; Egel et al., 1984; Ganz & Simpson, 2004; Goldstein & Brown,[1] 1989; Goldstein & Brown,[2] 1989; Handleman, 1979; Ingersoll et al., 2005; Koegel et al., 1998b; Koegel et al., 1987; Mancil et al., 2006; Marckel et al., 2006; Matson et al., 1993; McGee et al., 1992; Neef et al., 1984; Rogers et al., 2006; Schepis et al., 1998; Shafer et al., 1984; Tiegerman & Primavera, 1984). In addition, the *Behavioral Observation System* (BOS) was adapted and used by Chung et al. (2006).

Diagnostic Measurement

The diagnostic measurement of *y*oung children with ASD is particularly challenging, given their limited social interactions, emotional responsiveness, communication skills and individual child characteristics. In young children with ASD, it is also important to consider behavioural difficulties and emerging communication skills during the diagnostic process. Therefore, as can be seen in Table 2, a number of diagnostic instruments were used to measure participants' characteristics such as (a) intellectual level (e.g., Stanford-Binet, Leiter International Performance Scale), (b) language development (i.e., articulation/comprehension) (e.g., Test of Early Language Development), (c) adaptive behaviour (e.g., Vineland Adaptive Behavior Scale), (d) social functioning (e.g., Scale of Perceived Competence and Social Acceptance for Young Children), and (e) communication level (e.g., Sequenced Inventory of Communication Development).

Single Subject Research Designs (see Table 2)

According to Table 2, 52% of the studies utilized multiple baseline design across subjects (Charlop & Milstein, 1989; Chin & Bernard-Opitz, 2000; Egel et al., 1984; Goldstein & Brown[1] 1989; Goldstein & Brown,[2] 1989; Ingersoll, 2005; Koegel et al., 1998a; Koegel et al., 1987; McGee et al., 1992; Neef et al., 1984; Schepis et al., 1998; Shafer et al., 1984). Two studies used multiple baseline designs across

target behaviours (Keen et al., 2001; Matson et al., 1993). One study used a multiple baseline across responses (Buffington et al., 1998), and two studies used a multiple baseline design across descriptors (Mancil et al., 2006; Marckel et al., 2006). One study used single subject AB design (Chung et al., 2006). The AB design is the simplest version of this design in which a baseline ("A") is tracked, and then some treatment ("B") is implemented. If there is a change then the treatment is said to have had an effect. The other two studies used single subject reversal ABA designs (Koegel et al., 1998b; Rogers et al., 2006). In this design, the treatment ("B") is implemented and then removed. The last study used a mixed two-factor within subject design (Tiegerman & Primavera, 1984).

Intervention Characteristics (see Table 3)

This section describes (a) types of interventions (b) intensity, (c) duration, (d) fidelity of implementation, (e) major findings, and (f) other critical components.. Studies were selected based upon previous criteria, as noted in the Method section of this paper.

Types of Interventions

Thirteen studies (56%) utilized reinforcements. All of the 13 studies employed adaptations in the reinforcement system to increase participants' communication skills. The following eight used token systems, verbal praise, participants' preferred items and/or activities, etc., as reinforcements to determine significant changes in the participants' verbal responses (Buffington et al., 1998; Ganz & Simpson, 2004; Goldstein & Brown,[1] 1989; Koegel et al., 1998a; Marckel et al., 2006; Matson et al., 1993; McGee et al., 1992; Schepis et al., 1998). Rogers et al. (2006) compared two different development communication interventions: the Denver Model Therapy (DMT) and Prompts for Restructuring Oral Muscular Phonetic Targets (PROMPT). Mancil et al. (2006) used Functional Communication Training (FCT) while Greenspan & Wieder (1998) and Ingersoll et al. (2005) implemented an intervention; Developmental Social-Pragmatic Language Intervention (DSP). Lastly, Charlop and Milstein (1989) used video modeling. Two adult-mediated strategies (e.g., turn-taking,

making a conversation, maintaining topic, requesting, and choice making) were implemented by Chin & Bernard-Opitz (2000) and Keen et al., (2001). By contrast, Chung (2006) utilized peer-mediated strategies as an intervention in one study. More than half of studies (61%) implemented two interventions as alternative treatments or mixed treatments such as reinforces and some types of communication intervention (i.e., VOCA, PECS, etc.) procedures at the same time.

Intensity

Two studies implemented interventions on a daily basis (Haldeman, 1979; Matson et al., 1993). Less than half of the studies (34%) implemented interventions once or twice per week (Charlop & Milstein, 1989; Chin & Bernard-Opitz, 2000; Chung et al., 2006; Ganz & Simpson, 2004; Ingersoll et al., 2005; Koegel et al., 1998a; Koegel et al., 1998b; Koegel et al., 1987). Fifty-two percent of the studies identified the number of sessions which ranged from 3 sessions to 60 sessions (Buffington et al., 1998; Egel et al., 1984, Goldstein & Brown,[1] 1989, Goldstein & Brown,[2] 1989; Keen et al., 2001; Mancil et al., 2006; Marckel et al., 2006; Matson et al. 1993; McGee et al., 1992; Schepis et al., 1998; Shafer et al., 1984; Tiegerman & Primavera, 1984). Rogers et al., (2006) examined two different groups of subjects by alternating an intervention on daily and weekly bases.

Duration

Fifty-two percent of studies reported the duration of their intervention which ranged from seven to 23 weeks with a mean of 12 weeks (Chin & Bernard-Opitz, 2000; Chung et al., 2006; Ganz & Simpson, 2004; Ingersoll et al., 2005; Keen, 2001; Koegel et al., 1987; Koegel et al., 1998b; Mancil et al., 2006; Marcket et al., 2006; Matson et al., 1993; Rogers et al., 2006; Schepis et al., 1998; & Tiegerman & Primavera, 1984). The shortest session (2 days) was used in Mancil et al. (2006). The first and second longest interventions ranged from 2-15 months (Schepis et al., 1998) and 2-10 months (McGee et al., 1992), respectively.

Fidelity of Implementation

Four studies (Ingersoll et al., 2005; Koegel et al., 1998b; McGee et al., 1992; Rogers et al., 2006) used fidelity check. Ingersoll et al. (2005) used a 5-point rating scale to describe the components of 5 different intervention strategies across observations and videotaped 10% of the sessions conducted by the therapist, showing an average of 4.5 (range = 4.2–4.8). Two fidelity of implementation procedures were used in studies by Rogers et al. (2006): a fidelity rating system developed Rogers, and a PROMPT fidelity rating scale developed by Hayden. Based upon recorded videotapes and site visits, the averaged fidelity of implementation score was 85%. The final fidelity of implementation score, as reported in the Koegel et al. (1998b) study, was based on two independent observations—analogue versus naturalist interventions. In the analogue situation, the clinician modeled the target sound and asked the child to repeat it; if the child responded correctly, the clinician gave the child social praise and a desired reward. In contrast, in the naturalistic situation, the clinician modeled the target sound in words, phrase, and sentences as they naturally came up in the play interactions.

Major Findings: Communication Outcomes (see Table 4)

Verbal skill gains were documented in all 23 studies. However, each study also reported particular areas of communication skills that increased the most: (a) 69% reported improvement of appropriate verbal responses or talking; (b) nearly 22% mentioned improvement of number of words used; (c) 4.3% of the studies included their progress of use of elaborated phrases; (d) roughly 13% resulted in increases of spontaneous questions, making choices, and request; and (e) approximately 22% reported a decrease in participants' inappropriate behaviour.

Other Critical Components

As can be seen in Table 4, only 17% of the studies included any follow-up data to examine maintenance of the effectiveness of the intervention procedures across time (Charlop & Milstein, 1989; Ingersoll et al., 2005; Rogers et

al., 2006; Matson et al., 1993; & Schepis et al., 1998). Two other studies (Rogers et al. (2006) and Schepis et al. (1998)) included follow up data and reported positive results in communication skill maintenance after one to three months. Fourteen studies (61%) reported generalization outcomes through intervention. Each study reported that young children with ASD increased their communication skills when participants had learned in a natural learning environment with their families (i.e., home) (Buffington et al., 2006; Ganz & Simpson, 2004; Ingersoll et al., 2005; Koegel et al., 1998b; Mancil et al., 2006; & Rogers et al., 2006). Koegel et al. (1998b) reported that young children with ASD who using naturalistic methods not only showed the greatest increase in producing sounds (up to 80-100% correct), but generalized what they had leaned more easily than by using analogue methods.

Discussion

This synthesis examined the instructional effectiveness of communication strategies for young children with ASD using single-subject designs over the past three decades. These research studies were conducted in order to expand the communication abilities of young children with ASD. Although this synthesis study examined 23 peer reviewed journal articles, two important outcomes were evident. First, all of the interventions showed positive results even though various interventions (i.e., token reinforcement, verbal phrase, adult-mediated strategy, naturalistic, and analogue) were used. Second, participants improved in areas such as correct verbal and gestural responses and the imitation of conversations increased (e.g., number of word use, requesting turns, and making choices by asking questions or requesting). In 60% of the studies, there were reports of generalization of participants' progress in various settings such as novel settings and at home with family (Buffington et al., 1998; Charlop & Milstein, 1989; Ganz & Simpson, 2004; Goldstein & Brown,[2] 1989; Handleman, 1979; Ingersoll et al., 2003; Koegel et al., 1987; Koegel et al., 1998b; Mancil et al. 2006; Marckel et al., 2006; Matson et al., 1993; Neef et al., 1984; Rogers et al., 2006; Shafer et al., 1984). In addition, seven studies (30%) reported generalization outcomes showing that young children with ASD increased

their communication skills and had learned at home with their families. (Charlop et al., 1989, Chin et al., 2000, Handleman, 1979; Koegel et al., 1998a, Koegel, et al., 1998b, Mancil et al., 2006, Marckel et al., 2006, & Rogers et al., 2006). Only three studies (13%) exclusively implemented intervention at home. Consequently, it is difficult to draw conclusions from the data, because of the six studies (26%) conducted in multiple settings which had an influence on the outcomes (Charlop & Milstein, 1989; Handleman, 1979; Koegel et al., 1998a; Koegel et al., 1998b; Koegel et al., 1987; Rogers et al., 2006).

However, it has been noted that home-based settings promoted generalization and maintenance. Five of the studies involved family members and had at least part of the therapy conducted at home. This allowed the participants to generalize what they learned to their natural environment and allowed family members to help maintain progress in communication skills.

Limitations of Research Studies

The lack of reliability is an important limitation because only four studies included reports of fidelity (Ingersoll et al., 2005; Koegel et al., 1998b; McGee et al., 1992; & Rogers et al., 2006). Without reports of fidelity, data may be subject to observer bias and the conclusions drawn from the data can be faulty due to uncertainty in the reliability of the data. Without fidelity data, observer bias may cause researchers to miss connections or miss important features critical to the studies. Single subject research studies must provide sufficient information documenting that the intervention was implemented with fidelity (Horner et al., 2005). Moreover, investing time and resources in practices that lack of adequate input from educators could squander limited educational resources and, may result in the use of practices and procedures that do not serve the best interest of the children.

The lack of data in some studies relating to the intensity and duration of treatment makes it more difficult to determine if one communication intervention method was more efficient in treating young children with ASD as compared to a different method. Different routines were used in the reported studies: conducting the intervention once a day (1 study), three times

a day (1 study), once a week (3 studies), twice a week (4 studies), three to thirteen times a week (1 study), thirteen times a week (1 study) and two to three times a month (1 study), but 13 of the studies did not report how often the treatments were carried out, and 11 of the studies did not mention duration of treatment.

Recommendations for Future Studies

Even with the limitations associated with the studies mentioned previously, they still present some important information. First, communication intervention was primarily focused on very young children with the age range being between 1 year, 8 months and 7 years, 9 months (M = 5:0). The reason for this is that early detection and treatment of communications problems can have a large impact on a child's future. The damage due from lack of social developmental communication skills can potentially enlarge the chasm between these children and their normally developing peers (McGee et al., 1993). In addition, of the 83 participants, 76% were male. This is slightly lower than prevalence rates for ASD reported in DSM-III-R, IV, TR (male: female ratio = 5:1) but 11 participants (13%) did not report gender.

Finally, all participants in 9 studies reported communication skills of improvement by percentage of verbal performance (Buffington et al., 1998; Chung et al., 2006; Chin & Bernard-Opitz, 2000; Goldstein & Brown,[2] 1989; Ingersoll et al., 2005; Keen et al., 2005; Koegel et al., 1998b; Marckel et al., 2006; Schepis et al., 1998). In contrast, the others reported the improvement of words (e.g., words per minute).

Participants involved in the several studies improved their responses by using more elaborate phrases or more word phrases (Chin & Bernard-Opitz, 2000; Ganz & Simpson, 2004). In using natural reinforcers, Koegel et al. (1998a), had participants ask questions spontaneously after the intervention was completed. Also, Schepis et al. (1998) reported that young children with autism increased the number of per minute communicative interactions relative to baseline and Koegel et al. (1998b) found children with ASD scored 80% to 100% correct target sounds using the naturalistic condition as compared to near zero using the analogue condition mentioned previously.

Overall, this review supports the notion that if children with ASD receive therapy at an early age, they can make significant progress in their communication skills. In addition, naturalistic methods improve the generalization and maintenance of skills. Two important factors impact the generalization of results and findings: (a) the limited number of empirically-based studies with this group of children, and (b) the small sample size of subjects in these studies. Due to the small number of participants ($n = 83$) and limited number of studies published on this topic that met the criteria in the last three decades, caution must be used in interpreting the findings.

Thus, it suggested that more studies in this population and more detailed studies to further define the best strategies for communications skills intervention are needed in the field of special education. In addition, studies are needed to investigate and gather further evidence to clarify the advantages of implementing naturalistic methods or conditions compared to analogue methods. The lack of these studies highlights the importance of pursuing further evidence of ways to help young children with ASD to reach their full potential by improving their communication skills.

From this review, it is clear that the implementation of reinforcements is effective in increasing the language skills of young children with autism because they will be able to participate in more activities. However, it is difficult to determine the extent to which there will be the generalization of language skills to other activities due to the limited number of studies reporting the results of follow-up studies ($n = 4$) that support how young children with autism would maintain or increase their language skills without intervention. In addition, only one of four studies reported that the child with ASD being targeted maintained language skills without an interventionist or when reinforcements were removed (Koegel, 1987). Future research studies must be conducted to address research questions focused on the generalization and maintenance of language skills across activities and without reinforcements in young children with ASD.

References

American Psychiatric Association. (1987). *Diagnostic and statistical manual of mental disorders, (3rd ed., revised).* Washington, DC: Author.

American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders*, (4th ed., text revision). Washington, DC: Author.

Autism Society of America (n.d.). Retrieved June 19, 2009, from http://www.autism-society.org/site/PageServer

Bertrand, J., Mars, A., Boyle, C., Bove, F., Yeargin-Allsopp, M., & Decoufle, P. (2001). Prevalence of autism in a United States population. The Brick Township, New Jersey, Investigation. *Pediatrics, 108*(5), 1155–1161.

Binet, A., & Simon, T. (1905). Méthodes nouvelles pour le diagnostic du niveau intellectual desanormaux. *L'Année psychologique, 11*, 191–336.

Birnbrauer, J., & Leach, D. (1993). The Murdoch Early Intervention Program after 2 years. *Behavior Change, 10*, 63–74.

Bondy, A., & Frost, L. (1995). Educational approaches in preschool: Behavior techniques in a public school setting. In Shopler, E., & Mesibov, G.B. (Eds.), *Learning and cognition in autism* (pp. 311–334). New York: Plenum Press.

Buffington, D. M., Krantz, P. J., McClannahan, L. E., & Poulson, C. L. (1998). Procedures for teaching appropriate gestural communication skills to children with autism. *Journal of Autism and Developmental Disorder, 28*(6), 535–545.

Charlop, M. H., & Milstein, J. P. (1989). Teaching autistic children conversational speech using video modeling. *Journal of Applied Behavior Analysis, 22*, 275–285.

Chin, H. Y., & Bernard-Opitz, V. (2000). Teaching conversational skills to children with autism: Effect on the development of a theory of mind. *Journal of Autism and Developmental Disorder, 30*(6), 569–583.

Chung, K., Reavis, S., Mosconi, M., Drewry, J., Matthews, T., & Tasse, M. (2006). Peer-mediated social skills training program for young children with high-functioning autism. *A Multidisciplinary Journal, 28*(4), 423–436.

Egel, A. L., Shafer, M. S., & Neef, N. A. (1984). Receptive acquisition and generalization of prepositional responding in autistic children: A comparison of two procedures. *Analysis and Intervention in Developmental Disabilities*, 4, 285–298.

Ganz, J. B., & Simpson, R. L. (2004). Effects on communicative requesting and speech development of the Picture Exchange Communication System in children with characteristic of autism. *Journal of Autism and Developmental Disorders*, 34(4), 395–409.

Gillberg, C., & Wing, L. (1999) Autism: Not an extremely rare disorder. Acta *Psychiatrica Scandinavia, 99*, 399–406.

Goldstein, H. (2002). Communication intervention for children with autism: A review of treatment efficacy. *Journal of Autism and Developmental Disorders*, 32(5), 373–396.

Goldstein, H., & Brown, W. (1989). Observational learning of receptive and expressive language by preschool children. *Education and Treatment of Children, 12*, 5–37.

Greenspan, S. I., & Wieder, S. (1998). *The child with special needs*. Reading, MA: Addison-Wesley.

Handleman, J. S. (1979). Generalization by autistic-type children of verbal response across settings. *Journal of Applied Behavior Analysis*, 12(2), 273–282.

Harris, S., Handleman, J., Gordon, R., Kristoff, B., & Fuentes, F. (1991). Changes in cognitive and language functioning of preschool children with autism. *Journal of Autism and Developmental Disorders*, 21, 281–290.

Horner, R. H., Carr, K., Halle, J., McGee, G., Odom, S., & Wolery, M. (2005). The use of single-subject research to identify evidence-based practice in special education. *Exceptional Children, 71*(2), 165–179.

Ingersoll, B., Dvortcsak, A., Whalen, C., & Darryn. S. (2005). The effects of a developmental, social-pragmatic language intervention on rate of expressive language production in young children with autistic spectrum disorders. *Focus on Autism and Other Developmental Disabilities*, 20(4), 213–222.

Kaufman, A. S., & Kaufman, N. L. (1990). *Kaufman Brief Intelligence Test manual*. Circle Pines, MN: American Guidance Service.

Keen, D., Sigafoos, J., & Woodyatt, G. (2001). Replacing prelinguistic behaviors with functional communication. *Journal of Autism and Developmental Disorders*, 31(4), 385–398.

Koegel, L. K., Camarata, S., Valdez-Menchaca, M., & Koegel, R. L. (1998a). Setting generalization of question-asking by children with autism. *American Journal on Mental Retardation*, 102, 346–357.

Koegel, R. L., Camarata, S., Koegel, L. K., Ben-Tall, A., & Smith, A. E. (1998b). Increasing speech intelligibility in children with autism. *Journal of Autism and Developmental Disorders*, 28, 241–251.

Koegel, L. K, & Koegel, R. L. (1995). Motivating communication in children with autism. In Schopler, E., & Mesibov, G.B. (Eds.), *Learning and cognition in autism* (pp. 73–87). New York: Plenum Press.

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 Disorders, 17,* 187–200.

Laski, K., Charlop, M., & Schreibman, L. (1988). Training parents to use the natural language paradigm to increase their autistic children's speech. *Journal of Applied Behavior Analysis*, 21, 391–400.

Lotter, V. (1966). Epidemiology of autistic conditions in young children. *Social Psychiatry, 1*, 124–137.

Lovaas, O. I. (1987). Behavioral treatment and normal educational and intellectual functioning in young autistic children. *Journal of Consulting and Clinical Psychology, 55,* 3–9.

Mancil, G. R., Conroy, M. A., Nakao, T., & Alter, P. J. (2006). Functional communication training in the natural environment: a pilot investigation with a young child with autism spectrum disorder. *Education and Treatment of Children*, 29(4), 615–633.

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

Matson, J. L., Sevin, J. A., Box, M. L., Francis, K. L., & Sevin, B. M. (1993). An evaluation of two methods for increasing self-initiated verbalizations in autistic children. *Journal of Applied Behavior Analysis, 26*(3), 389–398.

McGee, G. G., Almeida, C., Sulzer-Azaroff, B., & Feldman, R. S. (1992). Promoting reciprocal interactions via peer incidental teaching. *Journal of Applied Behavior Analysis, 25*(1), 117–126.

McGee, G. G., Morrier, M. J., & Daly, T. (1999). An incidental teaching approach to early intervention for toddlers with autism. *Journal of the Association for Persons with Severe Handicaps, 24*, 133–146.

Myers, S.M., & Johnson, C.P. (2007). Management of children with autism spectrum disorder. Pediatrics, 120(5): 1162–1182.

National Institute of Child Health (2007). *Bipolar disorder*. Retrieved July 23, 2009, from http://www.nimh.nih.gov/publicat/bipolar.cfm

National Research Council. (2001). *Educating children with autism*. Lord, C., & McGee. J. (Eds.), Washington, DC: Committee on Educational Interventions for Children with Autism; National Academy Press.

Neef, N. A., Walters, J., & Egel, A. L. (1984). Establishing generative yes/no responses in developmentally disabled children. *Journal of Applied Behavior Analysis, 17*, 453–460.

Odom, S., Horner, R., Snell, M., & Blacher, J. (2009). Handbook of developmental disabilities. In S. Odom, S. Rogers, C.J. McDougle, K. Hume, & G. McGee (Eds.), *Early Intervention, for Children with Autism Spectrum Disorder* (pp. 199–223). New York: Guilford Press.

Rogers, S. J., Hayden, D., Hepburn, S., Charlifue-Smith, R., Hall, T., & Hayes, A. (2006). Teaching young nonverbal children with autism useful speech: A pilot study of the Denver Model and PROMPT interventions. *Journal of Autism and Developmental Disorder, 36*(8), 1007–1024.

Rogers, S. (1996). Brief report: Early intervention in autism. *Journal of Autism and Developmental Disorders, 26*, 243–246.

Schepis, M. M., Reid, D. H., Behrmann, M. M., & Sutton, K. A. (1998). Increasing communicative interactions of young children with autism using a voice output communication aid and naturalistic teaching. *Journal of Applied Behavior Analysis, 31*(4), 561–78.

Shafer, M. S., Egel, A. L, & Neef, N. A. (1984). Training mildly handicapped peers to facilitate changes in the social interaction skills of autistic children. *Journal of Applied Behavior Analysis, 17*, 461–476.

Sheinkopf, S., & Siegel, B. (1998). Home-based behavioral treatment of young children with autism. *Journal of Autism and Developmental Disorders, 28, 15–23.*

Spreckley, M., & Boyd, R. (2009). Efficacy of applied behavioral intervention in preschool children with autism for improving cognitive, language, and adaptive behavior: A systematic review and meta-analysis. *The Journal of Pediatrics, 154*(3), 338–344.

Tager-Flusberg, H., Rogers, S., Cooper, J., Landa, R., Lord, C., Paul, R., Rice, M., Stoel-Gammon, C., Wetherby, A., & Yoder, P. (2009). *Defining spoken language Benchmarks and selecting measures of expressive language development for young children with autism spectrum disorders*. Bethesda MD: National Institute on Deafness and Other Communication Disorders.

Tiegerman, E., & Primavera, L. H. (1984). Imitating the autistic child: Facilitating communicative gaze behavior. *Journal of Autism and Developmental Disorders, 14,* 27–38.

Wing L., & Gould, J. (1979). Severe impairments of social interaction and associated abnormalities in children: Epidemiology and classification. *Journal of Autism and Developmental Disorders, 9,* 11–29.

Wing, L., & Potter D. (2002). The epidemiology of autistic spectrum disorders: Is the prevalence rising? *Mental Retardation and Developmental Disabilities Research Reviews, 8,* 151–161.

Table 1. Participant characteristics

Authors	Sample Size	Gender F	Gender M	Chronological Age (years : months)	Language Level (years : months)	Intellectual Level (months)	Autism Characteristic	Diagnostic Criteria
Buffington et al. (1998)	4	1	3	4:5–6:5 (M = 5:5)	Expressive 2:2–3:4	N/R	Autism	DSM-III-R
Charlop & Milstein (1989)	3	–	3	6:10–7:10 (M = 7:4)	Receptive 4:5 (n = 1) EOWVT* 6:4 (n = 1) Echolalia (n = 1)	46–78 (M = 60)	Autism	DSM-III
Chung et al. (2006)	4	–	4	6:8–7:7 (M = 6:9)	Difficulty staying on topic/ carrying conversation/ specific weakness in language	N/R	Autism (n = 4) PDD-NOS (n = 1)	DSM-IV
Chin & Bernard-Opitz (2000)	3	–	3	5:11–7:9 (M = 6:7)	Receptive 300–400 words	Average	Autism	DSM-III-R
Egel et al. (1984)	4	–	4	6:0–8:0 (M = 7:3)	Receptive (M = 3:1)	29–55 (M = 45)	Autism	N/R
Ganz & Simpson (2004)	3	1	2	3:9–7:2 (M = 5:6)	2:5–4:2 (two male)	N/R	Autism (n = 1) DD (n = 2)	N/R
Goldstein & Brown[1] (1989)	3	–	–	2:6–3:8 (M = 3:4)	Receptive (M = -1:6) Expressive(M = -1:1)	62–102 (M = 79.2)	DD (n = 2) DS* (n = 1)	NR
Goldstein & Brown[2] (1989)	2	–	–	2:9–3:6 (M = 3:1)	Receptive (M = 3.5 mos.) Expressive (M = 7.5 mos.)	75–77 (M = 76)	DD	NR
Handleman (1979)	4	–	4	6:0–7:0 (M = N/R)	Language deficits	N/R	Autism	N/R

Table 1. Participant characteristics (continued)

Authors	Sample Size	Gender F	Gender M	Chronological Age (years : months)	Language Level (years : months)	Intellectual Level (months)	Autism Characteristic	Diagnostic Criteria
Ingersoll et al. (2005)	3	–	3	2:6–3:10 (M = 3:0)	Expressive 1:0–1:3	Mental Age 19–25 mos.	Autism (n = 2) PDD-NOS (n = 1)	DSM-IV-TR
Keen et al. (2001)	4	1	3	3:7–7:7 (M = 5:1)	Expressive (M = 5.3) Receptive (M = 6.5)	N/R	Autism	N/R
Koegel et al. (1998a)	3	1	2	3:7–5:4 (M = 4:4)	1:3–1:8	N/R	Autism	N/R
Koegel et al. (1987)	2	–	–	4:5–5:8 (M = 5:1)	Nonverbal	below 19 mos.	Autism	N/R
Koegel et al. (1998b)	5	1	4	3:8–7:6 (M = 5:6)	PPVT-R* EOWPVT-R* 1:6–3:0	N/R	Autism	DSM-IV
Mancil et al. (2006)	1	–	1	4:0	Lack of spontaneous verbal language	Slightly delayed	PDD*	N/R
McGee et al. (1992)	3	–	3	3:7–5:11 (M = 4:6)	N/R	N/R	Autism	N/R
Marckel et al. (2006)	2	–	2	4:0–5:0 (M = 4.5)	N/R	N/R	Autism	DSM IV-TR
Matson et al. (1993)	3	–	3	4:0–5:0 (M = 4.3)	Expressive 1:1–2:4	47–71 (M = 60)	Autism	DSM III-R
Neef et al. (1984)	4	1	3	4:0–6:0 (M = 5:0)	Severely language delayed	27–36	Autism	N/R

Table 1. Participant characteristics (continued)

Authors	Sample Size	Gender F	Gender M	Chronological Age (years : months)	Language Level (years : months)	Intellectual Level (months)	Autism Characteristic	Diagnostic Criteria
Rogers et al. (2006)	10	–	10	1:8–5:5 (*M* = 4:0)	Expressive: 6–18 mos. Receptive: 8–31 mos.	Mental Age 13–29 mos.	Autism	DSM-IV
Schepis et al. (1998)	4	–	–	3:0–5:0 (*M* = 4:0)	Some words	N/R	Autism	N/R
Shafer et al. (1984)	3	1	2	5:5–6:7 (*M* = 5:9)	N/R	30–39 (*M* = 32)	Autism	N/R
Tiegerman & Primavera (1984)	6	2	4	4:0–6:0 (*M* = 4.7)	Nonverbal (*n* = 4) Echolalia (*n* = 2)	N/R	Autism	N/R

Note. N/R = Not reported. DSM-III-R = Third Edition Revision (American Psychiatric Association, 1987). DSM-IV = Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association, 1994). DSM IV-TR = Diagnostic and Statistical Manual of Mental Disorders, Text Revision, Fourth Edition-Test Revision (American Psychiatric Association, 2000). PDD-NOS = Pervasive Developmental Disorder – Not Otherwise Specified; DS = Down Syndrome. PDD = Pervasive Developmental Disorder. Goldstein & Brown[1] (1989) represents "experiment 1" (pp. 8–23) and Goldstein & Brown[2] (1989) represents "experiment 2" (pp. 23–34).

Table 2. Research design characteristics

Authors	Research design	Data collection	Diagnostic instrument(s)	Follow-up	Reliability
Buffington et al. (1998)	Multiple baseline across responses	72 Videotaped Interactive episodes	AE*	No	94%
Charlop & Milstein (1989)	Multiple baseline across subjects	1. Observation 2. Videotape	PPVT, EOWVT	15 mos.	98%
Chung et al. (2006)	Comparison	1. Observation 2. Videotape 3. Interview (parents)	BOS*	No	86%
Chin & Bernard-Opitz (2000)	Multiple baseline across subjects	1. Self-report 2. Videotape	False Belief task* ToM* KBIT*	No	Cohen's K.69
Egel et al. (1984)	Multiple baseline across subjects	1. Observation	LIPS* Stanford-Binet	No	100%
Ganz & Simpson (2004)	Single subject within subjects	1. Observation 2. Videotape 3. Self-report	SLI* SLT* AE*	No	93%
Goldstein & Brown[1] (1989)	Multiple baseline across subjects	1. Observation	Stanford-Binet Intelligence Scale, SICD* BDIED*	No	99.3%
Goldstein & Brown[2] (1989)	Multiple baseline across responses	1. Observation	MSCA* LAPDE* SICD	No	97.6%
Handleman (1979)	Multiple baseline across settings	1. Standardized test 2. Observation	N/R	No	97%
Ingersoll et al. (2005)	Multiple baseline across subjects	1. Observation 2. Videotape	FEA*	1 mos.	80%
Keen et al. (2001)	Multiple-probe across behaviors	1. Videotape	N/A	No	97%
Koegel et al. (1998a)	Multiple baseline across subjects	1. Self-report (parents) 2. Videotape	VABS	No	98%

Table 2. Research design characteristics (continued)

Authors	Research design	Data collection	Diagnostic instrument(s)	Follow-up	Reliability
Koegel et al. (1987)	Multiple baseline across subjects	1. Observation 2. Videotape	VSMS* Cattell and Merrill Plamer intelligence, IPA*	No	79%
Koegel et al. (1998b)	Comparison Single Subject (A-B-A)	1. Self-report 2. Observation	AAPS* PPVT-R* EOWPVT-R* CELF*ACLC* VABS*TELD*	No	87%
Mancil et al. (2006)	Multiple baseline across descriptors	1. Interview 2. Videotape 3. Observation	FA*	No	97%
McGee et al. (1992)	Multiple baseline across subjects	1. Observation 2. Videotape	PSPCSAYC* PRSM*	No	95%
Marckel et al. (2006)	Multiple baseline across descriptors	1. Observation 2. Interview (parents)	PECS checklist	No	99%
Matson et al. (1993)	Multiple baseline across target behavior	1. observation	VABS*	2–10 mos.	99–100%
Neef et al. (1984)	Multiple baseline across subjects	1. Observation	Stanford-Binet Intelligence Scale	No	100%
Rogers et al. (2006)	Single Subject (A-B-A)	1.Self-report 2.Interview 3. Observation 4. Videotape	N/R	3 mos.	85%
Schepis et al. (1998)	Multiple-probe across subjects	1. Videotape 2. Observation	VABS BASIC	2–9 mos.	93%
Shafer et al. (1984)	Multiple-probe across subjects	1. Observation 2. Videotape	Stanford-Binet	No	89%
Tiegerman & Primavera (1984)	Mixed two-factor within-subject	1. Observation	Lovaas	No	85%

Table 2. Research design characteristics (continued)

Note. N/A = Not applicable. N/R = Not reported. BOS = Behavioral Observation System. IL = Imitative Language. SL = Spontaneous Language. MIS = Motor Imitation Scale. JAA = Joint Attention Assessment. SLO = Structured Laboratory Observation. PRT = Pivotal Response Training. FEA = Functional Emotional Assessment. VABS = Vineland Adaptive Behavior Scale. BASIC = A software application programmed. FA = Functional Analysis. AAPS = Arizona Articulation Proficiency Scale. CELF = Clinical Evaluation of Language Fundamentals-Revised. ACLC = Assessment of Children's Language Comprehension. TELD = Test of Early Language Development. KBIT = Kaufman Brief Intelligence Test. SICD = Sequenced Inventory of Communication Development. BDIED = Brigance Diagnostic Inventory of Early Development. MSCA = McCarthy Scales of Children's Ability. LAPDE = Learning Accomplishment Profile Diagnostic Edition. PSPCSAYC = Scale of Perceived Competence and Social Acceptance for Young Children. PRSM = Picture Rating Sociometric. LIPS = Leiter International Performance Scale. VSMS = Vinland Social Maturity Scale. IPA = International Phonetic Alphabet Binet (1905).

Table 3. Characteristics of communication interventions

Authors	Interventionist	Setting	Intervention type	Intensity	Duration	Fidelity
Buffington et al. (1998)	Author(s)	PCDI*	Reinforcement (i.e., token system and verbal praise to prompt)	60 sessions	N/R	N/R
Charlop & Milstein (1989)	Therapist Siblings	Home Workroom	Video modeling	Twice per week 8–35 sessions	N/R	N/R
Chung et al. (2006)	Author(s)	Conference room	Peer-mediated strategies	once per week 90min/session	12 weeks	N/R
Chin & Bernard-Opitz (2000)	Student in psychology department	Home	Adult-Mediated Strategies (making a conversation, turn-taking, listening, maintaining in a topic, and changing a topic appropriately)	Twice per week 60 min/session	5 weeks	N/R
Egel et al. (1984)	Teachers	Classroom	Discrete-trial with differential reinforcement prompting and modeling	3–18 sessions per each	N/R	N/R
Ganz & Simpson (2004)	Author(s)	Classroom	PECS* Reinforcers (preferred items)	Once per week 23 sessions	23 weeks	N/R
Goldstein & Brown[1] (1989)	Classroom	Classroom	Reinforcement (token system) & correction procedures	13 sessions	N/R	N/R
Goldstein & Brown[2] (1989)	Typically developing peers	Classroom	Peer modeling Praise	32 sessions per day	1–2 days	N/R
Handleman (1979)	Students in psychology, speech, & special education; mothers	Multiple natural settings	Different reinforcers & correction procedures	Three per day 20 sessions	N/R	N/R
Ingersoll et al. (2005)	Speech pathologist	Clinic	Developmental Social-Pragmatic Language	Twice per week 50 min/session	10 weeks	Yes
Keen et al. (2001)	Teacher(s)	Classroom	Teacher-implemented (greet, requesting, choice making, and turn taking)	24 sessions 30 min/session	N/R	N/R
Koegel et al. (1998a)	Natural reinforcers	Home University	Reinforcers (child's preferred items)	Twice per week 30 min/session	N/R	N/R
Koegel et al. (1987)	Clinicians	Clinic Living room	Stimulus items, prompts, interaction, natural reinforcers	Twice per week 2 hr/session	6–14 weeks	N/R

Table 3. *Characteristics of communication interventions* (continued)

Authors	Interventionist	Setting	Intervention type	Intensity	Duration	Fidelity
Koegel et al. (1998b)	Family Clinician Peers	Home Clinic School	Naturalistic (unstructured)–incorporated motivational variables Analogue (structured)	Twice per week 45 min/session	10 weeks	Yes
Mancil et al. (2006)	Mother	Home	Functional Communication Training	24 sessions (5min)	2 days	N/R
McGee et al. (1992)	Typically developing peers	Classroom	Natural reinforcers Choice-making by child's lead	17–38 sessions 5 min/sessions	2–10 mos.	Yes
Marckel et al. (2006)	Two therapists	Home	PECS* Reinforcers (preferred items)	45 sessions	N/R	N/R
Matson et al. (1993)	Speech therapist	Clinic	Reinforcers (child's preferred items) Visual cue procedure	24–37 sessions 20 min/sessions	2–3 mos.	N/R
Neff et al. (1984)	Teacher	Classroom	Non-contingent reinforcers	5 days per week 5–40 min/sessions	N/R	N/R
Rogers et al. (2006)	Parents Therapist	Home Laboratory	Denver Model therapy* PROMPT*	Daily (60 min) Once per week (60 min)	12 weeks	Yes
Schepis et al. (1998)	Teacher Teacher assistants	Classroom	VOCA* Reinforcers (child's preferred item, preferred activities)	Baseline 2–6 Intervention 2–13 (mos) (30–45 min)	5–15 mos.	N/R
Shafer et al. (1984)	Typically developing peers	Classroom	Preferred item, peer-modeling	3–6 peer modeling training sessions; 16 sessions in a play group	N/R	N/R
Tiegerman & Primavera (1984)	Experimenters	Classroom	Contingent imitation (adult-child interaction)	17 sessions 30 min/per session	6 weeks	N/R

Note. N/R = Not reported. Denver Model = which merges behavioral, developmental, and relationship-oriented intervention. PROMT = a neuron-developmental approach for speech production disorders. BCIS = Behaviour Chain Interruption Strategy. VOCA = Voice Output Communication Aids. PECS = Picture Exchange Communication System. PRT = Pivotal Response Training including response training (the child was taught to respond appropriately to joint attention bids of the experimenter) and initiation training (the child was taught to initiate joint attention bids to the experiment). PCDI = Princeton Child Development Institute. PECS = Picture Exchange Communication System. AE = Age-equivalent score.

Table 4. Major findings

Study	Primary findings	Limitations	Maintenance/ Generalization
Buffington et al. (1998)	• None of participants displayed gestural and verbal responses during baseline. • Participants produced a correct verbal and gestural response in the 92% to 100% percentile range during training. • Three participants increased their gestural and verbal performances within a range of 89% to 100% (M = 98%); one participant increased target behaviour within a range of 89% to 100% (M = 96%). • All participants learned to respond in the presence of novel stimuli • The participant's behaviour was indistinguishable from their typical peers.	• This study does not examine results of spontaneous use and gestures.	No/Yes
Charlop & Milstein (1989)	• All participants acquired conversational speech after video modeling. • Increase in asking questions • Increase in participant's spontaneous variations in their responses • Parents and typical children noticed significant changes in language after intervention.	N/R	Yes/Yes
Chung et al. (2006)	• Social skills training was effective in improving social communication skills. • All participants Appropriate Talking were increasing in range of frequency 9.0% to 41.9% (M = 13.8%). • Initiating Comments were reported in all participants with a frequency range of 0% to 70.0% (M = 27.4%). • Two participants' Elaborated Contingent Response were measured at a range of 0% to 39.0% (M = 27.2%). • Inappropriate talking decreased in the entire participants baseline to treatment at a range of 7.5% to 1.5% (M = 4.2%).	• Limited number of data points at baseline • Unblended coders • Absence of a control group	No/No

Table 4. *Major findings* (continued)

Study	Primary findings	Limitations	Maintenance/ Generalization
Chin & Bernard-Opitz (2000)	• All participants trained in false belief task improved in conversational ability. • Shared interest improved in all participants (M = 90.3%). • Appropriate responses in all participants improved (M = 67.7%). • Elaborated response improved in two out of three participants, on average from 0.5 to an average of 9 in frequency. Conversational competence after treatment depends on the quality of the participants' speech in baseline.	• Baseline and Intervention are not truly continuous. • Short duration • Small sample size (n = 3)	No/No
Egel et al. (1984)	• Both "positive self" (in which students placed themselves in a specific relation to an object) and "positive object" (in which they placed an object in a specific relation to another object) were effective in four children's acquisition and generalization of prepositional concepts. • Generalization with the exception of one student only occurred following specific generalized programming.	N/R	No/Yes
Ganz & Simpson (2004)	• All participants mastered all 4 phases of the PECS. • By the end of phase 4, 3 word responses were used. • Non-word vocalizations of students (i.e., shouts, and moans, etc.) decreased (n = 1), remaining stable (n = 1), increased (n = 1).	• One subject was bilingual. • Short baseline. (n = 3)	No/Yes
Goldstein & Brown[1] (1989)*	• Participants showed cross modal transfer. • Participants did not always learn expressive responses. • Expressive modeling facilitated responsive learning.	N/R	No/No

(continued on following page)

Table 4. Major findings (continued)

Study	Primary findings	Limitations	Maintenance/ Generalization
Goldstein & Brown[2] (1989)*	• Observational learning was accomplished by cross modular transfer. • When the peer answered verbally, the students leaned by the example. • Observational learning was accompanied by cross modal transfer to receptive responding. • The participants also produced and responded to novel utterances that recombined the included words. • Participants demonstrated (93–94% correct) generalization to their home settings.	N/R	No/Yes
Handleman (1979)	• 3 participants (total of 4) had better scores in multi-natural settings than in restricted settings. • 1 participant obtained the same score on the 1st probe in multi-natural setting. • 3 participants got better transfer of learning in home than restricted settings. • 1 participant received a high score in both multi-natural and restricted settings.	• Few trials in base • Small sample size	No/Yes
Ingersoll et al. (2005)	• All participants experienced had an average increase of 18% in using appropriate expressive language with the therapist. • Participants increased appropriate expressive language by 17%.	• Interventionist learned treatment before training. • No generalization in naturalistic setting. • No follow-up ($n = 2$)	No/Yes
Keen et al. (2001)	• Participants increased an average of 65.5% replacement behaviour and showed a 6.25% decrease in pre-linguistic behaviour. • Requesting turns increased replacement behaviour by 42.8% and decreased pre-linguistic behaviour by 13.5%. • Choice making average increased by 80.5% in replacement behaviour and 34% decrease in pre-linguistic behaviour.	• If the replaced behaviour was more efficient, the subject might adopt it more quickly, if not they might stay with the pre-linguistic behaviour.	No/No

Table 4. *Major findings* (continued)

Study	Primary findings	Limitations	Maintenance/ Generalization
Koegel et al. (1998a)	• Children answered "no" to questions in the baseline condition • All children were spontaneously asked questions • Following the intervention, participants continued to ask questions at home	NR	No/No
Koegel et al. (1987)	• Participants were non-verbal. • During the baseline (Analogue Treatment Paradigm) participants made very few immediate imitative utterances and no deferred imitative utterances. • After the Natural Learning Treatment Paradigm was implemented steady durable increases in both immediate and deferred utterances occurred. • All immediate imitative utterances were greater in duration and frequency than any of the immediate utterances in the analogue conditions. • After the intervention, participants demonstrated a considerable number of utterances outside of the clinic.	N/R	Yes/Yes
Koegel et al. (1998b)	• Children all scored 80 to 100% correct in producing target sounds using naturalistic methods. • Children scored near zero correct using analogue methods.	N/R	No/Yes

Table 4. Major findings (continued)

Study	Primary findings	Limitations	Maintenance/ Generalization
Mancil et al. (2006)	• Student's tantrums decreased from 2.0 minutes to 0.0, during mands training. • His tantrums decreased to 0.0 during verbal mands phase. • After the spontaneous communications phase his tantrums remained at 0.0 with verbalizations increasing from 2 words to 8. • In mands B and the distracter phase his tantrum peaked and then returned to 0.0 and his verbalization increased from 8 words to 24. • In mands C and the spontaneous phase the child's tantrum level remained 0.0 and his word verbalization went from 24 to 28. • In the mands D phase his word vocalizations rose from 38 to 50 words.	• Small sample size ($n = 1$). • No data points from a 3rd party • Recorded anecdotally in spontaneous verbalization	No/Yes
McGee et al. (1992)	• Reciprocal interaction response to initiation increased. • In maintenance, maintained level ($n = 2$), above baseline ($n = 5$) • All participants followed peer incidental teaching	N/R	No/No
Marckel et al. (2006)	• Children's mean point by point agreement was 99%. • Mean percent of steps ranged from 99 to 100% • The number of requests increased and were maintained at high levels.	N/R	No/Yes
Matson et al. (1993)	• No differences in social interaction skills using gradual time delay procedures. • Visual cues increased self-imitating responses • Follow-up study of participants indicated that communication skills were maintained at a high level	N/R	Yes/Yes

Table 4. Major findings (continued)

Study	Primary findings	Limitations	Maintenance/ Generalization
Neef et al. (1984)	• Performance improved in all participants when imbedded instruction was sequentially implemented. • All participants had a high level of correcting responses with new items • Little change on yes/no responses of tutoring probes. • All participants' scores improved during general prompting.	N/R	No/Yes
Rogers et al. (2006)	• Students in the DM "improve from an average of 7.4 words to 50.4." • Students in the PM "improve from an average of 3.6 words to 69.6."	• Heterogeneous group	No/Yes
Schepis et al. (1998)	• Teachers' ratings of children's VOCA communication, as well as ratings of a person unfamiliar with the children, supported the contextual appropriateness of the VOCA. • Young children with autism used VOCA communication for a variety of different messages including requests, yes and no responses, statements, and social comments without staff interaction within the proceedings	• No measure was provided for individual methods separating VOCA from non-VOCA in the naturalistic setting	No/No
Shafer et al. (1984)	• Direct prompting procedure increased the duration of positive social interactions between trainer and children with autism. • Social interactions were increased and maintained during free play. • Peers increased their social interactions with children with autism.	N/R	Yes/Yes
Tiegerman & Primavera (1984)	• Imitating autistic children's play with objects led to the greatest increase in eye contact and object manipulation • Experimenter imitation of subject movements and performance with objects in procedure 1 resulted in greater duration and frequency of given behaviour more than did procedure 2 and 3 manipulating the same object differently or different objects differently. • Imitative interaction provided experience about learning to control the environment through manipulation.	N/R	No/No

*Note: N/R = Not reported. DM = Denver Model. PM = Prompt Model. * (The superscripts 1 and 2 refer to two different studies described in this paper.)*