

Promoting Generalization and Maintenance of Skills Learned via Natural Language Teaching

Pete Peterson

Abstract

This paper addresses the ability of strategies associated with natural language teaching (NLT) to support the generalization of language skills by children with developmental disabilities. A discussion of critical issues (e.g., specific NLT procedures, generalization) is followed by a systematic review of 57 studies. The studies were selected from the results of a PsychLit search if they met specific criteria (e.g., they were published in a peer-reviewed journal, described original research, involved the use of NTL strategies, included children as participants). They are reviewed systematically with respect to evidence of generalization, maintenance, and features of the intervention contexts that may influence the generalization and maintenance of target language skills. Recommendations for future research follows this analysis.

Keywords: Language delay, language intervention, natural language teaching, generalization, maintenance

Introduction

Delays in language acquisition can have serious deleterious effects on the educational and social development of children (Goldstein & Kaczmarek, 1992; Ramey & Campbell, 1992; Warren & Kaiser, 1986). Such delays are considered by some to be a “developmental disaster” (Warren & Kaiser, 1986). Unfortunately, delayed language acquisition is one of the most prevalent disabilities in early childhood. For example, Wetherby and Prizant (1992) reported that 70% of 3- to 5-year-olds with developmental disabilities have language delays (Wetherby & Prizant, 1992).

The influence of various environmental factors on children’s language development has been clearly established over the last 20 years (e.g., Bricker, 1993; Hart & Risley, 1992, 1995; Moerk, 1986, 1992; Walker, Greenwood, Hart, & Carta, 1994); and children with developmental disabilities are known to be especially vulnerable to these variables (Tannock & Girolametto, 1992). These variables include, for example, the caregiver’s responsiveness to child vocalizations, the reciprocity in verbal interaction between caregiver and child, the frequency of verbal interaction, and the availability of stimulating materials (Bradley & Caldwell, 1976; Hart & Risley, 1992; Huttonlocher, Haight, Bryk, Seltzer, & Lyons, 1991).

Of the environmental factors that influence language development, patterns of child-addressed speech have surfaced as particularly important (Hart, 1991; Hemmeter & Kaiser, 1990; Warren & Kaiser, 1988). For this reason, caregivers are considered to have a “critical influence on the child and the child’s language learning environment” (Hemmeter & Kaiser, 1990, p. 335); and patterns of child addressed speech have been observed to either support or limit language learning opportunities (Nelson, 1973). For example, Hart and Risley (1995) reported differences between parents in both the quantity and quality of child-addressed speech. Moreover, they found that the style of parental responsiveness, feedback tone, and guidance was positively correlated with language growth. More specifically, the children of families from higher SES groups heard an average of 2,150 words per hour in comparison to the children families from lower SES group, who heard only 620 words per hour (Hart & Risley, 1995, p. 132). Further, the language addressed to the children in the higher SES group included a richer distribution of particular linguistic features (e.g., nouns, modifiers, past-tense verbs, auxiliary-fronted questions, declarative sentences, and multi-clause sentences) and a more positive pattern of messages (e.g., a higher frequency of positive feedback, fewer imperatives, less negative feedback). As expected, by age three years, the

vocabularies of the children who were provided with this richer and more positive language style were two times larger than the vocabularies of the children whose language input was more restricted and less positive. Furthermore, the children's language abilities at age three years were good predictors of later language abilities at nine years (Walker, Greenwood, Hart, & Carta, 1994).

Various methods of language instruction have been developed over the years to assist children who present with language delays. Some of these methods are characterized as trainer-directed (e.g., discrete trial instruction) and others are considered more naturalistic (Fey, 1986). The latter include incidental teaching (e.g., Hart & Risley, 1975), mand-modeling (e.g., Rogers-Warren & Warren, 1980; Warren, McQuarter, & Rogers-Warren, 1984), and delayed prompt or time-delay (e.g., Halle, Marshall, & Spradlin, 1979). These more naturalistic procedures have been combined into a comprehensive teaching strategy called milieu language teaching (e.g., Kaiser, 1993). Taken as a whole, these procedures will be referred to as naturalistic language teaching (NLT) for the purposes of this paper.

Studies of the effects of language intervention have reported that the adult-directed forms of intervention (e.g., discrete trial instruction) when used alone result in poor generalization of language skills (e.g., Fey, 1986, 1988; Guess, Keogh, & Sailor, 1978; Warren, 1988). In fact, Fey (1986) has characterized this limitation as a "black mark" in the history of language intervention. Studies on the effects of NLT have also been conducted (see Hepting & Goldstein, 1996; Kaiser, Hendrickson, & Alpert, 1991; Kaiser, Yoder, & Keetz, 1992; Warren & Kaiser, 1986) but without specific attention to the effects of NLT on generalization and maintenance of the targeted skills. The present article will review the NLT literature with systematic attention to generalization and maintenance. It will consider the components of NLT (conceptually and empirically) in relation to the generalization procedures described by Stokes and Baer (1977); and it will analyze the fidelity of treatment with respect to generalization and maintenance. Two primary questions will be addressed: (a) Are NLT procedures effective in promoting generalization and maintenance? If so, (b) what features of NLT seem to affect generalization and maintenance most directly?

This review will first discuss the process of generalization and maintenance in relation to language acquisition. Next, naturalistic language teaching procedures will be described and compared. Then, the empirical literature of naturalistic language teaching will be analyzed in terms of generalization and maintenance. Finally, conclusions will be drawn from the review and future directions for research discussed.

Generalization

Stokes and Baer (1977) defined generalization as "the occurrence of relevant behavior under different, nontraining conditions (i.e., across subjects, settings, people, behaviors, and/or time) without the scheduling of the same events in those conditions as had been scheduled in the training conditions" (p. 350). However, generalization does not always occur. Kirby and Bickel (1988) interpreted lack of generalization as a stimulus control problem. They proposed that generalization might fail for three reasons. First, the stimuli that control the target behavior in the training setting may not be present in the desired generalization setting. Second, the stimuli believed to be controlling the target behavior may in fact not be the controlling stimuli. And third, the controlling stimuli may be conditional upon other stimuli, which do not occur in the generalization setting. Clearly, an accurate analysis of stimulus control is essential for the purpose generalization training. Several techniques have been discussed for their potential to transfer stimulus control from training to nontraining environments. Each is summarized below.

Techniques for Increasing Generalization

Stokes and Baer (1977) described a number of methods that had been used in an effort to promote generalization. These included (a) train and hope (i.e., train the child and hope that the new behavior generalizes to other environments); (b) sequential modification (i.e., modify the behavior in every setting in which the behavior is desired); (c) introduce behaviors that will contact naturally occurring contingencies of reinforcement in the generalization settings; (d) provide a range of examples of the target behavior; (e) train loosely (i.e., vary the training routine enough to provide the child exposure to a wider range of stimuli); (f) make it difficult for the child to discriminate the contingencies, possibly through the use of an intermittent schedule of reinforcement; (g) program common stimuli in both the training and generalization settings; (h) mediate generalization via the child's own verbal behavior; and (i) train the child to generalize. These procedures have been discussed in relation to language intervention (e.g., Costello, 1983; Fey, 1986), teacher training (e.g., Halle, Baer, & Spradlin, 1981), social skills training (e.g., Stokes & Osnes, 1986), and even in martial arts training (Harding, 1993). A number of Stokes and Baer's (1977) generalization procedures were reviewed by Osnes and Lieblein (2003) specifically with regard to the generalization of language skills. Many of these are included in NLT.

Non-methods. Stokes and Baer (1977) considered "train and hope" and "sequential modification" as non-methods for achieving generalization. However, based on a review of the applied behavior analysis (ABA) literature, Stokes and Baer (1977) reported that the train and hope approach was that most commonly used by interventionists. This may also be the most common approach in speech and language intervention as well (Fey, 1986). In addition, speech-language therapists often engage in sequential modification when the target behavior does not generalize following the initial training (Fey, 1986).

Contact natural contingencies. Arranging for the child's behavior to come into contact with naturally occurring contingencies of reinforcement is one method of promoting generalization (Stokes & Baer, 1977). Teaching behaviors that are relevant or functional to the child in his or her everyday environments (i.e., home or classroom) will help those behaviors come into contact with naturally occurring contingencies of reinforcement (Fey, 1986; Warren & Kaiser, 1980). If the new behaviors are not functional for the child, or if others in the child's environment are unresponsive, then it is likely that the behaviors will not generalize (Baer, 1981; Fey, 1986; Guess, Keogh, & Sailor, 1978). As a part of a stimulus control analysis, the interventionist should identify naturally occurring contingencies of reinforcement in the child's environment (Fey, 1986; Kohler & Greenwood, 1986).

Generalization may fail because persons in the settings in which generalization is desired are unresponsive to the child's new verbal behavior (Baer, 1981). Thus, another useful strategy is to teach children to recruit reinforcement from persons in their natural environment. For example, Stokes, Fowler, and Baer (1978) taught children to prompt teachers for reinforcement on their written work in the classroom.

Provide a range of exemplars. Another approach to facilitating generalization is to have the child perform the target behavior in the presence of a range of stimulus situations. To achieve this, one might select a range of exemplars for training use (Baer, 1981) or one may simply "train loosely" (Stokes & Baer, 1977). This approach may reduce the probability that the target behavior will come under too narrow a range of stimulus control (Kirby & Bickel, 1988). Baer (1981) recommended presenting more than one example of the target behavior, utilizing more than one trainer at a time, training in more than one location, varying one's position, clothing, or time of day and so on. For example, Welch and Pear (1980) obtained increased generalization of verbal behavior for a child by conducting training in more than one room.

Stokes, Baer, and Jackson (1974) and Garcia (1974) both found that the introduction of a second

teacher facilitated the generalization of a greeting response after training by one teacher had not. Kaiser and Hester (1994) provide a good example of stimulus control at work. They found that children generalized new verbal responses to their parents more readily than to their peers after being trained by other adults (e.g., teachers). This may be due to the similarity of the two stimulus classes of parents and teachers. The parents and teachers may have used more mands than the peers (Kaiser & Hester, 1994).

Schroeder and Baer (1972) compared concurrent and serial training procedures in the training of vocal imitation. In serial training, each response was trained to criterion before moving on to the next response. In concurrent training, three words at a time were trained to criterion. The concurrent training approach was much more efficient at producing generalized vocal imitation. The concurrent training approach can be viewed as providing multiple exemplars of the response class of vocal imitation (Stokes & Baer, 1977).

Indiscriminable contingencies. Another way to facilitate generalization is to make the contingencies difficult to discriminate, thereby avoiding excessive stimulus control (Kirby & Bickel, 1988). Delayed and intermittent reinforcement are two methods that might be used to provide indiscriminable contingencies.

Continuous reinforcement, which is common during one-to-one discrete trial training may actually make the extinction of newly learned language skills more likely once the child returns to the natural environment (Spradlin & Siegel, 1982). The use of intermittent schedules of reinforcement may counteract this problem. Koegel and Rincover (1977) compared the effects of continuous reinforcement (CRF) with fixed-ratio (FR) schedules of reinforcement on the generalization of nonverbal imitation in children with autism. Continuous reinforcement led to the quickest extinction of the trained behavior in generalization settings. Although some generalization occurred under a FR2 schedule, a FR5 schedule produced the strongest results with regard to generalization and maintenance.

Fowler and Baer (1981) compared the effectiveness of reinforcement for children's verbal behavior immediately following a session in the training setting with reinforcement after the child had been in several other settings over the course of the school day. The longer delay of reinforcement promoted generalization, whereas the reinforcement immediately following the setting did not.

Halle, Marshall, and Spradlin (1979) used a time-delay procedure to teach children with language-delays to initiate requests for lunch trays. Time-delay involved the staff's withholding of the meal trays for 15 seconds while waiting for a child to appropriately request the tray. For some children, this behavior generalized across meal settings and servers. Halle, Baer, and Spradlin (1981) characterized time-delay as a source of "multiple stimulus control" (Skinner, 1957), which allows for a greater range of environmental stimuli to control language" (p.390).

Program common stimuli. One important aspect of a well-designed language intervention program is to ensure that the controlling stimuli of the target behavior occur in both the training context and in the child's natural environment (Fey, 1986; Kirby & Bickel, 1988; Stokes & Baer, 1977). For example, Welch and Pear (1980) found that verbal behavior trained using real objects (e.g., a cup) was more likely to generalize to nontraining settings than verbal behavior involving pictured objects (e.g., a picture of a cup). The authors also observed success when training involved some pairing of pictures and actual objects as training stimuli.

Hunt, Goetz, Alwell, and Sailor (1986) found an interrupted behavior chain procedure useful in promoting the generalization of requests from one behavior sequence (e.g., getting food from the refrigerator or brushing teeth) to other untrained sequences especially if there was overlap between the discriminative stimuli in both trained and untrained sequences. The authors argued that the interruption

of the behavior chain itself involved controlling stimuli with similarities between the trained and untrained sequences.

Rincover and Koegel (1975) assessed generalization failure of nonverbal imitation in four children with autism by conducting a stimulus control analysis. Various stimuli found in the training context were systematically introduced into the generalization setting in an effort to determine possible stimulus control functions. As a result, the experimenters identified incidental stimuli controlling the newly trained behavior for each child. The experimenters then introduced the incidental stimuli into the generalization environment and found that the desired behaviors were emitted in those contexts as well.

In sum, the processes associated with generalization have been addressed by many researchers, and these processes are extremely important as a consideration in the design of effective language intervention programs. It is argued below that NLT procedures are an effective means of promoting generalization and maintenance following language interventions. It will be shown that this class of interventions incorporates many of the key techniques recommended by Stokes and Baer (1977) to facilitate generalization.

Naturalistic Language Teaching (NLT)

Incidental Teaching

Incidental teaching (Hart & Risley, 1968, 1974) involves the use of naturally occurring situations and the child's interest to facilitate language learning. Hart and Risley (1975) characterized incidental teaching as "the interaction between an adult and a single child, which arises naturally in an unstructured situation such as free-play and which is used by an adult to transmit information or give the child practice in developing a skill" (p. 411). In this approach, the teacher or caregiver takes advantage of naturally occurring teaching situations to provide language-learning opportunities for the child. The situation or activity is "child selected" (Hart & Risley, 1975, p. 412), with the teacher or caregiver following the child's lead or interest. Following the child's lead should serve to increase the reinforcing value of the teaching situation for the child. Indeed, incidental teaching strategies are designed to maximize reinforcement and facilitate generalization (D. Baer, personal communication, May 30, 1996).

Once a teacher or caregiver identifies naturally occurring situations in which a child expresses interest, she or he then uses a series of graduated prompts to encourage the child's responses (Hart & Risley, 1974, 1975). Specifically, Hart and Risley (1974) identified four prompt levels associated with incidental teaching. The level of prompt required is dependent on the child's response. The Level 1 prompt involves instituting a 30-second delay when a child displayed an interest in a specific object or material. At Level 2, the caregiver prompts the child to ask for the desired object. At Level 3, prompts involve a more elaborate request by the caregiver (e.g., the caregiver shows the child the toy and asks "what is this?"). Finally, at Level 4, the caregiver models the correct response and the child is asked to imitate the model. Teachers are taught to use the lowest level of prompt that would encourage the correct response by the child.

In one of the first studies of incidental teaching procedures, Hart and Risley (1968) successfully increased preschool children's use of adjective-noun combinations. Children were taught adjective-noun combinations (e.g., "red truck") in a structured group setting. Although children increased their use of these combinations in the structured settings, the behavior did not generalize to free play settings. To increase the "spontaneous" use of adjective-noun combinations in free play settings, access to desired classroom materials (e.g., paints) was made contingent on the appropriate use of these combinations. Teachers used graduated levels of prompts similar to those described above to shape the children's verbal behavior.

In a follow-up study, incidental teaching procedures were used to shape children's use of compound sentences during free play (Hart & Risley, 1974). Children were progressively required to increase the complexity of their statements. At first, children were required to simply name objects. Later they were required to add a descriptive word, and finally they were required to formulate a compound sentence including the name of the object and a description of how they would use that object. The children participating in the study increased their use of nouns, adjective-noun combinations, and compound sentences.

In another study, Hart and Risley (1975) used incidental teaching procedures to increase preschool children's use of compound sentences directed toward teachers as well as peers in an attempt to facilitate the generalization of language skills. The results showed an increase in compound sentences directed toward both teachers and peers.

Mand-Model

The mand-model procedure (e.g., Rogers-Warren & Warren, 1980; Warren, McQuarter, & Rogers-Warren, 1984) extends the incidental teaching model by using prompt Levels 2, 3, and 4 described by Hart and Risley (1974). When using the mand-model procedure, the teacher or caregiver mands and/or models a response expected from the child. Manding involves requesting a verbal response (e.g., "tell me what you want" or "use words"). If the child responds correctly, the teacher or caregiver praises the child and provides the object of interest. Modeling (sometimes known as child-cued modeling [Alpert & Kaiser, 1992; Kaiser, 1993]) involves observing the focus of a child's interest (e.g., a toy fire truck) and modeling a matching verbal form (e.g., "that's a fire truck"). If the child imitates the verbal form (e.g., "fire truck"), the teacher or caregiver then praises the child and provides the object of interest. If the child produces an incorrect response (e.g., "choo-choo train"), the teacher or caregiver mands the correct response including the model (e.g., "say fire truck").

Rogers-Warren and Warren (1980) were successful in training teacher to use mand-modeling and contingent praise. Child participants displayed an increase in their rates of verbalization in general and in their rates of novel words and novel word combinations. Similarly, Warren, McQuarter, and Rogers-Warren (1984) used the mand-model procedure to promote generalization across settings and maintenance over time by gradually fading the use of this procedure.

One difference between incidental teaching (e.g., Hart & Risley, 1975) and the mand-model procedure is that, as originally-conceived incidental teaching procedure is dependent upon the child's initiations. With the mand-model procedure, the teacher or caregiver more directly controls the number of opportunities for the child to engage in the language interaction (Rogers-Warren & Warren, 1980). This procedure may be useful, then, for children with very low rates of initiation (Rogers-Warren & Warren, 1980; Warren, McQuarter, & Rogers-Warren, 1984).

Time-Delay

Another extension of incidental teaching is the time-delay or delayed prompt procedure (e.g., Halle, Baer, & Spradlin, 1981). Time-delay has been defined as "nonvocal cues for vocal language" (Halle, Baer, & Spradlin, 1981, p. 390). In the time-delay procedure, the teacher or caregiver identifies a situation in which the child wants an object or assistance and then waits for the child to make a response. If the child does not respond appropriately, another delay is usually instituted. If this is unsuccessful, the caregiver or teacher will then use the mand-model procedure. The time-delay procedure is especially useful for teaching children to initiate verbal interaction (Noonan & McCormick, 1993).

Halle, Marshall, and Spradlin (1979) used a time-delay procedure to increase the “opportunity to respond” for two groups of children who were institutionalized. Initially, meal trays were withheld for 15 seconds. Of the first set of three children, only one child requested the meal tray. Even this requesting was done only on a very limited basis. Next, modeling of the correct response was added to the delay resulting in an increase in appropriate responding. A second group of three children, who had observed the contingencies implemented for the first three, then participated in the delay condition. All three children in the second group responded appropriately to the delay contingencies; and some of the behavior of some of the children generalized across meal settings and servers.

Halle and his colleagues (1981) reported two experiments in which they successfully taught preschool teachers to identify opportunities in which time-delay would be effective with their students. Unfortunately, there was only limited generalization of the delay procedures in untrained situations by teachers. In a second phase of the study, it was found that the teachers’ behavior did generalize to untrained situations, but did not continue once observers left the classroom. It is interesting to note that in this study, teachers were required to drop back to a more teacher-directed modeling procedure if the time-delay was ineffective.

Charlop, Schreibman, and Thibodeau (1985) used a time-delay procedure to increase spontaneous speech in seven young boys with autism. Pretests were given to determine if each child could label certain preferred items and training was provided if the child did not have these skills in his repertoire. Next, training was provided in which the teacher modeled the correct response (e.g., “I want a cookie”). The child would receive the item if he correctly imitated the response. Then a brief time-delay was introduced with delays beginning at two seconds. These were then systematically increased to 10 seconds. All of the children, except one, acquired the target behavior. The one child who did not acquire the target behavior repeatedly demonstrated a specific preference and often said “no want.” Although these were not the responses sought by the experimenters, perhaps the child actually generalized the skill more thoroughly than the other children in that he applied manding to items of his own choosing. Ingenmey and Van Houten (1991) also successfully used time-delay procedures to increase spontaneous speech in children with autism.

Ostrosky and Kaiser (1991) described a number of useful strategies for implementing the time-delay procedure in the classroom. These can also be adapted for use in the home. Some of these strategies include placing toys or materials of interest to the child out of reach, giving the child too small an amount of a desired item, or by omitting a necessary item in a multi-step task. Each strategy is designed to encourage functional language use on the part of the child by arranging a situation in which the child must be motivated to make a request. Fey (1986) has characterized these motivating operations as “environmental sabotage.”

Milieu Language Teaching

Incidental teaching, mand-model, and time-delay have been combined with other strategies to encourage child language in natural environments (Alpert & Kaiser, 1992; Hart & Rogers-Warren, 1978). Hart and Rogers-Warren (1978) termed this approach “milieu language teaching.” Kaiser (1993) defined milieu language teaching as “a naturalistic, conversation-based teaching procedure in which the child’s interest in the environment is used as a basis for eliciting elaborated child communicative responses” (p. 77). Hemmeter and Kaiser (1994) proposed enhanced milieu teaching as a more comprehensive approach to naturalistic language intervention. There are three components to this intervention model: (1) environmental arrangement, (2) responsive interaction techniques, and (3) milieu teaching procedures.

Environmental arrangement involves arranging the child’s environment to facilitate language teaching. The goal is to increase the child’s engagement with the environment (Kaiser, 1993) while

setting up situations in which the child is more likely to use language. For example, having toys or other objects of interest available in the child's environment will make it more likely that the caregiver or teacher can use the situation to prompt the child to verbalize a request (see Ostrosky & Kaiser, 1991). Another important part of environmental arrangement is teaching caregivers to provide an "optimal affective environment for the child" (Kaiser, 1993, p. 76) by making sure that the interaction is nurturing and reinforcing from the child's perspective.

Responsive interaction techniques were designed to increase the engagement caregivers in conversational interactions with a child. These techniques include following a child's lead, turn taking, providing descriptive statements, imitating the child's verbalizations, and expanding on statements that the child previously made (Kaiser, 1993).

The milieu teaching procedures include modeling, mand-modeling, and time-delay. Each of these strategies builds upon the previous one, with later procedures incorporating components of earlier ones (Alpert & Kaiser, 1992). Both early childhood teachers (Yoder, Kaiser, & Alpert, 1991) and parents (Alpert & Kaiser, 1992; Kaiser, 1993) have been successfully trained to use milieu language teaching procedures.

Naturalistic Language Teaching vs. Discrete Trial Training

Naturalistic language teaching has been compared to discrete trial training, a trainer-directed approach to language intervention (Fey, 1986; Spradlin & Siegel, 1982; Sundberg & Partington, 1998). Discrete trial training is conducted under highly structured conditions, in which the interventionist selects the stimulus items to be used during training, divides the target language skills into a series of independent tasks, presents these tasks in a series of massed trials until criterion is met, and provides an often arbitrary reinforcer (usually an edible) combined with praise (Sundberg & Partington, 1998, pp. 254-256). In contrast, naturalistic language teaching is considered "looser" (Sundberg & Partington, 1998), with less of an emphasis, at least initially, on the correctness of the child's response. This approach follows the child's lead in terms of the stimulus of interest and provides a "natural reinforcer" (usually the object of interest to the child). The reinforcers delivered in naturalistic language teaching are considered to be more functional in relation to the child's response than in the discrete trial training approach (Sundberg & Partington, 1998).

In the traditional trainer-directed approach (i.e., discrete trial training), language intervention is typically conducted in a room designed for therapy and is highly structured by the interventionist (Fey, 1986; Sundberg & Partington, 1998). NLT techniques such as incidental teaching or milieu language teaching typically work with the child in his or her natural setting (i.e., classroom or home) and usually follow the child's lead or interest, not in terms of language skill goals, but in relation to toys and other objects of interest to the child. This requires the interventionist to respond more flexibly to naturally occurring language-teaching opportunities as they unfold throughout the day. The interventionist must also be able to identify potential reinforcing contingencies that will be functional for the child in other settings (D. Baer, personal communication, May 30, 1996), which should facilitate generalization.

In NLT, the role of the interventionist often changes from providing direct intervention to the child to serving as a consultant or coach to a child's teacher or caregiver, who then implements the procedures (Achilles, Yates, & Freese, 1991; Bunker, McBurnett, & Fenimore, 1987; Cipani, 1989). This change in role can be advantageous in that the teacher or caregiver has far more opportunities throughout the day to engage in milieu language teaching than would a speech-language therapist, for example, in a traditional pull-out program (Fey, 1986). Ideally, the use of these naturalistic language-teaching methods would become "automatic" to the teacher or caregiver and be used naturally throughout the day. Perhaps the most difficult part of this training is teaching caregivers and teachers how to identify naturally

occurring opportunities for language interaction. NLT strategies have been increasingly viewed as the treatment of choice for children at risk or children with disabilities (Noonan & McCormick, 1993; Tannock & Girolametto, 1992; Petersen, 2004).

Common Features of Naturalistic Language Teaching Approaches that Support Generalization

Taken together, there are a number of common features among NLT procedures. As listed in Kaiser, Yoder, and Keetz (1992, p. 9), these include: (a) language teaching that follows the child's lead or interest, (b) the use of multiple, naturally occurring examples, (c) explicit prompts for the child to use language, (d) the use of natural consequences to reinforce the child's verbal behavior, and (e) the use of embedded naturalistic language teaching strategies in the ongoing interactions between caregiver or teacher and child. These features are compatible with the strategies proposed by Stokes and Baer (1977) for promoting the generalization of functional language skills in children (Warren & Kaiser, 1986). Following the child's lead or interest and the use of natural consequences increases the probability that his or her behavior will contact naturally occurring contingencies of reinforcement. The loose structure of this approach makes it more likely that the child will be exposed to multiple exemplars (Laski, Charlop, & Schreibman, 1988), including variations in location, position of trainer, time of day, etc. (see Baer, 1981). This may prevent the behavior from coming under too narrow a range of stimulus control (Kirby & Bickel, 1988). Similarly, the embedded nature of the ongoing teaching interaction may make some of the contingencies less discriminable, perhaps creating "multiple stimulus control" (Skinner, 1957; see also Halle, Baer, & Spradlin, 1981). Furthermore, the fact that training is conducted in natural contexts makes it more likely that stimuli common to a wide range of potential language environments will be present. This is, in effect, a case of "programming common stimuli" (Stokes & Baer, 1977). Finally, it may also be that the language skills targeted in NLT as compared to discrete trial training, are more functional for the child and, therefore, more likely to facilitate generalization (Fey, 1986; Guess, Keogh, & Sailor, 1978; Sundberg & Partington, 1998).

The analyses of generalization by Stokes and Baer (1977) and Kirby and Bickel (1988) lead to a better understanding of how naturalistic language teaching may promote generalization and maintenance following language intervention. This understanding may help researchers develop even more effective intervention procedures.

Review of the Naturalistic Language Teaching Literature

The following is a summary of 57 research articles, all of which met the following criteria for inclusion: (a) published in a peer reviewed journal; (b) described original research; (c) involved the use of NLT procedures, as defined by Kaiser (1993), and (d) involved children or adolescents as participants. A PsychLit search was conducted using the terms incidental teaching, milieu language teaching, naturalistic language teaching, mand, model, mand-model, and time-delay. Studies were not included if any of the above terms were not being used in the context of NLT (e.g., if a child was simply receiving mand training).

Each of the 57 studies was analyzed for generalization and maintenance in relation to the (1) NLT procedures used, (2) participants included, (3) settings and agents, (4) language targets, (5) types of generalization, (6) length of maintenance, and (7) treatment fidelity (see Appendix A). The type of research design was not included as a category because nearly all of the studies (n=52) employed a multiple baseline design. The other four utilized group comparison designs. There was some overlap within categories as some studies may have had different types of participants (e.g., studied both parents' acquisition of milieu teaching skills and children's acquisition of language targets) or looked at several different types of generalization. In general, the 50 studies were allocated among relevant categories and graphed to aid visual inspection. In addition, 13 of the studies focused on training caregivers, teachers,

siblings, and peers to implement NLT procedures and were analyzed separately for generalization and maintenance of the use of the procedures by these agents. For the purposes of this review, generalization was judged not achieved if the target behavior occurred at rates above baseline in the generalization setting(s) for at least some of the participants. Similarly, maintenance was determined if the target behaviors continued at levels above baseline after treatment had been concluded for at least some of the participants. Thus, studies may have been completely successful in terms of all of the participants generalizing and maintaining their target behaviors, or not at all successful in terms of none of the participants generalizing and maintaining their behaviors, or partially successful in which only some of the participants' behavior generalized or in which generalization occurred initially but did not continue.

Naturalistic Procedures Used

Of the studies reviewed, 29 identified incidental teaching as their primary language teaching procedure, 16 used milieu language teaching, 5 used time-delay, 4 used the mand-model procedure, and 2 identified other approaches which could be classified as naturalistic. The other two types of language teaching procedures were termed “pragmatic teaching strategies” (Angelo & Goldstein, 1990) and “natural language paradigm” (Laski, Charlop, & Schreibman, 1988). The pragmatic teaching strategies approach used by Angelo and Goldstein (1990) included the same elements as milieu teaching, especially time-delay, with a communication board. The natural language paradigm approach of Laski, Charlop, and Schreibman (1988) involved a combination of the mand-model procedure and massed practice.

Incidental teaching. Of the 29 studies that used the incidental teaching procedure, 16 measured children's generalization of newly trained language skills. Of those, 13 found that children generalized their use of newly trained language skills (Carr & Kologinsky, 1983; Charlop-Christy & Carpenter, 2000; Fabry, Mayhew, & Hanson, 1984; Gobbi et al., 1986; Hart & Risley, 1975, 1980; McGee, Krantz, Mason, & McClannahan, 1983; McGee, Krantz, & McClannahan, 1985, 1986; Miranda-Linne & Melin, 1992; Oswald, Lignugaris/Kraft, & West, 1990; Seifert & Schwarz, 1991; Warren, 1992).

Several studies compared incidental teaching with either discrete trial training or with no intervention. Hart and Risley (1980) reported that children exposed to incidental teaching generalized their overall language skills, including more elaborate vocabulary and sentences, when compared to children who were not exposed to incidental teaching. Four studies compared the effectiveness of traditional language training procedures and naturalistic language teaching. For example, Miranda-Linne and Melin (1992) found that although children acquired color adjectives faster when taught using discrete trial training, the generalization effects were stronger following incidental teaching.

Similarly, McGee, Krantz, and McClannahan (1985) reported that incidental teaching promoted greater generalization across people and settings than did a traditional trainer-directed approach. The authors believed a greater use of exemplars during incidental teaching sessions would have enhanced the generalization effects, producing an even stronger effect. Seifert and Schwarz (1991) compared incidental teaching with direct instruction techniques and found that incidental teaching promoted greater generalization across targeted concepts to untrained concepts. Carr and Kologinsky (1983) employed discrete trial training procedures and then faded to incidental teaching to teach signing to three children with autism. The results indicated that discrete trial training was best for training the correct form of signs; incidental teaching was more likely to promote generalization and maintenance. Charlop-Christy and Carpenter (2000) compared discrete trial training, incidental teaching and their modified incidental teaching sessions (a combination of discrete trial and incidental teaching). They found that modified incidental teaching were superior to discrete trial or incidental teaching alone.

Some of the studies identified factors that may have facilitated or inhibited generalization effects.

Carr and Kologinsky (1983) speculated that the children's initial generalization across adults and settings in their study may have been facilitated by the use of multiple exemplars in training and by the presence of the same "monitors" in both the training and generalization settings (i.e., programming common stimuli). The authors also reported, however, that generalization of children's correct signing decreased when teachers in the generalization setting did not reinforce these new behaviors.

McGee, Krantz, Mason, and McClannahan (1983) found that two children with autism generalized their newly acquired receptive language skills across settings, from the kitchen to the dining room in a group home. It should be noted, however, that the same trainer and objects were used in the generalization setting as in the training setting. This, no doubt, made generalization much more likely. Similarly, McGee, Almeida, Sulzer-Azaroff, and Feldman (1992) believed that the generalization they did achieve was possibly due to the presence of similar stimuli in both the training and generalization environments. In another study, Gobbi et al. (1986) used multiple trainers to facilitate generalization, which was an example of providing multiple exemplars.

Fabry, Mayhew, and Hanson (1984) found that two of their six participants had problems generalizing sight-word vocabulary. The two students had more severe levels of retardation than the other participants. In addition, Fabry et al. (1984) believed that one of the problems causing the failure to generalize for the two students was that the probe sessions (generalization situations) were very dissimilar to the training situations.

Two studies reported that generalization did not occur following intervention. Hemmeter, Ault, Collins, and Meyer (1996) reported that children's language skills did not generalize across settings and speculated that this was due to a stimulus control problem. According to the authors, this may have been due to a very different generalization environment that minimized opportunities to use language targets. In an effort to promote independence, materials in the generalization environment were directly accessible to students. In addition, staff members in the generalization setting were not trained in naturalistic language teaching procedures. The authors speculated that an environment arranged to foster independence may actually work against an incidental teaching approach in which objects are placed such that students have to ask for them. Cavallaro and Bambara (1983) reported that children's language skills did not generalize following incidental teaching. They speculated that generalization did not occur because too few training sessions were conducted.

Maintenance effects were measured in eleven of the studies using incidental teaching. Eight of these studies reported good maintenance effects (Carr & Kologinsky, 1983; Charlop-Christy & Carpenter, 2000; Gobbi et al., 1986; Kohler, Anthony, Steighner, & Hoyson, 2001; McGee, Almeida, Sulzer-Azaroff, & Feldman, 1992; McGee, Krantz, McClannahan, 1986; Miranda-Linne & Melin, 1992; Mudd & Wolery, 1987). Two studies reported minimal to no maintenance effects (Cavallaro & Poulson, 1985; Hemmeter, Ault, Collins, & Meyer, 1996). Cavallaro and Poulson (1985) reported that children's spontaneous requests returned to low levels at follow up. Hemmeter, Ault, Collins, and Meyer (1996) reported that maintenance did not occur over an unspecified period of months to the end of the school year. The authors speculated that this may have occurred because the intervention was faded too fast and environmental arrangement was not in place.

Milieu language teaching. Ten of the studies using milieu language teaching procedures measured and obtained generalization effects (Hancock & Kaiser, 2002; Hemmeter & Kaiser, 1994; Kaczmarek, Hepting, & Dzubak, 1996; Kaiser, Hancock, & Nietfeld, 2000; Kaiser & Hester, 1994; Warren & Bambara, 1989; Warren & Gazdag, 1990; Warren, Gazdag, Bambara, & Jones, 1994; Warren, Yoder, Gazdag, Kim, & Jones, 1993; Yoder, Warren, Kim, & Gazdag, 1994). As with the incidental teaching studies, several of the milieu language teaching studies identified factors that may have facilitated or inhibited generalization.

Kaiser and Hester (1994) found that children participating in their study showed good generalization of their individual language goals to their parents, but more limited generalization across teachers and peers. The authors speculated that peers used fewer mands than parents and that teachers were often working with at least two other children during generalization probes whereas the interaction between parent and child was usually one-to-one. Kaczmarek, Hepting, and Dzubak (1996) used milieu language teaching to teach listener preparatory behaviors (e.g., selecting a listener, establishing proximity, and obtaining attention) and individual language targets to two children. Both children generalized across settings and persons, although one child with disruptive behavior had some difficulty generalizing the target behaviors. In addition, Kaczmarek, Hepting, and Dzubak (1996) reported that the time-delay component of their study promoted the greatest level of generalization.

While all three children participating in the Warren and Bambara (1989) study generalized their use of the action-object form to nonobligatory situations, only one participant generalized across settings and adults. Interestingly, Warren and Bambara (1989) noted in their study that the one participant who did generalize across settings and adults had more severe developmental disabilities than the other children in the study and received the fewest training sessions. However, the authors noted that her teacher (to whom her verbal behavior generalized) was far better at engaging her conversationally than the teachers of the other participants, possibly facilitating generalization. Warren and Gazdag (1990) reported good generalization effects across settings and adults as well as recombinant generalization for two children participating in their study. Recombinant generalization is “the use of novel word combinations within syntactic or relational semantic forms” (Warren & Gazdag, 1990, p. 73). Warren, Gazdag, Bambara, and Jones (1994) facilitated generalization by having different peers present while target children were receiving milieu language teaching. This strategy could be seen as programming common stimuli (Stokes & Baer, 1977). Similarly, Warren, Yoder, Gazdag, Kim, and Jones (1993) and Yoder, Warren, Kim, and Gazdag (1994) used two different trainers for each child to facilitate generalization. The last two generalization strategies involve the provision of multiple exemplars (Stokes & Baer, 1977).

Only six of the milieu language teaching studies measured maintenance. Kaczmarek, Hepting, and Dzubak (1996) found that the participants in their study maintained their use of language targets over 20 sessions. Kaiser and Hester (1994) reported that four of the six children in their study maintained their use of language targets during follow-up. In two of the studies (Kaiser, Hancock & Nietfeld, 2000; Hancock & Kaiser, 2002) the children maintained their language targets six months after treatment ended. Warren and Bambara (1989) reported that one of the three children in their study displayed some maintenance over a four-week period; while Warren and Gazdag (1990) found that the two children in their study maintained their use of targets at a 10-day post intervention follow-up.

Time-delay. Four of the five studies using the time-delay procedure assessed the generalization of children’s language skills and each reported success (Charlop, Schreibman, & Thibodeau, 1985; Halle, Marshall, & Spradlin, 1979; Ingenmey & VanHouten, 1991; Matson et al., 1993). For example, Charlop, Schreibman, and Thibodeau (1985) found that children’s labels for preferred stimuli taught using the time-delay procedure generalized to unfamiliar settings and persons as well as to untrained stimuli. Ingenmey and VanHouten (1991) employed a time-delay procedure following initial teaching using discrete trial training and found that the spontaneous speech of the child with autism participating in their study generalized across untrained probes. One of the studies, Matson et al. (1993) actually used a variant of the sequential modification strategy, which, according to Stokes and Baer (1978), is a “nonmethod” and does not legitimately result in generalization. The fifth study focused exclusively on measuring teachers’ use of time-delay (Halle, Baer, & Spradlin, 1981).

Two of the time-delay studies assessed maintenance effects. Ingenmey & VanHouten (1991)

found that their participant maintained his use of spontaneous speech at five weeks and four months. Matson et al. (1993) found that two of the boys in their study maintained their use of social phrases through a 10- month follow-up period and a third child maintained his behavior up to two months.

Mand-model. All four of the studies using the mand-model procedure assessed generalization effects, and each reported success (Hancock & Kaiser, 1996; Rogers-Warren & Warren, 1980; Smith & Camarata, 1999; Warren, McQuarter, & Rogers-Warren, 1984). Hancock and Kaiser (1996) found that only one of the three children participating in their study generalized his use of individual language targets. On the other hand, Rogers-Warren and Warren (1980) and Warren, McQuarter, and Rogers-Warren (1984) reported good generalization for all of their participants. Smith and Camarata (1999) found that verbal interactions and increased intelligibility of the children participating in their study generalized across persons.

In addition, maintenance effects were examined by three of the four studies utilizing the mand-model procedure, and, again, all three studies reported positive effects (Hancock & Kaiser, 1996; Rogers-Warren & Warren, 1980; Warren, McQuarter, & Rogers-Warren, 1984). Hancock and Kaiser (1996) collected data at one, two and three months after treatment and found that children's use of individual targets returned to baseline level for all three participants. Rogers-Warren and Warren (1980) collected follow-up data on two of the three children in their study at five, six, and seven months post-treatment and found that their rates of verbal behavior remained high. Finally, Warren, McQuarter, and Rogers-Warren (1984) found that all three of the target children maintained their verbal behavior after teacher mands and models were faded.

Other Approaches. Generalization was measured in the two other approaches as well. Angelo and Goldstein's (1990) "pragmatic teaching strategies" and Laski, Charlop, and Schreibman's (1988) "natural language paradigm" both achieved good generalization effects. In addition, Angelo and Goldstein (1990) found that children's newly learned language skills maintained through a 2-week follow-up.

Summary. Overall, naturalistic language teaching strategies, including incidental teaching, mand-model, time-delay, and milieu language teaching appeared to promote generalization. In a comparison of the studies listed in Appendix A, 94% of the studies measuring for generalization effects demonstrated generalization. In addition, 86% of the studies measuring for maintenance effects reported maintenance. Some limitations were revealed in the literature, however. Problems with generalization were noted if the child's newly learned language skills were not reinforced in the generalization environments (e.g., Carr & Kologinsky, 1983; Warren & Bambara, 1989). In addition, generalization failed to occur if the generalization settings were too dissimilar to the training settings (e.g., Hemmeter, Ault, Collins, & Meyer, 1996; McGee, Almeida, Sulzer-Azaroff, & Feldman, 1992). These are both stimulus control problems (see Kirby & Bickel, 1988). In contrast, some of the studies that reported successful generalization had very similar training and generalization settings (e.g., Carr & Kologinsky, 1983). Limited generalization was also noted when too few sessions were conducted (e.g., Cavallaro & Bambara, 1982). This may have resulted from an insufficient number of exemplars presented during the child's training. The strategies employed that seemed to have promoted generalization in the naturalistic language teaching studies described above include the programming of common stimuli (e.g., McGee, Krantz, Mason, & McClannahan, 1983; Warren, Gazdag, Bambara, & Jones, 1994), the use of multiple exemplars during training (e.g., Carr & Kologinsky, 1983; Warren, Yoder, Gazdag, Kim, & Jones, 1993).

Participants

The review indicated that these studies included a number of participants. In rank order by the number of studies participants were most likely to be (1) children with mental retardation, (2) children

with autism, (3) children from low-income families (e.g., children in Head Start), (4) children with language delays, (5) children with developmental delays, and (6) children learning a second language. In looking at participants, some interesting patterns emerge. For example, children with autism were more often in studies that measured and found generalization and maintenance. Low-income children were in studies much less likely to measure generalization, but those that did so found it. The same seemed to be the case with maintenance for these children. Studies involving children who were learning a second language did not measure for generalization or maintenance effects.

Generalization effects were found for children from low-income families (e.g., Hart & Risley, 1975, 1980), children with mental retardation (e.g., Gobbi et al., 1986; Warren, 1992), children with developmental delays (e.g., Angelo & Goldstein, 1990; Oswald, Lignugaris/Kraft, & West, 1990), children with language delays (e.g., Rogers-Warren & Warren, 1980; Warren, McQuarter, & Rogers-Warren, 1984), and children with autism (e.g., Charlop, Schreibman, & Thibodeau, 1985; Laski, Charlop, & Schreibman, 1988). However, some studies reported limited or no generalization. One study found that children with more severe retardation were less likely to generalize (Fabry, Mayhew, & Hanson, 1984), while another reported good generalization effects for children with severe mental retardation (Gobbi et al., 1986). Two other studies reported problems in achieving generalization for children with mild to moderate mental retardation (e.g., Hemmeter, Ault, Collins, & Meyer, 1996; Warren & Bambara, 1989), so it is not clear if the level of retardation is a factor affecting generalization. Maintenance effects were found for children from low-income families, children with mental retardation, children with developmental disabilities, children with language delays, and children with autism. Maintenance effects ranged from good to poor, however.

Settings/Agents

Of the 57 studies reviewed, 28 were conducted in preschool settings, 12 in classrooms, 7 in clinical settings, 4 in residential facilities, and 3 in the home. Although generalization and maintenance were not measured in all of the studies conducted in clinical, residential facility, or home settings, when they were measured, generalization and maintenance were found.

Successful generalization was reported for a range of settings, including preschools (e.g., Hart & Risley, 1975, 1980; Warren & Gazdag, 1990; Warren, McQuarter, & Rogers-warren, 1984), classrooms (e.g., Angelo & Goldstein, 1990; Charlop, Schreibman, & Thibodeau, 1985), residential facilities (e.g., Halle, Marshall, & Spradlin, 1979; McGee, Krantz, Mason, & McClannahan, 1983), clinics (e.g., Laski, Charlop, & Schreibman, 1988; Matson et al., 1993), and family homes (e.g., Ingenmey & VanHouten, 1991). Similar effects for maintenance were reported as well (e.g., Ingenmey & VanHouten, 1991; Miranda-Linne & Melin, 1992; Schepis et al., 1982; Warren, McQuarter, & Rogers-Warren, 1983).

When generalization is considered in relation to intervention agent, it is clear that multiple interventionists can facilitate the process. Of the studies reviewed, 25 involved teachers as intervention agents, 15 involved therapists or trainers, 2 involved staff members, 5 involved parents, 1 involved siblings, and 1 involved peer tutors. Although not always achieved, generalization effects were found when teachers (e.g., Halle, Baer, & Spradlin, 1981; Warren, McQuarter, & Rogers-Warren, 1984), therapists and trainers (e.g., Charlop, Schreibman, & Thibodeau, 1985; Warren, 1992), staff (e.g., Halle, Marshall, & Spradlin, 1979), and parents (e.g., Hemmeter & Kaiser, 1994; Laski, Charlop, & Schreibman, 1988) were the intervention agents. When generalization effects were achieved those effects were generally strong. In addition, although generalization is indicated in all studies utilizing siblings (Hancock & Kaiser, 1996) and peer tutors (McGee, Almeida, Sulzer-Azaroff, & Feldman, 1992) to implement naturalistic language teaching procedures, the effects were not always as strong. For example, in Hancock and Kaiser's (1996) study using siblings as intervention agents, generalization occurred for only one of three target children. Similarly, in McGee, Almeida, Sulzer-Azaroff, and Feldman (1992)

generalization occurred for only one of the three target children in that study. These difficulties may have been due to the age of the persons implementing the procedures.

In general, teachers (e.g., Halle, Baer, & Spradlin, 1981; Kasier Ostrosky, & Alpert, 1993), staff (i.e., therapists, trainers) (e.g., Hester, Kaiser, Alpert, & Whiteman, 1995; MacDuff, Krantz, MacDuff, & McClannahan, 1988), and parents (e.g., Alpert & Kaiser, 1992; Hester, Kaiser, Alpert, & Whiteman, 1995) generalized their use of NLT procedures. However, some studies reported difficulty achieving generalization, particularly those employing younger intervention agents such as siblings and peers (e.g., Hancock & Kaiser, 1996; McGee, Almeida, Sulzer-Azaroff, & Feldman, 1992).

Parents, trainers and siblings also generalized their use of NLT procedures across settings and activities (e.g., Alpert & Kaiser, 1992; Hancock & Kaiser, 1996; Hester, Kaiser, Alpert, & Whiteman, 1996). For example, Alpert and Kaiser (1992) found that mothers generalized their use of milieu language teaching techniques to other situations in the home. Similarly, Hester, Kaiser, Alpert, & Whiteman (1996) found that parent trainers generalized their teaching of milieu language teaching across families and parents generalized their use of the milieu language teaching procedures across settings from the clinic to the home.

Language Targets

A number of different types of language targets were studied in the NLT literature as well. Of the 57 studies reviewed, 15 examined single word production (i.e., color nouns), 15 examined combinations (i.e., adjective-noun), 14 studied initiations or requests, 4 studied signing, 4 addressed other targets (e.g., global measures of language, reciprocal interaction), 2 examined only receptive language, 1 studied complexity, and 1 addressed reading. Some studies included more than one type of language target.

Generalization effects were demonstrated for a range of language targets, including single words (e.g., Charlop, Schreibman, & Thibodeau, 1985; Warren & Gazdag, 1990), combinations (e.g., Cavallaro & Bambara, 1982; Warren & Bambara, 1989), sentence complexity (e.g., Hart & Risley, 1980), initiations and requests (e.g., Angelo & Goldstein, 1990; Warren, McQuarter, & Rogers-Warren, 1984; Warren, Yoder, Gazdag, Kim, & Jones, 1993), signing (e.g., Carr & Kologinsky, 1983; Kaczmarek, Hepting, & Dzubak, 1996), reading (e.g., Fabry, Mayhew, & Hanson, 1984) and receptive language (e.g., McGee, Krantz, Mason, & McClannahan, 1983; McGee, Krantz, & McClannahan, 1986). In some cases, generalization effects were found at first, only to dissipate later. For example, Carr and Kologinsky (1983) found that children's new signing skills initially generalized across persons and settings, but then decreased when adults in the generalization environment did not reinforce the new behaviors. Maintenance effects were less clear, as fewer studies measured for maintenance effects.

Types of Generalization

Of the 57 studies reviewed, 28 assessed generalization across settings or activities, 21 across persons, and 12 across language skills. Most of the studies that measured the three different types of generalization found generalization effects. Of the 28 studies that assessed generalization, 24 reported generalization effects across settings (e.g., Angelo & Goldstein, 1990; Carr & Kologinsky, 1983; Charlop, Schreibman, & Thibodeau, 1985; Rogers-Warren & Warren, 1980; Warren, 1992; Warren & Gazdag, 1990). Of the 21 studies that measured the generalization of children's language skills across persons, 17 reported good generalization across teachers and trainers (e.g., Carr & Kologinsky, 1985; Charlop, Schreibman, Thibodeau, 1985; Warren, 1992), parents (e.g., Miranda-Linne & Melin, 1992), and other children (e.g., Hart Risley, 1975). Further, 10 of 12 studies found that children generalized across language skills, including generalization to untrained stimuli (e.g., Charlop, Schreibman, & Thibodeau, 1985; Hart & Risley, 1975, 1980; Ingenmey & VanHouten, 1991), as well as recombinant generalization

(e.g., Warren & Bambara, 1989; Warren & Gazdag, 1990; Warren, Gazdag, Bambara, & Jones, 1994).

Generalization effects were demonstrated across settings and activities, persons, and language skills. However, some problems with generalization were reported. For example, Kaiser and Hester (1994) reported mixed generalization results for the children participating in their study. They found only some generalization across teachers and peers for these children, but good generalization to parents. Similarly, Warren and Gazdag (1990) found good generalization across teachers for the two children participating in their study, but reported that generalization was poor across peers. Problems occurred when the newly trained behaviors were not reinforced in the generalization setting (e.g., Carr & Kologinsky, 1983), when there were not enough training sessions (e.g., Cavallaro & Bambara, 1982), or when the environment was not arranged to facilitate the use of the new language skills (e.g., Hemmeter, Ault, Collins, & Meyer, 1996), a stimulus control problem. Sometimes language skills generalized across one type of person (e.g., teachers) and not others (e.g., peers).

Length of Maintenance

The periods of data collection after training procedures were implemented ranged from less than one month to 12 months. These periods are presented below as studies conducting follow up at less than one month, from one to three months, from four to six months, and from six to twelve months.

Less than 1 month. Five studies reported maintenance effects for less than one month (Angelo & Goldstein, 1990; Carr & Kologinsky, 1983; Charlop-Christy & Carpenter, 2000; McGee, Krantz, & McClannahan, 1986; Warren & Gazdag, 1990). For example, Warren and Gazdag (1990) found that children maintained their use of single words and multi-word combinations at a 10-day follow-up after treatment was completed.

1 to 3 months. Five studies measured maintenance effects during one to three months following the end of treatment (Cavallaro & Poulson, 1985; Gobbi et al., 1986; Kaczmarek, Hepting, & Dzubak, 1996; Kaiser & Hester, 1994; Kaiser, Ostrosky, & Alpert, 1993). Four of these studies found successful maintenance of children's language skills (Gobbi et al., 1986; Kaczmarek, Hepting, & Dzubak, 1996; Kaiser & Hester, 1994; Kaiser, Ostrosky, & Alpert, 1993). Cavallaro and Poulson (1985) reported that children's spontaneous requests returned to low levels during maintenance.

4 to 6 months. Four studies looked at maintenance between four and six months. Ingenmey and VanHouten (1991) found that a 10-year-old male with autism exposed to a time-delay procedure maintained spontaneous speech at five weeks and four months. Schepis et al. (1982) found that children maintained their signing vocabulary at 5 and 17 weeks post intervention. Hancock and Kaiser (2002) and Kaiser, Hancock, and Nietfeld (2000) found that most of the children in their studies maintained their use of individual targets through a 6-month follow-up.

7 to 12 months. Matson et al. (1993) found that two of the three boys with autism participating in their study maintained their use of social phrases up to 10 months following the end of intervention. The third boy maintained these skills up to two months.

Summary. Studies of naturalistic language teaching examined maintenance as long as a year following training, with the majority of studies determining whether maintenance occurred one to three months post-training. No studies reported maintenance data over one year. Thus, it is difficult to ascertain the long-range effects of naturalistic language teaching. In addition, it would be interesting to know whether generalization effects last or maintain over time.

Treatment Fidelity

Treatment fidelity measures the accuracy of implementation of the procedures being studied. Poor or inconsistent treatment outcomes may be due to differences in the quality of treatment between studies or to differences in intervention received by children within the same study (Carta & Greenwood, 1989). In the present review, 16 studies measured the quality of the independent variable. Of these, 13 reported children's generalization of language skills (Charlop-Christy & Carpenter, 2000; Hancock & Kaiser, 2002; Hemmeter & Kaiser, 1994; Kaczmarek, Hepting, & Dzubak, 1996; Kaiser, Hancock, & Nietfeld, 2000; Kasier & Hester, 1994; MacDuff, Krantz, MacDuff, & McClannahan, 1998; McGee, Krantz, & McClannahan, 1986; Smith & Camarata, 1999; Warren, Gazdag, Bambara, & Jones, 1994; Warren, McQuarter, & Rogers-Warren, 1984; Warren, Yoder, Gazdag, Kim, & Jones, 1993; Yoder, Warren, Kim, & Gazdag, 1994). Four studies measured the occurrence of the independent variable, but not the quality of implementation. Of these, three found generalization (Hancock & Kaiser, 1996; Rogers-Warren & Warren, 1980; Warren, 1992). One might hypothesize that ensuring the fidelity of the independent variable would ensure the quality of the intervention, and hence generalization. In addition, the measurement of treatment fidelity may help identify the key components of intervention approaches that may facilitate generalization and maintenance. Unfortunately, the effects of treatment fidelity on generalization and maintenance are not clear in the present review.

Conclusions

Fifty-seven studies of naturalistic language teaching procedures were reviewed for generalization and maintenance effects in an attempt to (1) determine if naturalistic language teaching procedures are effective at promoting generalization and maintenance and to (2) identify the features of naturalistic language teaching that seem to support generalization and maintenance. From the review of the literature it can be concluded that naturalistic language teaching procedures facilitate the generalization and maintenance of children's language skills following intervention. This conclusion is consistent with those of other authors who have reviewed this literature (Hepting & Goldstein, 1996; Kaiser, Hendrickson, & Alpert, 1991; Kaiser, Yoder, & Keetz, 1992; Warren & Kaiser, 1986). For example, in their review of the incidental teaching literature, Warren and Kaiser (1986) found that this approach was effective in increasing specific language targets and in facilitating generalization. The authors stated that further research was needed to ascertain the more general effects of incidental teaching (i.e., increases in general vocabulary, complexity of language) and that the interaction between child characteristics (i.e., IQ) and incidental teaching be studied. They also recommended that further research was needed to determine the best methods for training teachers and parents to implement incidental teaching. Similarly, Kaiser, Yoder, and Keetz (1992) stated that milieu language teaching was an effective means of increasing children's use of specific language targets. However, they argued that the milieu language teaching research on generalization effects was methodologically weak. For example, Kaiser et al. (1992) argued that across-setting and across-persons generalization data are weak because the settings and persons in the training and generalization contexts are too similar. They also advocated that future research study the effects of different levels of intervention duration and intensity. The present review has systematically examined generalization and maintenance effects in naturalistic language teaching studies up through the most current research. Furthermore, the present review has attempted to tie naturalistic language teaching, both conceptually and empirically, to the procedures recommended by Stokes and Baer (1977) for promoting generalization in an effort to identify those factors facilitating generalization.

Are Naturalistic Language Teaching Procedures Effective at Promoting Generalization and Maintenance?

Overall, naturalistic language teaching strategies, including incidental teaching, mand-model, time-delay, and milieu language teaching appear to be effective means of promoting generalization and

maintenance. Nearly all of the studies (94%) that assessed generalization effects demonstrated generalization. In addition, a high percentage (86%) of studies that measured maintenance found maintenance effects. Studies comparing naturalistic strategies to trainer-directed procedures (e.g., discrete trial training) found that children who were exposed to naturalistic language teaching were more likely to generalize their use of language. Generalization effects were found for a variety of participants, including children from low-income families (e.g., Head Start), children with mental retardation, children with developmental disabilities, children with language delays, and children with autism. Successful generalization and maintenance of children's language skills was reported across a range of settings, including preschools, classrooms, residential facilities, clinics, and homes and across a range of intervention agents, including teachers, therapists and trainers, staff, and parents. Generalization effects were demonstrated for a range of language targets, including single words, combinations, complexity of sentences, initiations and requests, signing, reading, and receptive language. Naturalistic language teaching was found to be effective in promoting a number of different types of generalization, including generalization across settings and activities, across persons, and across language skills.

Despite the many positive findings revealed by this review, limitations were also noted. For example, although generalization and maintenance effects were abundant, a number of studies identified problems achieving those effects. Some were related to poor stimulus control. If the new language behavior was not reinforced in the generalization setting, then generalization was less likely to occur. Similarly, if the generalization environment was too dissimilar from the training environment generalization was not as likely to occur. Many of the studies reporting successful generalization had very similar training and generalization settings. However, Kaiser, Yoder, and Keetz (1992) have criticized this as a weak measure of generalization effects. Other research reported difficulties with generalization and maintenance when too few training sessions occurred. In this case, generalization may have failed because the child was provided with too few exemplars of the new behavior. Despite the advantages of naturalistic language teaching, it is clear that generalization must still be planned for.

The child's level of intellectual functioning may play a role as well (Kaiser, Yoder, & Keetz, 1992). The present review found that the children in some studies with more severe retardation had greater difficulty generalizing their language skills. These findings, however, were somewhat equivocal in that other studies reported successful generalization by children with severe retardation and others still reported that children with mild to moderate retardation had difficulties generalizing. So, the effects of intellectual functioning on generalization are not clear. In addition, studies examining the effects of training various agents as implementers of naturalistic language teaching reported some difficulties with younger agents, such as peers and siblings, in implementing the procedures.

Another limitation identified by this review is that none of the studies included long term follow-up. None of the studies examined maintenance effects beyond a one year period. Most assessed maintenance from one to three months. It would be interesting to know if generalization effects maintain over time.

What Are The Features of Naturalistic Language Teaching That Seem To Facilitate Generalization and Maintenance?

Conceptually, NLT strategies seem well suited for promoting generalization and maintenance (Peterson, 2004), because this class of interventions incorporates many of the key generalization techniques recommended by Stokes and Baer (1974). As noted above, NLT strategies include following the child's lead; using multiple, naturally occurring examples; using natural consequences; and embedding language instruction in the ongoing interactions that occur between teacher or caregiver and child throughout the day. Following the child's lead or interest and the use of natural consequences increases the probability that his or her behavior will contact naturally occurring contingencies of

reinforcement. The loose structure of this approach makes it more likely that the child will be exposed to multiple exemplars (Laski, Charlop, & Schreibman, 1988). Several studies planned for generalization by utilizing multiple trainers (e.g., Warren, Yoder, Gazdag, Kim, & Jones, 1993). Similarly, the embedded nature of the ongoing teaching interaction may make some of the contingencies more indiscriminable, perhaps creating a situation of “multiple stimulus control” (Skinner, 1957). The fact that training is conducted in natural contexts makes it more likely that stimuli common to a wide range of potential language environments will be present. This is, in effect, a case of “programming common stimuli” (Stokes & Baer, 1977). Another method of programming common stimuli is to have different peers present during training (e.g., Warren, Gazdag, Bambara, & Jones, 1994). Finally, it may also be that the language skills taught in the naturalistic language teaching approach, as compared to more traditional speech and language therapy (i.e., discrete trial training), are more functional for the child and, therefore, more likely to generalize to other language environments.

Skinner’s (1957) discussion of verbal behavior may also shed some light on the generalization process. NLT often takes advantage of mand situations in which an establishing operation is functioning (Sundberg & Partington, 1998). Much of traditional language intervention utilized tact training with somewhat irrelevant consequences for the child. Mand training, particularly in naturalistic language teaching, employs the use of consequences that are functional for the child across a range of environments (Sundberg & Partington, 1998). In addition, Skinner (1957) discussed the influence of multiple-control in language. NLT actively attempts to establish situations involving multiple-control through its emphasis on multiple exemplars. Finally, Skinner’s (1957) concept of automatic reinforcement may encourage generalization because it may bring strong contingencies into the generalization settings.

Future Directions

This review has shown that NLT is an effective approach for promoting generalization and maintenance based on both empirical and conceptual considerations. However, a number of questions have surfaced requiring further research. First, a systematic program of research might look more closely at the factors that promote generalization and maintenance. For example, a systematic comparison of training carried out with varying numbers of sessions, the level or type of the child’s language impairment, number of trainers or variety of stimulus examples (i.e., multiple exemplars), different types of procedures, and the quality of implementation (i.e., treatment fidelity) would be useful in the design of future intervention strategies. Also, it would be useful to determine how similar the training and generalization environments must be to facilitate generalization. Second, there is a need to develop techniques for training teachers and caregivers how to analyze training and generalization environments, how to identify naturalistic language teaching opportunities (i.e., following the child’s lead), and how to plan for generalization. Finally, it would be useful to know if naturalistic language teaching has long-term benefits for children at risk for language delays. Answering these questions should further strengthen the effectiveness of naturalistic language teaching as a means of facilitating the generalization and maintenance of children’s language use.

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Author Contact Information

Pete Peterson
Psychology
Johnson County Community College
Overland Park, Kansas
Phone: 913-469-8500, Extension 2461
e-mail: ppetersn@jccc.edu

APPENDIX, NEXT PAGE!

Appendix A. Naturalistic Language Studies Reviewed

Reference	Procedure	Participants	Setting/ Agent	Language Target	Treatment Fidelity	Generalization	Maintenance
Alpert & Kaiser, 1992	Milieu language teaching	6 mothers of language delayed preschool children	Clinic & home	# of techniques used & % of correct use	yes, recorded moms use of MLT skills as correct or incorrect	generalized to other situations in home (tv on, mother doing household chores)	1x a month for 3 months; very good for 2 moms, okay for 4
Angelo & Goldstein, 1990	pragmatic teaching strategies: MLT (esp. time-delay) on communication board	4 non-speaking children with developmental delays ages 5-6 years	therapy room near classroom/ trainer	who, what, where initiated requests	not measured	across settings to classroom	maintained at 2-week follow up
Car & Kologinsky, 1983	DTT faded to a more child-initiated approach (incidental teaching)-2 experiments	6 children with developmental disabilities, 3 in each experiment	school/ trainers	correct sign; found DTT best for teaching forms, IT for maintenance	not measured	yes, across adults and settings. Maybe due to multiple exemplars & same "monitors" Gen. decreased when new adults did not reinforce	maintained for 4 sessions (about 1 week)
Cavallaro & Bambara, 1982	incidental teaching vs. "question-label" procedure (really mand-model?)	1 preschool child with severe language delays	preschool free play sessions/ teachers	2 word requests (e.g. want+ noun, need+ noun, noun + please). IT more effective	measured teacher use of procedures, but not quality	did not generalize across language skills (not enough sessions?)	not measured
Cavallaro & Poulson, 1985	incidental teaching	4 language-delayed children with moderate to severe mental retardation, ages 3 to 6	classroom (free play or lunch)/ teachers	spontaneous requests	only measured frequency of use, with reliability checks for observers, no rating of quality	not measured	children's vb returned to low levels at follow-up

IT = Incidental Teaching
 MLT = Milieu Language Teaching
 DTT = Discrete Trial Training
 VB = Verbal Behavior

Appendix A, continued

Reference	Procedure	Participants	Setting/ Agent	Language Target	Treatment Fidelity	Generalization	Maintenance
Charlop-Christy & Carpenter, 2000	modified incidental teaching (compared IT, DTT and "MITS")	3 children with autism ages 6-9	home/parents	imitation and spontaneous speech	parents' monitored for procedural reliability via tape recording, 10% or fewer errors by parents	probes across settings and persons; generalization better after MITS as compared to IT and DTT	3 week follow up showed spontaneous speech for all 3 children following MITS but not for IT or DTT
Charlop, Schreibman, & Thibodeau, 1985	time-delay	7 children with autism, ages 5-11	school/therapists	labels for preferred stimuli	not measured	found behaviors generalized to unfamiliar setting, unfamiliar setting & person, to untrained stimuli	not measured
Dolley & Wheldall, 1988	incidental teaching (contingent access to materials)	Children from English-speaking & Punjabi-speaking homes, ages 3-5 years	preschool/teachers	imitations	not measured	not measured	not measured
Dolley & Wheldall, 1991	incidental teaching (contingent access to materials)	8 Punjabi-speaking children acquiring English	preschool/teacher & nurse	imitations & # of words	not measured	not measured	not measured

IT = Incidental Teaching
 MLT = Milieu Language Teaching
 DTT = Discrete Trial Training
 VB = Verbal Behavior

Appendix A, continued

Reference	Procedure	Participants	Setting/ Agent	Language Target	Treatment Fidelity	Generalization	Maintenance
Fabry, Mayhew, & Hanson, 1984	token system+ incidental teaching	6 sped students in residential facility, ages 12-22 years	classroom/ teachers	read sight words on tokens	not measured	4 out of 6 generalized to untrained words; children with the most severe retardation had the most difficulty	not measured
Farmer- Dougan, 1998	incidental teaching (contingent access to materials)	4 Head Start children, ages 4 years	preschool/ trainer	on task vs. off task vb, naming letters, very interesting, found moderate interruptions best	not measured	not measured	not measured
Fox & Hantine, 1993	incidental teaching	4 year old child w/it mild develop- mental delays	preschool/ teacher	label color red, 3 conversational turns, and complete 2-step task	not measured	across settings and persons; good generalization	yes measured over six sessions (days or weeks not specified). Good maintenance.
Gobbi, Cipani, Hudson, & Lapenta- Neudeck, 1986	incidental teaching & quick transfer method (mand & time-delay)	2 children with severe mental retardation, ages 5 & 7	classroom (at snack)/ multiple trainers (to facilitate general- ization)	spontaneous requesting	not measured	100% across time (to lunch) & trainers	continued requests at 1 month follow up
Halle, Baer, & Spradlin, 1981	time-delay	2 teachers in 2 experi- ments	sped preschool/ teachers	use of time-delay use by teachers	sort of measured teachers' use of time-delay, reliability	measured general- ization to other delay opportunities	5 month follow up=teachers' use of delay dropped off during covert observations, returned to high levels during in- class obs.

IT = Incidental Teaching
 MLT = Milieu Language Teaching
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Appendix A, continued

Reference	Procedure	Participants	Setting/ Agent	Language Target	Treatment Fidelity	Generalization	Maintenance
Halle, Marshall, & Spradlin, 1979	time-delay (and modeling)	6 children with mental retardation, ages 11-15	residential facility (dining area)/ staff	meal requests	not measured	yes, across meal time, people serving meals, & mealtime & people	not measured
Hancock & Kaiser, 1996	mand-model	3 children with language delays, ages 4-6, & 3 siblings, ages 8-12	home/ siblings	individual targets (e.g., prepositions, color & size adjectives) & total vb	measured frequency of teaching episodes & % of consequence, but not quality	across rooms in home (snack time): 2 of 3 sibs generalized; only 1 target child generalized	observations at 1, 2, & 3 months: all 3 target children returned to about baseline
Hancock & Kaiser, 2002	Enhanced Milieu Teaching	4 children with autism	clinic/trainers	agent-action action-object attribute-object 2-3 word request	measured talk at child's target level, expansions, balance of turns, responsive feedback, pause errors, not following child's lead	3 of 4 children generalized across settings to home	measured to 6 months following treatment; better early on in maintenance
Haring, Neetz, Lovinger, & Peck, 1987	incidental teaching (contingent access to material)	3 SH teachers; 21 SH students with moderate to profound retardation	SH classrooms/ teachers	prompted & spontaneous requests; teacher incidental teaching behaviors	measured accuracy of teacher implementation	not measured	not measured

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Hart & Risley, 1968	incidental teaching	15 low income children, ages 4-5	preschool/ teachers	color nouns	not measured	across contingencies: contingencies for color noun response removed: children continued to use color nouns	not measured
Hart & Risley, 1974	incidental teaching	12 low income children, ages 4	preschool/ teachers	nouns, adjective-noun, compound sentences	not measured	not measured	not measured
Hart & Risley, 1975	incidental teaching	11 low income children, ages 4 & 5	preschool/ teachers	compound sentences directed to teachers & peers	not measured	yes, some generalization to other children & spontaneous variety of compound sentences	not measured
Hart & Risley, 1980	incidental teaching; compared data from Hart & Risley, 1975 to other children	11 children from hart & Risley, 1975 compared to 8 Head Start & 12 University preschool children	preschool/ teachers	compared untrained language skills: more words, different words, complexity of sentences	not measured, including nonuse of incidental teaching not measured	yes, across language skills, esp. overall language, more elaborate vocabulary & sentences	not measured

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Hemmeter, Ault, Collins, & Meyer, 1996	incidental teaching	4 children with mild to moderate mental retardation, ages 5 - 8	classroom/ teacher	prompted & spontaneous adjective + noun combinations	procedural reliability- 98%	across activities: free play to work time, did not generalize (a stimulus control problem?)-gen. setting arranged to encourage independence	minimal or no maintenance over an unspecified period of months to end of schc year-intervention fade too fast; environment arrangement not in pl;
Hemmeter & Kaiser, 1990	environmental arrangement	a father & 3 year old child with mental retardation	home/ parent	dad: attempts to teach & responsiveness, mlt; child: engagement & spontaneous language	yes, measured dad's correct teaching attempts	did not exhibit environmental arrangement during tx withdrawal	not measured
Hemmeter & Kaiser, 1994	Enhanced milieu teaching	4 parent-child dyads; children ages 2-4 years	clinic/trainer to parents	Parent= environmental arrangement; responsive interaction, milieu language teaching; child= social communication skills (i.e., spontaneous utterances, receptive & expressive comm.	yes, measured % correct use of skills by parent	parents= generalized across settings to home; child= language targets across settings to home; plus across persons (to grad students)	not measured

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Hester, Kaiser, Alpert, & White- man, 1995	milieu language teaching	3 trainers & 6 mothers	clinic/ trainers + parents + children	trainers: parent training of MLT skills; parents: MLT skills; children: agent + action, action + object, etc.	measured trainer behavior; parent correct use of MLT	trainers generalized across families,; parents generalized across settings (clinic to home)	not measured
Ingenmey & Van- Houten, 1991	time-delay (following DTT)	10 year old male with autism	home/ therapist	spontaneous speech (not prompted or imitated)	not measured	generalized to untrained probes & across behaviors (untrained probes)	maintained spontaneous speech at 5 weeks & 4 months
Kacz- marek, Hepting, & Dzubak, 1996	milieu language teaching	2 children with low rates of verbal behaviors, age 3	school/ teachers	individual targets: action signs; verbal action + object, attribute + noun	found excellent "procedural fidelity"	showed some generalization across settings, teachers in training setting & nontraining teachers in nontraining settings	measured maintenance of generalization up to 20 sessions
Kaiser, Hancock, & Niefeld, 2000	enhanced milieu teaching	6 children with autism; 2.5-6 yrs.	Clinic/ parents	individual targets: agent-action, 2-3 word requests, attribute-object, single nouns, single action verbs, agent- action-object	yes for MLT procedures, expansions, balance of turns, not following lead, pause errors, talk at child's level	across settings from clinic to home. Good generalization for both parents' use and child vb.	measured maintenance once a month for 6 months; maintenance better later in followup

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Kaiser & Hester, 1994	enhanced milieu language teaching	6 children, mostly language delayed, some CP, Downs, 3-6 year olds	early intervention preschool/teachers	individual language goals (e.g., agent + action)	yes, measured frequency and correct use of techniques	across conversational partners: teachers= some, but variable; peers= some, but variable; parents= good increase	Use of language targets remained above baseline through 5 session follow-up
Kaiser, Ostrosky, & Alpert, 1993	milieu language teaching	3 preschool teachers; 3 target children; 3 children identified as generalization children	preschool/teachers	teachers: MLT skills used correctly; children: use of targets & total vb, sign or communication board	measured correct use of MLT	teachers across children & settings	measured 1x month for 3 months; good maintenance for teachers & children
Kohler, Anthony, Steighner, & Hoyson, 2001	incidental teaching	4 children with autism/PDD	preschool/teachers	social interaction with teachers and peers	measured teachers use of prompts, other interaction, or passive behavior	not measured	measured 2x weekly for 4-5 weeks; social interaction maintained at rates much higher than baseline.

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Kok, Kong, & Bernard- Opitz, 2002	incidental teaching ; compared structured play with facilitated play (incidental teaching)	8 children with autism	preschool/ teachers	play and communication	measured directive instructions & mass practice vs. incidental teaching techniques and multiple exemplars	not measured	not measured
Laski, Charlop, & Schreib- man, 1988	natural language paradigm (mand-model & massed practice)	8 children with autism, ages 5-9 years	clinic/ parents	child vocal- izations; parent verbalizations (increased)	not measured	measured across settings= playroom in clinic, break room & home. Parents & children showed increase in freeplay & breakroom, data barely reported for home	not measured
MacDuff, Krantz, MacDuff, & Mc- Clanna- han, 1988	incidental teaching	3 therapists & 5 children with severe language delays	group home/ trainers	episodes of incidental teaching (5 training sessions, examples faded over time)	measured if all components of an incidental teaching episode were present	generalized across rooms, activities, & children	yes, through 10 session follow up
Matson, Sevin, Box, Francis, & Sevin, 1993	time-delay	3 boys with autism, 5-5 years old	clinic/ therapist	social phrases (e.g., hello, play with me, thank you)	not measured	yes, across settings (to home), but sequential modification	2 boys maintained to 10 month follow up, 2 months for 1 boy

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McGee, Almeida, Sulzer-Azaroff, & Feldman, 1992	incidental teaching (wait for initiation, ask for toy label...)	3 children with autism, 3-5 years old; 3 nondisabled tutors, 4 years old	preschool (free play)/ peer tutors	reciprocal interaction= bidirectional vb	not measured	only 1 child generalized across settings (to other free play)	maintained for all 3 children
McGee, Krantz, Mason, & McClannahan, 1983	incidental teaching	2 children with autism, age 7	group home/ home teaching parents	receptive language (teacher- "give me...")	not measured	across settings (from kitchen to dining room, though same trainer, same objects	not measured
McGee, Krantz, & McClannahan, 1985	incidental teaching vs. traditional training procedures	3 children with autism, ages 6-11 years	day tx program classroom/ teacher	prepositions (on, under, next to, in front of), randomly assigned sets to IT or regular	not measured	IT fostered greater generalization across people & settings	not measured
McGee, Krantz, & McClannahan, 1986	incidental teaching: 3-level prompt system, prompts on "word cards"	2 children with autism & severe language delays, ages 5 & 13	classroom/ teacher	toy labels (teacher: "give me the ...")	Measured teacher use of prompts: "high degree of teacher compliance with protocol"	generalized across settings (rooms), typesets & oral reading; note clever generalization probe-labeled shoe boxes	maintained at 15 & 25 days

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Miranda-Linne & Melin, 1992	incidental teaching vs. discrete trial training	2 boys with autism, ages 10 & 12	classroom/ teacher	color adjectives	not measured	across settings to home & parents; across stimuli to novel stimulus colors. Gains occurred more slowly with incidental teaching, but were more permanent	good at 1 week follow up
Mudd & Wolery, 1987	incidental teaching	4 Head Start teachers; 20 Head Start students	Head Start classroom/ teachers	teachers use of IT procedures; children's requests	gave written feedback with % IT steps completed	not measured	IT maintained from 1-4 weeks
Oswald, Lignugaris/Kraft, & West, 1990	incidental teaching	16 year old high school student with mild developmental disability	classroom/ teacher	thank you, please	not measured	generalized across classrooms & teachers	not measured
Rogers-Warren & Warren, 1980	mand-model	3 children with severe language delays, 3-4 years old, plus compared to 2 nondelayed children	preschool/ teachers	1-3 word responses. Complete sentences (depending on child), total verbalization, novel words	measured rate of teachers use, but not quality	trained words generalized to classroom	collected data on 2 children at 5, 6, & 7 months post-treatment; verbalization rates remained high

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Schepis, Reid, Fitz- gerald, Faw, Van Den Pol, Welty, 1982	modified incidental teaching (desired objects out of reach, prompts, modeling, physical guidance)	5 children with profound retardation; 4 children with autism	residential facility (living room)/ direct care staff	signing vocabulary (e.g., yes, no, tv, more, eat, etc)	not measured	not measured	maintained at 5 & 17 weeks
Seifert & Schwarz, 1991	incidental teaching combined with direct instruction	57 Head Start students)in a group compariso n design)	preschool/ teachers	concepts (e.g., pair, third, other, etc.)	not measured	across concepts to untrained concepts, more effective for treatment group	not measured
Smith & Camarata, 1999	modeling	3 children with autism	preschool and kindergarten/ teachers	intelligibility; verbal interactions	measured teachers' use of modeling in relation to opportunities	increased intelligibility and verbal interactions generalized across persons	not measured

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Valdez-Menchaca & Whitehurst, 1988	incidental teaching	16 middle class, non-disabled English-speaking children (note: a group comparison design)	preschool/ experimenter	Spanish words, prompted & spontaneous	not measured	not measured	not measured
Warren, 1992	incidental teaching	5 children with borderline to mild mental retardation, 3 year olds	early intervention preschool/ trainer	teachers: vb to child, mands & models; children: nouns & verbs, obligatory responses, nonobligatory	measured use but not accuracy	children generalized across adults & settings	not measured
Warren & Bambara, 1989	milieu teaching	3 children with borderline to moderate mental retardation, ages 4-5 years	preschool/ trainer	action-object	not measured	all 3 children used target vb in nonobligatory situations, only 1 child generalized across classrooms & teachers	one child showed some maintenance over a 4-week follow-up
Warren & Gazdag, 1990	milieu teaching	2 children with mental retardation, ages 3 years	early intervention preschool/ trainer	nouns & verbs, agent-action, adjective-noun	not measured	good generalization across settings (to play area), adults, & recombinant; poor across peers	good at 10 day post intervention

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Warren, Gazdag, Bambara, & Jones, 1994	milieu teaching	11 children with mental retardation	early intervention preschool (playroom)/ trainer & different peers	novel word combinations	measured "degree of support" & function	measured in classroom with 1 peer present, found generalization across teachers, setting, & recombinant	not measured
Warren, McQuarter, & Rogers-Warren, 1984	mand-model	3 unresponsive children with language delays	preschool/ teachers	obligatory responses, initiations, total vb	assessed correct use of mand-model by teachers	child vb generalized across settings; teacher use of mand-model did not generalize	maintenance: faded mand-model
Warren, Yoder, Gazdag, Kim, & Jones, 1993	modified milieu teaching (+ linguistic mapping)	experiment 2 looked at generalization 4 children with mild-moderate retardation	early intervention preschool (playroom)/ 2 trainers each (to facilitate generalization)	prelinguistic requesting, commenting, vocal imitation (measured by CSBS)	measured contingent vocal imitation, linguistic mapping, mands, turn taking	generalization across persons (teachers), setting, materials, & interaction style	not measured
Yoder, Kaiser, & Alpert, 1991	milieu language teaching vs. discrete trial training	40 preschool children with handicaps	preschool (classroom or therapy room)/ trainers	individual language goals (e.g., nouns, verbs)	yes, used a rating scale of quality of implementation	not measured	not measured

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Yoder, Kaiser, Goldstein, Alpert, Mousetis, Kacz- marek, & Fischer, 1995	milieu language teaching vs. responsive interaction	36 children with develop- mental delays in a group design, matched on pre- treatment variables	across 6 SPED preschool classrooms/ teachers	global measures of language level (MLU, SICD, PPVT)	fidelity of treatment feedback sheet	not measured	not measured
Yoder, Warren, Kim, & Gazdag, 1994	modified milieu teaching	4 children with mental retard- ation & mothers	playroom in early intervention classroom/ 2 trainers each (to facilitate generaliza- tion)	prelinguistic intentional requesting + mothers linguistic mapping (including transactional effects)	measured IV- requests for child communication	generalization across adults, settings, material, & interaction style for both prelinguistic requests & general communication	not measured

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