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Parent-Implemented Enhanced Milieu Teaching With Preschool Children Who Have Intellectual Disabilities

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Purpose: The purpose of this study was to compare the effects of enhanced milieu teaching (EMT) implemented by parents and therapists versus therapists only on the language skills of preschool children with intellectual disabilities (IDs), including children with Down syndrome and children with autism spectrum disorders.
Method: Seventy-seven children were randomly assigned to 2 treatments (parent + therapist EMT or therapist-only EMT) and received 36 intervention sessions. Children were assessed before, immediately after, 6 months after, and 12 months after intervention. Separate linear regressions were conducted for each standardized and observational measure at each time point.
Results: Parents in the parent + therapist group demonstrated greater use of EMT strategies at home than untrained parents in the therapist-only group, and these effects maintained over time. Effect sizes for observational measures ranged from $d = 0.10$ to $d = 1.32$ favoring the parent + therapist group, with the largest effect sizes found 12 months after intervention.
Conclusion: Findings from this study indicate generally that there are benefits to training parents to implement naturalistic language intervention strategies with preschool children who have ID and significant language impairments.

Key Words: early intervention, language intervention, milieu teaching, parent training, intellectual disabilities

Children with intellectual disabilities (IDs) are a heterogeneous population that includes children with (a) genetically based disabilities such as Down syndrome, (b) autism spectrum disorders (ASDs), and (c) global developmental delays, often of unknown etiology. Children with IDs are likely to have difficulty acquiring all aspects of the language system as a result of limitations in short- and long-term memory, and sometimes specific language-learning deficits (Van der Schuit, Peeters, Segers, Van Balkom, & Verhoeven, 2009). These young children present a significant challenge for language interventionists due to the severity of their communication impairments and their specific needs for systematic early intervention.

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A common characteristic of children with IDs is difficulty in generalizing skills learned during therapy or individual instruction to functional use in everyday interactions (Kaiser & Trent, 2007). Effective language intervention for this population of children must include teaching strategies that support acquisition of a wide range of language skills and subsequent generalization of these skills. Functional communication outcomes can be improved by using strategies known to facilitate generalization such as involving multiple interventionists, teaching multiple examples of communicative forms, and embedding opportunities to learn and use communication across settings (Snell et al., 2010).

Parents as Language Interventionists

Parents are important partners in language intervention for children with significant language impairments. Parents are children's first language teachers and play a critical role in their early communication development. Several specific aspects of parent behavior are associated with language development in typically developing children and in children with language impairments: (a) amount of parent–child interaction (Alston

& St. James-Roberts, 2005), (b) responsiveness to child communication (Warren & Brady, 2007), (c) amount and quality of linguistic input (Weizman & Snow, 2001), and (d) use of language-learning support strategies (Smith, Landry, & Swank, 2000). Although parents of children with IDs do provide many of these supports for learning naturally, the extent of children's language impairments often requires more systematic training for their parents to be effective communication partners and collaborators in early intervention.

Group Design Studies of Parent-Implemented Interventions

Roberts and Kaiser (2011) examined the effects in 18 group design studies of parent-implemented language interventions and reported strong positive effects on the receptive and expressive language skills of children with language impairments, including children with IDs. The studies reviewed included a range of intervention models implemented by parents (e.g., enhanced milieu teaching, parent responsiveness training, focused stimulation). The most common approach was the Hanen Program (Manolson, 1992), which was used in eight studies. When parent-implemented treatment was compared with a nontreatment control or business-as-usual comparison group, the effect sizes for child language outcomes ranged from g = .35 to g = .81, and six of the seven effect sizes were statistically significant. When parent-implemented treatment was compared with therapist-implemented treatment, effect sizes ranged from g = –.15 to g = .42, and only two of the effect sizes were significant. Overall, the effects of parent-implemented language intervention on global language, expressive language, receptive language, and rate of communication did not differ for children with and without IDs. Children with language impairments and typical cognition did show larger effects for expressive vocabulary than did children with cognitive impairments. Seven studies reviewed included children with ID; four compared parent-implemented intervention with therapist interventions, and three compared parent-implemented with a nontreatment or community control condition.

The findings in the Roberts and Kaiser (2011) review were more positive in terms of outcomes for children with cognitive impairments than the findings in two earlier meta-analyses. Previous reviews included only small numbers of parent-implemented interventions. McConachie and Diggle's (2007) analysis of parent-implemented interventions for children with ASDs included three studies that reported language outcomes. The effects of parent-implemented intervention were nonsignificant for parent-reported measures of child language (vocabulary and sentence length). Law, Garrett, and Nye (2004) conducted a comprehensive meta-analysis in which the effects of therapist- and parent-implemented interventions were examined. They reported nonsignificant effects when parent-implemented language interventions were compared with nontreatment controls; however, their analysis included only three studies. Effect sizes for the parent-implemented versus no-treatment control conditions varied depending on the language construct, with ds ranging from –0.53 for receptive syntax to 1.06 for expressive vocabulary. The Law et al. review did not include studies enrolling children with IDs.

There is evidence that parent-implemented language interventions can have positive effects on language outcomes for children with IDs. However, there are several important gaps in the evidence. First, there are relatively few studies focusing on children with IDs and no group design studies of parent training when the studies including primarily children with ASDs are excluded. Second, procedures for training parents are often not well described, and the impact of variations in training procedures is unknown. General approaches to training and amount of parent training varies across studies. Some interventions have been taught to parents in individual teaching sessions (e.g., in most single-subject studies), whereas other interventions were provided as part of a group session with limited individual follow-up (e.g., Hanen Parent Program). Instructional methods have included didactic instruction, modeling, video feedback, in vivo coaching, written materials, and role playing. No studies have been published on the effectiveness of individual training components in relation to parent and child outcomes. In most published studies, the dosage for potentially important training procedures, such as coaching and feedback, had not been specified. Fidelity of procedures for training parents has not been reported. Third, the causal link between parent fidelity of implementation of the specific language intervention strategies and child outcomes is not well established in many studies.

Enhanced Milieu Teaching

The purpose of the current study was to address known gaps in the literature by comparing the effects of an evidence-based language intervention, enhanced milieu teaching (EMT), when simultaneously delivered by a parent and therapist with EMT delivered only by a therapist. EMT is a naturalistic model of early language intervention in which child interest and initiations are used as opportunities to model and prompt language use in everyday contexts (Kaiser, 1993). It blends developmentally appropriate responsive interaction strategies (contingent responsiveness, language modeling, expansions of child utterances) with behavioral teaching strategies to increase the frequency and complexity of

language. These behavioral strategies include (a) arranging the environment to increase the likelihood that the child will communicate; (b) selecting and teaching specific language targets appropriate to the child's skill level; (c) responding to the child's initiations with prompts for elaborated language consistent with the child's targeted skills; and (d) functionally reinforcing the child's communicative attempts by providing access to requested objects, continued adult interaction, and feedback in the form of expansions and confirmations of the child's utterances.

More than 50 studies incorporating variants of milieu teaching have been conducted (Kaiser & Trent, 2007). There is evidence across single-subject design studies that EMT increases both the linguistic complexity and social communicative use of language by children with disabilities (Hancock & Kaiser, 2002; Kaiser, Hancock, & Nietfeld, 2000). The effects of EMT on specific targeted language structures in the training context have been consistently strong across studies. Although some generalization of target language forms to other settings and partners has been reported for most subjects in every study containing such measures, the frequency, diversity, and spontaneous use of trained structures have varied across studies and across individuals within studies (Kaiser, Yoder, & Keetz, 1992; Olive et al., 2007). The effects of EMT and its variants on developmental outcomes for children with significant language impairments are less clear. No previous group design studies have been designed to investigate the effects of EMT on developmental outcomes. Two group design studies in which prelinguistic milieu teaching was implemented with samples of children that included children with IDs and included a parent-responsive education component to promote support for newly taught communication skills have been reported to have had positive outcomes for some children with specific characteristics (Fey et al., 2006; Yoder & Warren, 2001).

EMT has been implemented by parents in several single-subject studies (Hancock & Kaiser, 2002; Kaiser et al., 2000) with clear effects on children's use of target language and some evidence of generalization to parent–child interactions at home. EMT was selected for the intervention in our current study on the basis of the existing evidence of its effectiveness when implemented by parents and by therapists, the validity of this approach as a naturalistic intervention appropriate for use during parent–child interactions at home, and the availability of well-developed procedures for training parents in this model (Kaiser, Hancock, & Trent, 2007).

Purpose of the Current Study

In the current study, we compared primary and generalized communication outcomes for children who received EMT provided by a parent and a therapist (parent + therapist) with the communication gains of children who received EMT by a therapist only (therapist only).

The following research questions and hypotheses guided the study:

1. Do children receiving parent + therapist EMT show greater gains in language than children receiving therapist-only EMT at the end of intervention and at 6 and 12 months following intervention? We hypothesized that there would be no significant difference in children's language performance immediately after intervention but that children in the parent + therapist EMT group would have longer sentences, use more language targets, and use a greater diversity of vocabulary over time (6 and 12 months following intervention) than would children in the therapist-only EMT group, based on previous pilot data (Kaiser & Hancock, 1998).
2. Do parents receiving parent + therapist EMT use more EMT strategies at home than parents receiving therapist-only EMT at the end of intervention and over time? We hypothesized that parents in the parent + therapist condition would demonstrate more use of EMT strategies during home observations at each time point than would parents in the therapist-only EMT group, based on previous pilot data (Kaiser & Hancock, 1998).

In the current study, we extended existing research in several important ways. First, this is the first study to compare the effects of the same intervention when delivered simultaneously by the parent and therapist in comparison with when the same intervention is delivered by a therapist alone. Second, fidelity of parent training procedures was measured and described. Third, parents' use of EMT strategies was measured during and following intervention. Fourth, generalization of skills to home activities and maintenance of skills during the year after intervention were measured for both child and parent outcomes.

Method

Design

A randomized group design study was used to evaluate the effects of EMT for children with IDs. Children were randomly assigned to one of two experimental conditions: parent + therapist or therapist only. Randomization was completed using an automated randomization computer program after the child qualified for the study. Children were assessed prior to intervention, immediately after intervention, and 6 and 12 months

following intervention. All study procedures were reviewed and approved by the university Institutional Review Board.

Participants

A total of 77 children and their primary caregivers completed all baseline assessments and participated in the two experimental conditions. Attrition was moderate at each phase of the study and did not differ between groups; however, only 78% of the families assigned to the two intervention conditions were available for assessments 12 months following intervention (Post 3). The largest attrition occurred between the beginning of the pretest assessments and the beginning of the intervention, possibly when families became fully aware of the time requirements of the study. There were no differences in any parent or child characteristics between families who did not complete the study and those who did. Eighty-seven percent of the families who completed the intervention phase also completed the 12-month follow-up assessments. Families were recruited through local agencies and schools serving preschool children with disabilities and through advertisements placed in local newspapers. Criteria for child inclusion in the study were (a) age at screening between 30 and 54 months, (b) nonverbal IQ between 50 and 80 as measured by the Leiter International Performance Scale–Revised (Leiter-R; Roid & Miller, 1997), (c) total language standard score less than the 11th percentile on the Preschool Language Scale–fourth edition (PLS-4; Zimmerman, Steiner, & Pond, 2002), (d) a mean length of utterance (MLU) between 1.00 and 2.00 as measured in a standardized 20-min language sample with a research assistant, (e) at least 10 productive words observed during the language sample, (f) ability to verbally imitate seven of 10 words during an imitation-screening task, (g) normal hearing, and (h) English as the child's primary language. In addition, children were included only if the child's primary caregiver was willing to be trained as part of the intervention procedures and if the child's caregiver consented to be in the study and provided consent for the child to participate. The Leiter-R, PLS-4, a 20-min language sample, the imitation-screening task, and a general demographic and information form were completed before the child was accepted into the study. Following acceptance, each parent–child dyad was randomly assigned to an experimental condition. Table 1 contains a description of child characteristics, and Table 2 contains a description of parent characteristics. The majority of children in both groups received regular community-based speech-language therapy in addition to receiving intervention as part of the study. Groups did not differ on any of the child and parent characteristics presented in Tables 1 and 2.

Measures

Several methods of assessment were used to evaluate intervention outcomes. Measures collected for children and parents included (a) observational child and parent measures at home, (b) norm-referenced standardized measures of child language, and (c) parent reports. Each outcome measure was assessed at the start of the study (pretest), immediately following intervention (Post 1), 6 months after intervention (Post 2), and 12 months after intervention (Post 3). Administration and scoring of norm-referenced assessments were completed by staff members who were not involved in the child's intervention but were not blind to the experimental condition. Observational measures were transcribed and coded by hourly students who were blind to the experimental condition.

Child Measures

Norm-referenced measures. All assessments were administered by project staff members who were trained to criterion on the standardized procedures for each assessment before testing began. All testing was conducted in a small room with child-sized furnishings located in a clinical research facility on a university campus. All test sessions were videotaped. Each assessment protocol was checked and scored by the data manager. Data were entered by two independent research assistants, and data entry errors were resolved by the data manager.

Children's nonverbal cognitive skills were assessed with the Leiter-R. The Leiter-R is a norm-referenced instrument that assesses reasoning, visualization, memory, and attention for children 2–20 years old. The following Leiter-R subtests were administered to obtain the brief IQ score: figure ground, form completion, sequential order, and repeated patterns. Children's language skills were assessed with the PLS-4, the Expressive Vocabulary Test (EVT; Williams, 1997), and the Peabody Picture Vocabulary Test—III (PPVT–III; Dunn & Dunn, 1997). The PLS-4 is composed of two subscales: Auditory Comprehension and Expressive Communication. For this study, raw scores and standard scores were calculated for Auditory Comprehension, Expressive Communication, and the Total Language Score.

The EVT is an individually administered norm-referenced instrument with 190 items measuring expressive vocabulary knowledge of labels and synonyms. The PPVT–III measures receptive vocabulary by asking children to select a picture from one of four color pictures arranged on a page.

Observational measures. Child observational measures were collected in several contexts. Standardized language samples were collected during a 20-min play

Table 1. Child characteristics at the start of the study.

Characteristic	Definition	Therapist only (*n* = 38)		Parent + Therapist (*n* = 39)	
		M (SD)	%	*M (SD)*	%
Age	Age in months	41.32 (7.30)		40.05 (8.76)	
Gender	Male		28 (74)		29 (74)
Race	African American		14 (37)		7 (18)
	Caucasian		20 (53)		28 (72)
	Asian		2 (5)		1 (2)
	Other		2 (5)		3 (8)
Disability	Developmental delay		21 (55)		22 (56)
	Autism spectrum disorders		9 (24)		7 (18)
	Down syndrome		8 (21)		10 (26)
Other special education services	Number of other special education (e.g., OT, PT, SLP) sessions received in the last 6 months	12.88 (16.23)		13.83 (17.11)	
Speech-language therapy	Number of children who received additional speech language therapy		25 (66)		28 (72)
Cognitive skills	Brief Non-Verbal Leiter IQ	69.76 (7.92)		70.72 (9.14)	
Language skills	PLS–4 Auditory Comprehension	59.29 (9.91)		57.36 (8.96)	
	PLS–4 Expressive Communication	66.29 (8.42)		65.33 (9.67)	
	Mean length of utterance	1.42 (0.57)		1.36 (0.40)	
Problem behaviors	Total T Score on the CBCL	54.49 (9.00)		55.21 (10.96)	

Note. OT = occupational therapy; PT = physical therapy; SLP = speech-language pathology; PLS–4 = Preschool Language Scale—Fourth Edition; CBCL = Child Behavior Checklist.

interaction with a responsive adult who did not prompt the child. A standard set of age-appropriate toys was used in each language sample. Each language sample was transcribed by an observer who was trained to 95% reliability on three consecutive transcripts prior to transcribing study data. Consensus reliability was conducted by a second transcriber for all transcripts, as speech intelligibility was poor for this population of children. The second transcriber noted any disagreements, and these disagreements were discussed between transcribers until consensus was reached; thus, only child and adult utterances with perfect agreement between transcribers were included in the analysis. The following linguistic measures were derived from transcriptions of the language sample sessions using the Systematic Analysis of Language Transcripts (SALT; Miller & Chapman, 2000): number of different words (NDW) and mean length of utterance in words (MLUw). NDW was chosen as a complementary observational measure of expressive vocabulary to the EVT. MLUw was chosen because it is a commonly used measure of sentence length. Additionally, syntactic/semantic development was measured by scoring the verified language sample transcripts with the Index of Productivity of Syntax (IPSyn; Scarborough, 1990). Scoring yielded a total IPSyn score composed of the noun phrase, question phrase, verb phrase, and sentence structure subscales.

In order to assess the generalization of the effects of the intervention, children and parents in both experimental conditions were also observed in play activities at home. Two, 5-min observations during a trained play activity and two 5-min observations during an untrained play activity were videotaped by a familiar staff member who was not the child therapist or parent trainer. Typical activities during the play observations were blocks, dolls and accessories, pretend food and dishes, trucks and cars, and barns or houses with miniature people and animals. The parents in the parent + therapist EMT condition received coaching and feedback in the trained play activity during the 12 home-based intervention sessions; they did not receive coaching or feedback in the untrained play activity. No coaching or feedback was provided to the parents in either experimental condition during the pre- and postobservations. These sessions were transcribed using SALT and coded using the Milieu Teaching Project KidTalk Code (Vijay, Windsor, Hancock, & Kaiser, 2004). Child-coded variables included the number of unique targets produced during the activity and percentage of child utterances that contained any of the child language targets. In addition, MLUw and NDW were calculated from SALT for each of the activities.

Parent report measures. Several parent report measures assessing child language and problem behaviors were collected as well as demographic information. The

Table 2. Parent characteristics at the start of the study.

Characteristic	Definition	Therapist only (n = 38)		Parent + Therapist (n = 39)	
		M (SD)	# %	*M (SD)*	# %
Parent age	Age in years	34 (6.40)		36 (6.40)	
Marital status	Single		4 (10)		3 (8)
	Separated/divorced		0 (0)		3 (8)
	Married		33 (87)		33 (85)
	Did not respond		1 (3)		0 (0)
Mother's employment	Homemaker		17 (45)		18 (46)
	Employed (part or full)		20 (52)		21 (54)
	Did not respond		1 (3)		0 (0)
Income	$1,000/month or less		1 (3)		2 (5)
	$1,000–$2,500/month		8 (21)		3 (8)
	Over $2,500/month		27 (71)		33 (85)
	Did not respond		2 (5)		1 (3)
Language spoken	Multiple languages		1 (3)		4 (10)
	One language		37 (97)		35 (90)
Parent education	High school		5 (13)		10 (25)
	Some college		7 (18)		6 (15)
	Bachelor's degree		16 (42)		13 (33)
	Graduate degree		7 (18)		9 (23)
	Did not respond		3 (8)		1 (3)
Parental stress	PSI Parent Stress domain score	232.70 (35.23)		233.88 (42.08)	
Home environment	Overall HOME score	49.43 (4.29)		49.17 (3.99)	
Parent trained	Mother				34
	Father				5
EMT strategies	Responsive interaction	.56 (.09)		.56 (.11)	
	Language modeling	.10 (.07)		.09 (.08)	
	Expansions	.13 (.12)		.10 (.08)	
	Milieu teaching prompts	.01 (.05)		.01 (.04)	

Note. PSI = Parenting Stress Index; HOME = Home Observation for Measurement of Environment; EMT = Enhanced Milieu Teaching.

MacArthur Communication Development Inventory-Words and Sentences (MCDI; Fenson et al., 1993) was completed by each parent. Parent report of the total number of words the child produced was the primary variable derived from this measure. Parents rated their child's behavior using the Child Behavior Checklist for ages 1½–5 (Achenbach & Rescorla, 2000) and completed a demographic form about their child's developmental history. Parents also provided information about race, disability, frequency of special education services, and speech-language therapy sessions.

Parent Measures

Observational measures. During the home observations, a familiar staff member other than the child therapist or parent trainer completed The Early Childhood Home Observation for Measurement of Environment (HOME; Caldwell & Bradley, 1984). This 55-item checklist measures the quality and quantity of home stimulation and support available to the child. It contains eight subscales (Learning Materials, Language Stimulation, Physical Environment, Parental Responsivity, Learning Stimulation, Modeling of Social Maturity, Variety of Experience, and Acceptance of the Child), which combine to yield an overall HOME score, which was the primary variable used from this measure.

Parents' use of EMT strategies was also measured during the same trained and untrained play activities described above. The Milieu Teaching Project KidTalk Code (Vijay et al., 2004) yielded the following adult variables: (a) percentage of child utterances to which the adult responded (responsive interaction); (b) percentage of adult utterances that contained one of the child language targets (language modeling); (c) percentage of child utterances to which the adult expanded the child's utterance by repeating the child's words and then adding one or more words (expansions); and (d) percentage of prompting episodes that were delivered in response to a child request, following a system of least to most support, and giving the child the desired action or object at the end of the prompt sequence (correct milieu teaching prompts). Prior to coding, all observers achieved 85% point-by-point

interobserver agreement (IOA) on utterance codes on three consecutive videos. Point-by-point IOA was calculated for 20% of sessions. Reliability exceeded 80% for each parent and child behavior.

Parent report measures. Parents completed the Parenting Stress Index (Abidin, 1995), a measure of the relative magnitude of stress in the parent–child system for parents of children birth to age 12. Scores are summarized into three domains: (a) child domain, (b) parent domain, and (c) life stress. The parent domain, which served as the primary variable from this measure, provides information about dimensions of parent functioning that may be a source of stress for the parent–child system and includes seven subscales: (a) Competence, (b) Isolation, (c) Attachment, (d) Health, (e) Role Restriction, (f) Depression, and (g) Spouse. Parents also completed a demographic form about their marital status, employment, income, language spoken at home, and education.

Experimental Procedure

Intervention Components

The intervention implemented in this study, EMT, is a hybrid naturalistic teaching procedure that includes four components: (a) environmental arrangement, (b) responsive interaction, (c) specific language modeling and expansions, and (d) milieu teaching prompts. When implementing EMT, the adult (a) arranges the environment to set the stage for adult–child interactions and to increase the likelihood that the child will initiate to the adult (environmental arrangement); (b) models specific language targets appropriate to the child's skill level in response to the child's communication and connected to the child's play and focus of interest (modeling, responsive interaction); (c) expands child communication forms by adding words to child utterances (expansions, responsive interaction); and (d) responds to the child's requests with prompts for elaborated language consistent with the child's targeted skills and functional reinforcement of the child's production of prompted target forms by providing access to requested objects and verbal feedback for communication (milieu teaching prompts).

Generally, three or four broad classes of language targets were selected for each child based on the standardized tests administered during the pretest period and the child's productive use of language during the pretest language samples and the baseline sessions with the child therapist and the parent in the clinic. Common targets included early two- and three-word semantic structures (e.g., agent + action; action + object; agent + action + object), two- to four-word requests (e.g., I want more), and vocabulary (nouns, verbs, modifiers). Child progress in using each target class was monitored, and more complex targets were added when early targets were acquired. The intervention was delivered by a therapist who had at least a bachelor's degree related to child development or special education and who was trained to criterion on the intervention procedures prior to working with children.

Therapist only. Participants in the therapist-only EMT (EMT-T) group received 36 intervention sessions (24 in the clinic and 12 at home). In the clinic-based sessions, the two therapists used all EMT strategies implemented within child-preferred play activities, which were identified by the parent. Each session lasted for a total of 20 min (10 min with each therapist). The parent did not watch these intervention sessions. In addition to biweekly clinic sessions, one therapist implemented EMT in the child's home during four routines during a 20-min home session: (a) play for 10 min, (b) cleanup, (c) snack for 5 min, and (d) book for 5 min. These routines included using toys and materials available in the home. It is unknown whether parents used similar materials in these routines outside the intervention sessions.

Parent + therapist. This condition was identical to the therapist-only EMT condition with the addition of the parent training (see Table 3 for a comparison). In this condition, one therapist intervened with the child, and the other therapist taught the parent. Prior to the start of intervention, parents participated in an interactive workshop that included individualized information about language development, behavior, play, environmental arrangement, and routines that are foundational to the EMT intervention. The workshops lasted between 2 and 3 hr, and the parents received a notebook of information about each topic and handouts that provided specific, individualized information about their child's language development.

Following the workshop, EMT topics were introduced in a systematic and sequential order (see Table 4 for the session in which each topic was introduced). Manuals consisting of individual modules for each EMT component were developed and used to teach the intervention to parents. Each module contained a target skill or set of closely related skills to be taught; defined the component behaviors; gave examples of the skill in context; and included handouts, homework, and video-recorded examples. Parents were not taught a new skill until they had demonstrated mastery of the previous skill, as evidenced by coded data. Criterion levels for each key parent behavior were established before the study began and are summarized in Table 4. Each clinic-based intervention session lasted approximately 1 hr and included four parts: (a) training on a specific EMT strategy, (b) the therapist-implemented EMT session, (c) the parent-implemented EMT session, and (d) a review of the day's session and a plan for the next session. During the first 15 min of the session, the parent trainer provided the parent with graphed or summative feedback from the last session and discussed the EMT

Table 3. Description of intervention conditions.

Condition	Sessions	Implementation	Context	Intervention components
Therapist only	24 clinic sessions (30 min each)	2 trained EMT child therapists	Play	All EMT components
	12 home sessions (20 min each)	1 trained EMT child therapist	Play, book, snack, cleanup	All EMT components
Parent + Therapist	24 clinic sessions (30 min each)	1 trained EMT child therapist; parent supported by 1 parent trainer	Play	Child therapist—all EMT components Parent–EMT components taught to date
	12 home sessions (20 min each)	Parent supported by 1 parent trainer	Play, book, snack, cleanup	Child therapist—all EMT components Parent–EMT components taught to date

strategy the parent would be learning or practicing that day. During this instruction and review period, the child was in another room playing with a staff member. This staff member was an undergraduate university student who had not been trained in the EMT intervention; thus, children did not receive additional intervention during this time.

Following this initial parent training, an experienced child therapist implemented the full range of EMT strategies during play sessions with the child. These therapist sessions were identical to those in the therapist-only condition, except the parent trainer and parent watched the session from an observation room. While the parent watched the session, the parent trainer verbally described the child therapist's use of the target EMT strategy.

After the child therapist completed her session, the parent played with his or her child for 10 min and practiced the EMT strategies he or she had learned. The parent trainer sat near the parent and child. Parent trainers supported the parents' use of the strategies through in-vivo coaching and feedback, especially when parents were learning a new strategy.

Twelve of the 36 training sessions occurred in the families' homes. During home intervention sessions, the parent trainer supported the parent's use of the targeted EMT strategy with coaching and feedback during the same four activities as the therapist-only condition. These activities included using toys and materials available in the home; it is unknown how often these routines occurred outside the parent-training sessions. Because the child was present, training and feedback to the parent were limited to brief comments, typically lasting less than 10 min.

Treatment Fidelity

Clinic and home measures of treatment fidelity were used to assess the fidelity of implementation of the treatment during 20% of intervention sessions in both conditions. Therapist implementation of the four EMT strategies (responsive interaction, language modeling, expansions, milieu teaching prompts) during two clinic sessions with the child was measured by video recording the session then transcribing and coding using the Milieu Teaching Project KidTalk Code. Overall fidelity of therapist delivery of EMT was calculated by dividing the percentage of use of each of the four EMT strategies by the criterion level to yield a percentage of fidelity. If the actual strategy use exceeded the criterion level, 100% was recorded. The four percentages were then averaged to yield an overall EMT fidelity score. The fidelity measures are presented in Table 5. For the parent + therapist group, three components of parent training (pre-teaching, coaching, feedback) were evaluated using a checklist for 20% of clinic and 20% of home sessions. Overall fidelity of parent training was calculated by summing scores for each of the individual components. Fidelity was high (100%) for therapist use of all EMT strategies for both

Table 4. Criterion levels of mastery and fidelity for each EMT component.

Session	EMT component	Criterion for mastery
1–2	Environmental arrangement[a]	
3–6	Responsive interaction	Adult responds to child communication 80% of the time
7–10	Modeling language targets	Adult uses a child language target 50% of the time
11–13	Expanding language	Adult expands 40% of child communication
14–36	Milieu-prompting procedures	Adult uses milieu-prompting procedure correctly 80% of the time

[a]Environmental arrangement was established as the context for intervention.

Table 5. Fidelity of intervention by the child therapist for both experimental conditions.

Characteristic	Definition	Therapist only (n = 38)	Parent + Therapist (n = 39)
Pre-teaching	Home pre-teaching parent training		.90 (.57–1.0)
	Clinic pre-teaching parent training		.97 (.64–1.0)
Coaching	Home coaching of the parent		.86 (.00–1.0)
	Clinic coaching of the parent		.97 (.50–1.0)
Feedback	Home feedback to the parent		.91 (.00–1.0)
	Clinic feedback to the parent		.76 (.00–1.0)
Overall	Home overall parent training		.89 (.00–1.0)
	Clinic overall parent training		.89 (.00–1.0)
Responsive interaction	Therapist's % responsiveness	1.0 (1.0–1.0)	1.0 (1.0–1.0)
Language modeling	Therapist's use of targets	1.0 (1.0–1.0)	1.0 (1.0–1.0)
Expansions	Therapist's use of expansions	1.0 (1.0–1.0)	1.0 (1.0–1.0)
Prompting	Therapist's use of prompting	1.0 (1.0–1.0)	1.0 (.95–1.0)
Overall EMT	Overall EMT score for the therapist	1.0 (1.0–1.0)	1.0 (.95–1.0)

groups. Fidelity was also high (above 80%) for all parent-training variables except feedback in the clinic (76%). The clinic feedback was low due to the fact that children frequently wanted to leave the clinic room at the end of the session, and the therapist often did not have sufficient time to adequately summarize the session and make a plan for the next clinic or home session.

Data Analysis

First, standardized and observational measures were summarized (see Tables 6 and 7). Means and standard deviations for each group were examined to assess differences at the start of the study. Groups were equivalent on all child and parent characteristics presented in Tables 1 and 2, as well as all child language measures in Tables 6 and 7.

To determine whether parents in the parent + therapist group used more EMT strategies relative to parents in the therapist-only group (Research Question 1), separate linear regression analyses for each of the main components of EMT were conducted. Parents' use of each of these strategies at each time point (immediately after intervention, 6 months after intervention, 12 months after intervention) was included as the dependent variable. Experimental condition was the independent variable, and initial use of the strategy prior to intervention was included as a covariate. To examine whether children in the parent + therapist group showed greater language gains relative to children in the therapist-only group at each time point (Research Question 2), separate linear regressions were conducted for each standardized and observational measure at each time point (immediately after intervention, 6 months after intervention, 12 months after intervention). The dependent variable was each child's outcome measure raw scores, and the independent variable was the experimental condition. Pretest raw scores and age in days at the time of assessment were included as covariates. The significance level was set at .05, and the Bonferroni correction method was used to counteract the problem of multiple comparisons within the same language construct. As a result, the significance value for MLUw, NDW, and use of targets was set at .01. All statistical analyses were conducted using SPSS version 17.

Results

Child Language as a Function of Treatment

Norm-referenced and parent report measures. There were no child language differences between groups for any norm-referenced or parent report measures for any time point. See Tables 6 and 7 for unadjusted means and standard deviations for each of these measures by group and Table 8 for effect sizes and significance levels. After controlling for pretest scores, experimental condition, and age, IQ was a significant predictor for the PPVT–III (B = 0.95, p = .01) and EVT (B = 0.40, p = .03). After controlling for pretest scores, experimental condition, age, and IQ, disability (0 = developmental delay, 1 = Down syndrome, 2 = ASDs) was a significant predictor for the PPVT–III (B = –5.90, p = .04) and EVT (B = –3.62, p = .04).

Observational measures. There were no differences in child language between groups for MLUw and NDW in the language sample at any time point. However, after controlling for pretest scores, experimental condition, age, and IQ, disability (0 = developmental delay, 1 = Down syndrome, 2 = ASDs) was a significant predictor for MLUw (B = –0.32, p = .02) and NDW (B = –17.81, p = .01).

There were no significant group differences between MLUw and NDW at the end of intervention for trained

Table 6. Unadjusted means (and *SD*s) for standardized and parent report child outcome measures.

Child measure	Score	Therapist				Parent + Therapist			
		Pre	Post 1	Post 2	Post 3	Pre	Post 1	Post 2	Post 3
PPVT	Raw	9.55 (8.0)	16.61 (10.4)	24.18 (13.78)	29.97 (16.2)	10.05 (8.0)	17.05 (11.5)	23.74 (15.3)	33.32 (19.9)
	Standard	57.97 (14.2)	64.94 (14.7)	67.03 (15.9)	66.94 (17.9)	59.96 (16.0)	66.00 (17.6)	68.32 (18.6)	71.84 (21.8)
EVT	Raw	15.08 (12.4)	20.33 (12.6)	26.91 (11.6)	32.79 (11.0)	13.13 (11.4)	22.00 (12.2)	25.90 (12.9)	32.58 (12.6)
	Standard	65.50 (20.7)	68.97 (20.2)	70.15 (19.0)	72.33 (19.3)	63.11 (21.1)	72.29 (21.7)	71.32 (20.8)	75.88 (21.1)
PLS–AC	Raw	26.2 (4.2)	29.97 (5.1)	34.48 (6.7)	37.43 (8.3)	24.82 (4.2)	29.51 (5.7)	32.68 (7.5)	37.32 (8.6)
	Standard	59.18 (9.8)	61.36 (12.7)	62.36 (13.1)	61.77 (13.9)	57.42 (0.1)	62.81 (13.9)	63.16 (14.3)	66.41 (17.1)
PLS–EC	Raw	28.89 (3.8)	34.08 (5.1)	35.94 (6.8)	38.33 (7.7)	28.05 (3.2)	33.08 (4.7)	36.23 (6.4)	40.15 (8.6)
	Standard	66.13 (8.2)	68.11 (12.5)	62.55 (13.7)	60.83 (13.6)	65.18 (9.8)	68.05 (15.4)	66.48 (17.2)	66.74 (19.1)
MLUw		1.33 (0.60)	1.68 (0.68)	1.93 (0.66)	2.16 (0.74)	1.3 (0.35)	1.66 (0.64)	2.01 (0.89)	2.22 (0.80)
NDW		29.27 (23.4)	49.30 (31.9)	72.18 (44.9)	85.03 (48.7)	22.29 (0.20)	45.24 (30.8)	67.61 (42.9)	85.55 (49.5)
IPSyn		18.03 (14.3)	27.26 (15.9)	32.55 (22.2)	42.61 (22.5)	14.39 (13.5)	24.61 (16.9)	32.47 (22.9)	42.77 (23.0)
MCDI		181.84 (157.6)	286.42 (187.5)	374.5 (187.1)	357.8 (193.9)	160.43 (119.64)	293.03 (170.1)	403.2 (222.2)	421.7 (221.7)

Note. PPVT = Peabody Picture Vocabulary Test; EVT = Expressive Vocabulary Test; PLS–AC = Preschool Language Scale—Auditory Comprehension subscale; PLS–EC = Preschool Language Scale—Expressive Communication subscale; MLUw = mean length of utterance in words; NDW = number of different words; IPSyn = Index of Productivity of Syntax; MCDI = MacArthur Communication Development Inventory–Words and Sentences.

Table 7. Unadjusted means (and *SD*s) for observational child outcome measures from trained and untrained home activities.

Child measure	Context	Therapist				Parent + Therapist			
		Pre	Post 1	Post 2	Post 3	Pre	Post 1	Post 2	Post 3
Frequency of unique targets	Trained	5.10 (4.48)	10.77 (7.04)	12.91 (9.00)	16.94 (10.64)	3.99 (3.41)	11.71 (7.60)	18.26 (9.90)	21.34 (13.58)
	Untrained	4.93 (4.11)	8.06 (6.07)	13.73 (8.52)	14.49 (10.19)	3.59 (3.41)	11.72 (9.69)	17.55 (9.90)	17.80 (12.14)
Percentage of target talk	Trained	0.15 (0.14)	0.16 (0.13)	0.23 (0.17)	0.26 (0.17)	0.13 (0.17)	0.33 (0.19)	0.39 (0.21)	0.39 (0.19)
	Untrained	0.10 (0.12)	0.13 (0.10)	0.23 (0.18)	0.26 (0.20)	0.15 (0.18)	0.31 (0.22)	0.37 (0.24)	0.39 (0.20)
Mean length of utterance	Trained	10.49 (0.43)	10.75 (0.62)	10.79 (0.49)	20.09 (0.66)	10.39 (0.35)	10.86 (0.70)	20.07 (0.85)	20.41 (0.87)
	Untrained	10.51 (0.42)	10.70 (0.61)	10.83 (0.51)	20.05 (0.70)	10.40 (0.38)	10.82 (0.72)	20.11 (0.77)	20.26 (0.92)
Total number of different words	Trained	170.65 (120.18)	260.46 (150.10)	300.56 (150.62)	370.58 (190.71)	150.29 (90.47)	260.53 (150.06)	380.39 (210.64)	440.05 (230.70)
	Untrained	170.17 (110.04)	220.67 (130.34)	310.81 (170.41)	320.96 (190.51)	130.13 (70.24)	230.62 (130.17)	330.65 (180.56)	370.64 (230.20)

Table 8. Regression coefficient, standard errors, significant values, and effect sizes for child outcome measures.

	Pre	Post 1				Post 2				Post 3			
Measure	*d*	*B*	*SE*	*p*	*d*	*B*	*SE*	*p*	*d*	*B*	*SE*	*p*	*d*
PPVT	0.06	–0.34	2.12	.87	–0.03	–0.57	3.55	.87	–0.04	2.27	4.20	.59	0.13
EVT	–0.16	2.69	0.11	.15	0.22	1.38	2.30	.55	0.11	0.106	2.59	.97	0.01
PLS-AC	–0.30	0.73	0.84	.39	0.13	–0.16	1.55	.92	–0.02	–0.12	2.19	.96	–0.01
PLS-EC	–0.24	–0.15	0.75	.84	–0.03	1.56	1.25	.22	0.23	1.17	2.02	.57	0.14
MLUw Language sample	–0.06	–0.02	0.13	.857	–0.03	0.21	0.17	.23	0.27	0.09	0.19	.61	0.14
NDW Language sample	–0.32	3.40	4.87	.49	0.11	6.07	8.58	.48	0.14	9.54	10.08	.35	0.19
IPSyn	–0.26	–0.10	2.38	.97	–0.01	5.34	3.67	.15	0.24	2.70	4.57	.56	0.12
MCDI	–0.15	43.67	23.44	.07	0.24	71.54	46.15	.13	0.35	62.30	40.52	.13	0.30
Unique targets Trained activity	–0.28	1.30	1.74	.10	0.46	7.20	2.21	.00	0.76	7.08	2.71	.01	0.58
Unique targets Untrained activity	–0.36	4.21	1.95	.03	0.52	4.35	2.32	.07	0.47	5.08	2.63	.06	0.45
% target talk Trained activity	–0.13	0.16	0.04	.00	0.96	0.18	0.04	.00	0.91	0.18	0.04	.00	1.03
% target talk Untrained activity	0.36	0.15	0.04	.00	0.85	0.10	0.05	.05	0.48	0.13	0.05	.00	0.64
MLUw Trained activity	–0.24	0.20	0.12	.09	0.32	0.39	0.15	.01	0.57	0.47	0.17	.00	0.60
MLUw Untrained activity	–0.26	0.19	0.15	.21	0.28	0.32	0.16	.05	0.48	0.28	0.21	.18	0.35
NDW Trained activity	–0.22	1.48	2.82	.60	0.10	11.62	3.89	.00	0.62	9.96	4.73	.04	0.46
NDW Untrained activity	–0.44	3.33	3.00	.30	0.25	7.01	4.32	.11	0.39	9.27	5.27	.09	0.43

and untrained home routines (Post 1). This result was expected because children in both groups received intervention. However, 6 months following intervention, children in the parent + therapist group had longer MLUw and greater NDW in the trained activity at home than children in the therapist-only group 6 months (d = 0.57, p = .01, for MLUw; d = 0.62, p = .00, for NDW) and 12 months after the end of intervention (d = 0.60, p = .00, for MLUw; d = 0.46, p = .04, for NDW). This difference was not observed for the untrained activity.

In addition to MLUw and NDW, children in the parent + therapist group used a significantly higher percentage of target utterances than children in the therapist-only group at 6 months (d = 0.91, p = .00) and 12 months (d = 1.03, p = 1.03) following intervention during the trained activity. Children in the parent + therapist group used between 16% more utterances with language targets 6 months after intervention and 13% more utterances with language targets 12 months after intervention in the trained play activity than children in the therapist-only group. Children in the parent + therapist group also used a greater number of unique targets at 6 months (d = 0.76, p = .00) and 12 months (d = 0.58, p = .01) following intervention during the trained activity. Children in the parent + therapist group used five more different language targets 6 months after intervention and four more different language targets 12 months after intervention.

Parent Use of EMT Strategies as a Function of Treatment

After training, parents in the parent + therapist group used significantly more EMT strategies (responsive interaction, language modeling, expansions, and milieu teaching prompts) than parents in the therapist-only group. These differences remained significant over time. Unadjusted means for each time point are presented in Table 9. Effect sizes, regression coefficients, and p values are presented in Table 10.

Parents in the parent + therapist group used significantly more responsive interaction strategies in both trained (d = 2.18, p = .00, at the end of intervention; d = 1.59, p =.00, at 6 months following intervention; d = 1.56, p = .00, at 12 months following intervention) and untrained activities (d = 1.60, p = .00, at the end of intervention; d = 1.70, p = .00, at 6 months following intervention; d = 1.26, p = .00, at 12 months following

Table 9. Unadjusted means (and *SD*s) for parental use of EMT strategies in trained and untrained play activities.

Adult measure	Context	Therapist				Parent + Therapist			
		Pre	Post 1	Post 2	Post 3	Pre	Post 1	Post 2	Post 3
Responsive interaction	Trained	.56 (.09)	.54 (.09)	.59 (.09)	.56 (.13)	.56 (.11)	.81 (.13)	.77 (.13)	.76 (.14)
	Untrained	.56 (.12)	.56 (.13)	.49 (.12)	58 (.14)	.56 (.12)	.78 (.16)	.77 (.20)	.74 (.12)
Percentage of language modeling	Trained	.10 (.07)	.10 (.08)	.13 (.07)	.11 (.08)	.09 (.08)	.49 (.21)	.40 (.23)	.37 (.21)
	Untrained	.09 (.09)	.10 (.08)	.11 (.25)	.11 (.08)	.09 (.07)	.41 (.23)	.38 (.25)	.33 (.22)
Expansions	Trained	.13 (.12)	.08 (.09)	.10 (.08)	.08 (.05)	.10 (.08)	.41 (.20)	.32 (.20)	.32 (.21)
	Untrained	.10 (.10)	.10 (.09)	.06 (.06)	.07 (.06)	.12 (.12)	.34 (.21)	.27 (.19)	.27 (.20)
Milieu teaching prompts	Trained	.01 (.05)	.02 (.05)	.04 (.06)	.05 (.10)	.01 (.04)	.48 (.32)	.31 (.26)	.27 (.26)
	Untrained	.01 (.04)	.05 (.18)	.06 (.15)	.03 (.07)	.03 (.05)	.39 (.33)	.28 (.26)	.29 (.33)

intervention). Parents in the parent + therapist group also used more language modeling in both trained (d = 2.24, p = .00, at the end of intervention; d = 1.63, p = .00, at 6 months following intervention; d = 1.78, p = .00, at 12 months following intervention) and untrained activities (d = 1.57, p = .00, at the end of intervention; d = 1.15, p = .00, at 6 months following intervention; d = 1.35, p = .00, at 12 months following intervention). Parents in the parent + therapist group used more expansions in trained activities (d = 1.90, p = .00, at the end of intervention; d = 1.46, p = .00, at 6 months following intervention; d = 1.56, p = .00, at 12 months following intervention) and untrained activities (d = 1.34, p = .00, at the end of intervention; d = 1.16, p = .00, at 6 months following intervention; d = 1.36, p = .00, at 12 months following intervention). Last, parents in the parent + therapist group used more milieu teaching prompt episodes in trained (d = 1.86, p = .00, at the end of intervention; d = 1.42, p = .00, at 6 months following intervention; d = 1.17, p = .00, at 12 months following intervention) and untrained activities (d = 1.27, p = .00, at the end of intervention; d = 0.92, p = .00, at 6 months following intervention; d = 1.09, p = .00, at 12 months following intervention).

Discussion

The results of this study confirm that parents of young children with IDs can learn, generalize, and maintain their use of naturalistic teaching strategies with their children. Parents in this study who received training in EMT increased their use of responsive interaction, expansions, language modeling, and milieu teaching prompts in trained and untrained play settings

Table 10. Regression coefficient, standard errors, significance values, and effect sizes for parental use of EMT strategies in trained and untrained play activities.

Measure	Pre	Post 1				Post 2				Post 3			
	d	β	*SE*	*p*	*d*	β	*SE*	*p*	*d*	β	*SE*	*p*	*d*
Responsive interaction Trained activity	0.05	.26	.03	.00	2.18	.18	.03	.00	1.59	.21	.04	.00	1.56
Responsive interaction Untrained activity	−0.01	.24	.04	.00	1.60	.28	.04	.00	1.70	.17	.03	.00	1.26
Language modeling Trained activity	−0.02	.40	.04	.00	2.24	.28	.04	.00	1.63	.28	.04	.00	1.78
Language modeling Untrained activity	0.01	.31	.04	.00	1.57	.27	.05	.00	1.15	.22	.04	.00	1.35
Expansions Trained activity	−0.27	.33	.04	.00	1.90	.25	.04	.00	1.46	.24	.04	.00	1.56
Expansions Untrained activity	0.14	.23	.04	.00	1.34	.20	.04	.00	1.16	.20	.04	.00	1.36
Milieu teaching Trained activity	0.00	.47	.06	.00	1.86	.27	.05	.00	1.42	.23	.05	.00	1.17
Milieu teaching Untrained activity	0.27	.36	.07	.00	1.27	.22	.06	.00	0.92	.26	.06	.00	1.09

with their children at home over a year after training was completed. Parent use of EMT strategies subsequently had a positive impact on child language.

The effects of parent-implemented EMT were evident in children's use of targets, length of utterances, and NDW in play activities at home in which parents received training at both 6 and 12 months following intervention. However, the magnitude of the differences between groups was reduced between 6 and 12 months following intervention for NDW (d = 0.62 to d = 0.46) and unique targets (d = 0.76 to d = 0.58). This reduction may be due to the fact that parent use of EMT strategies declined somewhat between 6 and 12 months following intervention, although their strategy use remained well above pretraining levels. Furthermore, although parents maintained their strategy use in both trained and untrained activities 12 months after intervention, their strategy use was consistently higher in the trained activities at 6 and 12 months after intervention. This difference may account for the differences in child language outcomes favoring the parent + therapist group for the trained routine and not for the untrained routine at 6 and 12 months following intervention. These findings suggest that children with IDs need consistent and high levels of language support strategies to maintain skills learned in intervention. High levels of language support strategies may be achieved through systematic parent training that occurs in a greater number and variety of routines that are specific to individual families. Customizing the context of intervention to meet the individual needs of families is necessary for achieving maximal levels of language support strategy use.

There were no significant differences on standardized assessments of language between children whose parents were trained and those who received the therapist-only intervention. We hypothesized there would be no differences in these outcomes immediately after intervention because children in both conditions received high-quality treatment of a similar dosage during the primary intervention period. We expected, but did not find, effects favoring children in the parent + therapist group at 6 and 12 months following intervention in standardized assessments. Although children learned to use more targets, longer sentences, and a greater number of different words during play activities in which their parents were trained, it is likely that children required this level of language-learning support to be able to produce language at higher levels. The lack of significant differences between groups on norm-referenced measures may be due to the fact that this level of language-learning support is not present in these types of assessments.

There are several possible explanations for the current findings. First, it is important to consider the design of the study. This study contrasted the delivery of EMT in a carefully matched comparison: (a) Children in both groups received 24 sessions of intervention implemented at high levels of fidelity specified to their target language level by a therapist in a clinic setting, and (b) children in both groups received some training using EMT at home provided by their parents or by a therapist during 12 home sessions. In both conditions, generalization from clinic to home was supported during the primary intervention period. There is evidence that children in both groups responded positively to the primary intervention, gaining more than 0.5 *SD*s on the PPVT–III and an average of more than 20 different words in the language sample after approximately 4 months of intervention. Smaller gains were seen on other standardized assessments in both groups. Parents reported an average increase of more than 100 new words on the MCDI. Because children in both treatment groups continued to participate in other services throughout the study, it is not possible to isolate the specific contribution of the intervention above and beyond growth due to community-based services or maturation. Without a nontreatment control group, it is not possible to confidently estimate the effects of two interventions except in comparison to each other. Although observational and standardized assessment measures favored the parent + therapist group, the closely matched interventions resulted in similar outcomes.

Second, the observations of parents at home, although frequent by contemporary research standards, were limited to eight observations (two at each time point). Parents may have been reactive to the observation conditions, especially if they had received training at home. It is unknown whether their performance during the observations was representative of their daily interactions with their children. The actual dosage of parent-implemented EMT after the primary intervention may not have been sufficient to affect standardized measures of child language development. When trained parents used the EMT strategies at home, it was observed that their children responded with more advanced language. However, future studies should incorporate new technologies such as the Language Environment Analysis System (LENA Research Foundation, 2012) that support continuous collection of data at home over multiple observations.

Third, this population of children had significant IDs and language impairments, and the overall intervention package may not have provided sufficient dosage to affect their performance on standardized assessments. The total number of hours of clinic and home intervention was about 18, or about 1 hr per week across 4 months. There are few language intervention studies that have enrolled children in this IQ range (mean Leiter IQ of 70), but studies with prelinguistic children with significant IDs have also reported relatively modest gains, particularly for children with Down syndrome (Fey et al., 2006; Yoder & Warren, 2001). Fourth, parents in this study were relatively responsive to their children at the pretest (mean

responsiveness was 56% in both groups at pretest), suggesting that this aspect of language support was available to children in both groups throughout the study.

Limitations and Need for Further Study

Among the limitations of the study are overall sample size, limited diversity in the population of parents, and heterogeneity of the populations of children. The sample size of 77, although relatively large for treatment studies of this type, and the heterogeneity of the population limited the analysis of child-level moderators and of treatment responses by children with ASDs and Down syndrome. Parents participating in this study were highly educated, middle-class parents, and this sample is not necessarily representative of the parents of children with IDs. Thus, the findings of the study are limited to a subset of parents and children.

In addition, there are some procedural concerns with the study as implemented. It was not possible to have testers who were blind to the children's assignment to the parent-implemented or therapist conditions. Testers were never involved in interventions for the children they tested, but they did know the procedures of the study and may have known the condition to which the child and parent were assigned; thus, the potential for experimental bias exists. Recruitment of participants was challenging, and the participation requirements of the study were extensive for the families.

Taken together, the procedures and findings of this study suggest that well-designed naturalistic language interventions implemented by parents and therapists together can have an impact on children's everyday use of language at home. Although promising, these results need replication. Further research on the parameters of treatments (dosage, setting, interventionists) is needed to determine whether positive language outcomes across settings and partners can be achieved through intervention. This population of children with IDs may require more intensive and longer term language intervention to ensure improvements in their functional and social communication measured across contexts and over time.

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