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The Effects of the Teach-Model-Coach-Review Instructional Approach on Caregiver Use of
Language Support Strategies and Children's Expressive Language Skills

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Abstract

Purpose

The purpose of this study was to examine the effects of the Teach-Model-Coach-Review instructional approach on caregivers' use of four Enhanced Milieu Teaching (EMT) language support strategies and on their children's use of expressive language.

Method

Four caregiver-child dyads participated in a single-subject, multiple-baseline study. Children were between 24 and 42 months of age and had language impairment. Interventionists used the Teach-Model-Coach-Review instructional approach to teach caregivers to use matched turns, expansions, time delays, and milieu teaching prompts during 24 individualized clinic sessions. Caregiver use of each EMT language support strategy and child use of communication targets were the dependent variables.

Results

The caregivers demonstrated increases in their use of each EMT language support strategy following instruction. Generalization and maintenance of strategy use to the home was limited, indicating that teaching across routines is necessary to achieve maximal outcomes. All children demonstrated gains in their use of communication targets and in their performance on norm-referenced measures of language.

Conclusion

The results indicate that the Teach-Model-Coach-Review instructional approach is resulted in increased use of EMT language support strategies by caregivers. Caregiver use of these strategies was associated with positive changes in child language skills.

Introduction

Approximately 15% of 24-month-old children exhibit a primary developmental language impairment not due to another identifiable etiology (Horowitz, Irwin, Briggs-Gowan, Heenan, Mendoza & Carter, 2003). Children with early language impairment are a heterogeneous population with varying degrees of receptive, expressive, or mixed expressive-receptive impairment. Children who exhibit both receptive and expressive language impairment during the toddler and preschool years are at increased risk for persistent communication problems (Preston et al., 2010), poor school readiness (Prior, Bavin, & Ong, 2011), and reading difficulties (Snowling, Bishop, & Stothard, 2000). Thus, effective early intervention for these children may be essential for preventing long-term, language-related problems. The current study addresses the need for information about how to teach caregivers to use a set of language support strategies designed to improve language skills in children. A multiple-baseline, single-subject design across Enhanced Milieu Teaching (EMT) language support strategies was used to examine the effects of the Teach-Model-Coach-Review caregiver instructional approach. Changes in the use of specific communication targets by children was also measured.

The Effects of Caregiver-Implemented Interventions for Children with Primary Language Impairment

Results from correlational studies of caregiver-child interactions indicate that the quantity and quality of linguistic input provided by caregivers is associated with positive child language skills (Hart & Risley, 1995; Smith, Landry, & Swank, 2000; Tamis-LeMonda, Bornstein, & Baumwell, 2001). Given the strong relationship between caregiver language input and child language development, teaching caregivers to use specific language support strategies is an important element of early language intervention. A number of studies have examined the effects

of teaching caregivers of children with primary and secondary language impairments to use specific language support strategies (Roberts & Kaiser, 2011).

The Hanen Parent Program (HPP) is a commonly used caregiver-implemented language intervention for children with primary language impairment. During the HPP instruction, caregivers are taught how to follow their child's lead to increase engagement as well as how to use specific responsive interaction strategies to facilitate language learning throughout daily routines. Girolametto, Pearce, and Weitzman (1996), in a study of 24 toddlers (23 to 33 months of age) with expressive language impairment, found significant and positive results between the intervention and control groups. Children whose caregivers received the 11-week group training program had greater vocabularies than those children in the control group. Wake and colleagues (2011) examined the effects of a 6-week modified HPP for 149 children (76 treatment, 73 control) with limited expressive vocabularies. Children were 18 months at baseline and outcomes of the intervention were measured at 24 months of age (12 weeks after the end of intervention) and at 36 months of age. While caregivers reported high satisfaction with the program, no differences between groups on receptive or expressive language skills were observed. Law and colleagues (1999) also failed to find significant effects for the Hanen Parent Program. In their study of 38 three-year olds with receptive and expressive language impairment, caregivers participated in 10 weekly training sessions. Receptive and expressive language skills and caregiver use of language strategies did not differ between groups.

The difference in the results between these studies may be attributed to a number of factors. First, the variable effects of this program may be due to modification in content and dose (Wake et al., 2011). Second, the characteristics of the participants varied across studies. Law et al. (1999) included children between 33 and 39 months of age with expressive and receptive language impairment. Wake et al. (2011) included 18-month-old children with expressive impairment only

and Girolametto et al. (1996) included children between 25 and 35 months of age with expressive impairment only. Children with receptive and expressive language impairment may require a greater amount of intervention. Third, caregivers may have used different amounts of language support strategies. Wake et al. (2011) reported no measure of caregiver use of strategies. Law et al. (1999) reported no differences in caregiver use of language strategies between groups. Girolametto et al. (1996) reported large difference in caregivers' rate of speech and use of specific language targets. This difference in caregiver strategy use between groups appeared to have a subsequent effect on child language skills.

Other studies of caregiver-implemented interventions have found positive results. In a study of a 13-week caregiver-implemented intervention (the Heidelberg Parent-Based Language Intervention), Buschmann, Jooss, Rupp, Feldhusen, Pietz, and Philippi (2009) found significant and positive results for children with expressive language impairment. Caregivers were taught how to maximize interactions with their children to promote language development. Children in the intervention group had significantly higher expressive vocabularies than children in the control group ($d=.73$). Gibbard, Coglán, and MacDonald (2004) also found positive results in their study of the Parent-Based Intervention (PBI) in 28 children with expressive language impairment. Caregivers received 11 group-based intervention sessions over 26 weeks. Caregivers learned how to teach their children to use specific language targets in daily routines. Children whose caregivers received training made greater language gains than those children whose caregivers did not receive training. Because neither of these studies included a measure of caregiver use of language support strategies, it is difficult to determine the level of caregiver strategy use necessary to achieve optimal child language outcomes.

This body of research illustrates that teaching parents to use language facilitation strategies results in positive child language outcomes for young children with language delays as well as the

need to measure caregiver use of language support strategies in addition to child language outcomes. In addition, all of these studies failed to report fidelity measures related to the instructional methods used to teach caregivers to use the language support strategies. Thus, specific information about effective caregiver teaching strategies is lacking. Other limitations include the lack of maintenance data to determine the long-term effects of these interventions and lack of generalization data to evaluate whether caregivers generalized their strategy use to other settings or activities.

Using Single-Subject Designs to Simultaneously Monitor Caregiver and Child Behaviors

In contrast to group design studies for which the primary focus has been child language skills with little attention to the relationship between child and adult outcomes, the focus in single-subject designs has included the effects of caregiver training on caregivers' use of language intervention strategies as well as the subsequent effect on child language skills. More than 20 single-subject studies have examined caregiver-implemented language interventions for children with language impairment secondary to autism or intellectual disabilities (e.g., Kashinath, Woods, & Goldstein, 2006; Gillet & LeBlanc, 2007) and children at-risk for language impairment (Hancock, Kaiser, & Delaney, 2002). These single-subject studies have included: (a) measurement of generalized strategy use by caregivers (Kashinath et al., 2006), (b) examination of child communication in relation to changes in caregiver use of language support strategies (Gillet & LeBlanc, 2007), and (c) detailed description of the caregiver teaching procedures (Kashinath et al., 2006).

The most commonly studied caregiver-implemented language intervention in single-subject research is Enhanced Milieu Teaching (EMT). EMT is a conversation-based model of early language intervention using child interest and initiations as opportunities to model and prompt language in everyday contexts (Kaiser, 1993). Currently, more than 50 studies using different

combinations of EMT language support strategies have been conducted and results have consistently shown positive effects of EMT on various language forms and structures (Kaiser & Trent, 2007). Gains in language have been observed across settings (Alpert & Kaiser, 1992; Hancock & Kaiser, 1996; Kaiser, Hancock, & Nietfeld, 2000), classes of language structures (Goldstein & Mousetis, 1989; Warren, Gazdag, Bambara, & Jones, 1994), and global language development (Hancock & Kaiser, 2002; Kaiser et al., 2000). To our knowledge, no single-subject studies of caregiver-implemented language intervention have enrolled children with primary language impairment.

Caregiver Teaching as a Cascading Intervention

Results from group design studies of children with primary language impairment and single-subject studies of children with autism and intellectual disabilities illustrate the need for studies that measure both caregiver and child outcomes of caregiver-implemented interventions. Results from Law et al. (1999) indicate that when intervention methods fail to achieve positive effects for caregiver outcomes there are minimal effects for child outcomes. Child language outcomes appear to be directly related to the frequency and accuracy of their caregiver's use of language support strategies. Caregiver outcomes are related to the skill and proficiency of the interventionist who teaches the caregiver to use the language support strategies. Because the interventionist teaches the caregiver who then teaches the child, the caregiver training methods have a cascading effect. That is, the methods used to teach the caregiver impact the caregiver's use of language support strategies, which subsequently impact the child's language skill (Kaiser & Roberts, 2013).

This cascading model of intervention requires monitoring and measuring: (a) the teaching of language support strategies to the caregiver, (b) the caregiver implementation of intervention strategies, and (c) child language outcomes. The current study is the first study to measure all three components of this cascading intervention model (interventionist, caregiver, child). In this study,

the interventionists' teaching methods are closely monitored to ensure that all caregivers receive the same quantity and quality of intervention. In addition, the caregivers' use of language support strategies is measured during every intervention session rather than only at the beginning and end of intervention. Continuous monitoring of both interventionist and caregiver behavior maximizes the effects of the intervention on child language outcomes.

Effective Caregiver Teaching Methods

Because the cascading effects of caregiver-implemented interventions originate with the methods used to teach the caregiver, it is important to understand which adult teaching methods are most effective. Dunst and Trivette (2009) summarized the effects of six adult teaching methods on knowledge, skills, self-efficacy beliefs, and attitudes. The six strategies included: (a) introduction (i.e., previewing the strategy that is the focus of the teaching), (b) illustration (i.e., demonstrating the strategy use by the interventionist), (c) practice (e.g., practicing the strategy by the caregiver), (d) evaluation (i.e., assessing the outcome on the child's language skills of use of the strategy by the caregiver and interventionist), (e) reflection (i.e., reflecting on the strategy to identify the next steps in the learning process), and (f) mastery (i.e., assessing strategy use in relation to goals or standards). Dunst and Trivette (2009) used meta-analytic techniques to calculate an average effect size for each of the six adult learning methods on adult learning outcomes. Simultaneous use of these different methods had the largest effect ($d = 1.25$) when at least five methods were used. When only one or no strategy was used the effect was $d = .20$. When two, three, or four adult learning methods were used the average effect was $d = .75$. These results illustrate the added benefit of using multiple methods when teaching caregivers to use specific language support strategies.

The caregiver teaching model (teach-model-coach-review) used in the current study included all six methods found to be effective by Dunst and Trivette (2009). The "teach"

component of the intervention included the “introduction” method of explaining the targeted language support strategy. The “model” component of the intervention included the “illustration” method of real-life examples of the interventionist modeling the strategies with the child. The “coach” component of the intervention included the “practice” method of real-life application with the caregiver practicing the strategies while they received coaching from the interventionist. The “review” component of the intervention included the “evaluation” and “reflection” methods of reviewing the session and making a plan for next steps in learning the strategies. The “mastery” method was used when caregivers compared their strategy use to the criterion levels described in greater detail below.

Effective Language Support Strategies

A transactional model of child development (Sameroff, 1975) provides a theoretical basis for developing language intervention techniques based on transactional exchanges (Nelson, 1989). These transactions between adults and children serve as an opportunity for the child to acquire new, developmentally-appropriate language skills. From an intervention perspective, the transactional model serves as a means for tailoring adult responses to child utterances by using the child’s current language level to inform the appropriateness of new input to the child (Camarata & Yoder, 2002).

Matched turns and expansions are two EMT language support strategies that are specifically tailored to the child’s previous utterance. For example, when a child says “ball” and the adult responds by saying “roll the ball,” the adult has not only “matched” the child’s previous utterance by responding contingently but has also “expanded” the child’s previous utterance by adding a related word (“roll”). However, these transactional exchanges depend heavily on the child’s rate of communication. For example, if a child communicates at a low rate, the caregiver has fewer opportunities to provide matched turns and expansions. Thus, a child with a lower rate

of communication may have access to less linguistic input. Time delays and prompting are two EMT language support strategies that are designed to increase the child's rate of communication. For example, the caregiver holds up two different toys and waits for the child to gesture to the toy that he or she wants. Once the child initiates this non-verbal communicative request, the transactional exchange begins and the adult is able to map language onto the child's non-verbal communicative act. These four EMT language support strategies (matched turns, expansions, time delay, prompting) were chosen as the caregiver outcome measures in the current study because of this strong theoretical rationale coupled with strong empirical evidence of the effectiveness of EMT for children with intellectual disabilities and autism (Kaiser et al., 2000; Hancock & Kaiser, 2002; Hemmeter & Kaiser, 1994; Kaiser & Hester, 1994; Kaiser & Roberts, 2013).

Purpose of the Present Study

The purpose of this study was to investigate: (a) the effects of the Teach-Model-Coach-Review instructional approach on caregivers' use of four specific EMT language support strategies with toddlers with language impairment and (b) the subsequent effects of caregiver strategy use on child expressive language skills. The following research questions were addressed within the context of a single-subject design study, which allows for the simultaneous and continuous measurement of child and caregiver behavior:

1. What are the effects of the Teach-Model-Coach-Review instructional approach on caregivers' use of four different EMT language support strategies in a clinic setting?
 - a. Do caregivers generalize use of these strategies to new activities at home?
 - b. Do caregivers maintain their use of these strategies over time?
2. What are the effects of teaching caregivers to use EMT language support strategies on children's expressive language skills in the clinic?
 - a. Do children generalize language skills to new activities at home?

b. Do children maintain language skills over time?

The present study addressed the limitations of previous research by: (a) examining the effects of a caregiver-implemented language intervention with young children with primary language impairment within the context of a single-subject design study, (b) specifying and measuring the methods of caregiver teaching, (c) examining caregiver use of EMT language support strategies in relation to changes in child language, and (d) including measures of both caregiver and child maintenance and generalization.

Methods

Participants

Children were included in the study if they: (a) were between 24 and 42 months of age, (b) had a cognitive composite standard score of 80 or above on the *Bayley Scales of Infant and Toddler Development, Third Edition* (Bayley-III; Bayley, 2006), and (c) had a total language standard score of 79 or less on the Bayley-III. The 10th percentile cutoff on standardized language measures is a commonly used standard for identifying language impairment (Paul, 2007). Children were excluded from the study if they: (a) had a primary diagnosis of any specific disability other than language impairment (e.g., autism, Down syndrome, developmental disabilities), (b) had sound field hearing thresholds over 30dB, as measured by an audiologist, (c) demonstrated symptoms of a motor speech disorder based on the *Kaufman Speech Praxis Test for Children* (KSPT; Kaufman, 1995), (d) spoke a language other than English at home, as measured by caregiver report, (e) demonstrated signs of autism spectrum disorder as measured by a score of 2.0 or greater on the *Screening Tool for Autism in Two-Year Olds* (STAT; Stone, Coonrod, & Ousley, 2000) or (d) their caregiver was not willing to attend two intervention sessions in the clinic each week. All participants were recruited through an email sent to the university staff and community members describing the study. The first four children who met the aforementioned

inclusion criteria participated in the study. Table 1 includes demographic information about the caregivers and children.

Each caregiver-child dyad had two interventionists: a child interventionist who worked directly with the child and a caregiver educator who taught the caregiver. The child and caregiver educator for each dyad is listed in Table 1. There were a total of five interventionists. Jane, Amy, and Carol were second year students in an Early Childhood Special Education Master's Program. Jane and Carol had prior experience: (a) coding EMT data as undergraduate research assistants and (b) delivering the EMT intervention as graduate assistants for a randomized controlled trial of EMT (Kaiser & Roberts, 2013). Amy had two years of teaching experience. Martha and Cindy were certified speech-language pathologists with 5 and 3 years of experience working with children with language impairment. All interventionists were supervised by the first author and achieved fidelity levels on all intervention components on three consecutive sessions prior to the start of the study. The first author assisted the interventionists and was present for the majority of sessions.

Setting and Materials

Baseline and intervention sessions were conducted in a clinic room with child-sized furniture (child-sized table, cube chair). A variety of age-appropriate toys were used in baseline and intervention sessions. Toys included a farm, doll house, water toys, dolls, blocks, puppets, animal figures, play-doh, pretend cooking items, cars, and trains.

Design and Procedures

A single-subject, multiple-baseline across behaviors design, replicated across four caregiver-child dyads, was used to examine the effects the Teach-Model-Coach-Review instructional approach on the use of four EMT language support strategies. Caregiver use of the four EMT language support strategies was graphed for each session and examined using visual

inspection. The criterion for sequential introduction of the Teach-Model-Coach-Review instructional approach across EMT language support strategies was three consecutive sessions of caregiver use of the targeted language strategy at or above a pre-determined criterion level. These levels were chosen based on prior research of implementation rates necessary for optimal child outcomes (Kaiser & Roberts, 2013). In addition, child use of language targets for each session was graphed and examined using visual inspection. A summary of study components is provided in Figure 1.

Baseline. Baseline sessions lasted approximately 10 minutes. During these sessions, the caregiver was instructed to select toys and to play with her child and the toys as she typically would. Only the caregiver interacted with the child while the caregiver educator and supervisor watched the session. No teaching or coaching was provided.

Intervention. Caregivers were taught to use four different EMT language support strategies using the Teach-Model-Coach-Review instructional approach. Each of the four EMT language support strategies was taught individually. However, caregiver use of the strategies was cumulative. That is, the caregiver used each language support strategy after it was taught in all subsequent sessions. The EMT language support strategies are described in detail in the measures section. The “teach” component included an hour-long workshop in the clinic in which the caregiver educator: (a) defined the language support strategy, (b) provided a rationale for each component of the strategy, (c) described how to do the strategy, (d) showed video examples of the strategy, and (e) answered caregiver questions about the strategy. The workshop included standardized information (e.g., handouts, PowerPoint slides, video examples). Examples are available upon request from the first author. The child interventionist, the caregiver educator, the supervisor, and the caregiver were present during the workshop. Another adult played with the child in another room during this time.

Following the workshop, caregivers practiced the language support strategy during two, 40-minute intervention sessions each week in the clinic. The total duration of the intervention was approximately 12 weeks. These sessions included four, 10-minute sections corresponding to each of the four components of the Teach-Model-Coach-Review instructional approach. First, the caregiver educator reviewed the strategy by: (a) re-stating the strategy and giving an example of the strategy, (b) role playing with the caregiver, and (c) discussing with the caregiver ways to use the strategy with the specific set of toys selected based on child interests and skills. Second, the child interventionist modeled the language support strategy during a 10-minute session, while the caregiver educator highlighted and explained the strategy use to the caregiver. All sessions were play-based and toys varied by session based on the interest of each child. Only the child interventionist and the child were in the clinic room during this segment. The caregiver and the caregiver educator watched through a two-way mirror in an adjoining observation room. Third, the caregiver played with her child for 10 minutes. Age-appropriate toys were selected for each session based on child interest. During this part of the session, only the caregiver educator, the caregiver, the child, and the supervisor were present. The caregiver used the specific strategy being taught while the caregiver educator verbally coached the caregiver in her strategy use. This coaching included both praise (i.e., providing a positive statement about the caregiver's use of the strategy) and constructive feedback (i.e., telling the caregiver when to use a specific strategy or how to do the strategy correctly). Coaching focused on the specific strategy currently being taught, consistent with the multiple-baseline design across behaviors.

Fourth, after the practice section, the caregiver educator and the caregiver reviewed the session. The caregiver educator first asked the caregiver, "How did that feel?" or "What do you think about the session?" This allowed the caregiver to review and reflect about the session and her use of the strategies. The interventionist responded to the caregiver's comments,

acknowledging her feelings and summarizing the caregiver's use of the language support strategy in a positive way. The caregiver educator also linked the caregiver's use of strategies to child communication behavior (e.g., "I noticed that he imitated almost every word that you expanded. You taught him so many new words today."). Finally, the caregiver educator answered any questions and the caregiver and the caregiver educator made a plan for the next session (e.g., areas of focus/improvement). The caregiver was also instructed to use the target strategy throughout the day at home during daily routines and activities.

Treatment fidelity. Treatment fidelity data were collected on all four parts of the caregiver intervention: (a) teach, (b) model, (c) coach, and (d) review for 25% of sessions in each of the four conditions and across all four caregivers using treatment fidelity assessments. These assessments were completed by the child interventionist while watching the session from the observation booth. These assessments measured the occurrence or non-occurrence of specific caregiver teaching behaviors for each component of the caregiver intervention (teach, model, coach, review). Separate checklists were used for each EMT strategy, so that only behaviors specific to targeted strategies were measured. A percentage of compliance with the experimental protocol was calculated for each checklist using the following formula: number of behaviors implemented correctly divided by the number of planned behaviors (e.g., therapist highlights and models the target strategy at least 6 times; therapist summarizes the session) with the quotient multiplied by 100 (Billingsley, White, & Munson, 1980). Fidelity exceeded criterion levels for all interventionists across all four components of caregiver intervention as shown in Table 2.

Fidelity data on implementation of the EMT language support strategies by the child interventionist were collected from video recordings of the interventionist's session with the child. All sessions were transcribed and coded for the behaviors listed below using *Systematic Analysis of Language Transcripts* (SALT; Miller & Chapman, 2008). The coded transcripts were summarized

and data were graphed in Microsoft Excel. Coders were graduate students in special education. Coders were trained on transcription and coding by watching video recordings of practice sessions of caregiver-child interactions. Feedback was provided by a senior staff member who was reliable on the coding and transcription procedures. Coders were considered reliable when they achieved at least 85% point-by-point agreement on each of the EMT language support strategies described below for three consecutive 10-minute video recordings. Fidelity exceeded criterion levels across all EMT language support strategies as shown in Table 2.

Inter-rater reliability data were collected on at least 33% of all treatment fidelity sessions per condition for each interventionist-caregiver pair. For fidelity sessions, a second observer (a graduate student in special education) completed the caregiver intervention fidelity assessment by viewing a video recording. Agreement was calculated using Cohen's Kappa coefficient (Cohen, 1960).

Reliability exceeded $Kappa = .73$ for all treatment fidelity measures.

Home generalization. Caregiver-child interactions at home were video recorded to assess generalization of caregiver use of EMT language support strategies. Two home generalization observations were conducted on two different days at four time points in the study: (a) before baseline, (b) immediately after the last intervention session, (c) 3 months after intervention, and (d) 6 months after intervention. During each home generalization session an observer, who was not the child or caregiver educator, video recorded the caregiver and child interacting during three activities (book, play, snack). The play session lasted 10 minutes and book and snack each lasted 5 minutes. The caregiver chose the toys, book, or snack used during these home generalization activities. The caregiver was instructed to interact as she typically would with her child in these activities. No restrictions were placed on where or how the activities were conducted.

Dependent Variables

All sessions were video recorded and then transcribed and coded for the caregiver and child behaviors using SALT. The coded transcripts were summarized and data were graphed in Microsoft Excel. Coders were graduate students in special education and were trained as described above. Four caregiver support strategies served as the caregiver dependent variables: matched turns, expansions, time delays, and milieu prompting.

Matched turns. Matched turns were defined as adult verbal or non-verbal communicative turns that immediately followed (within 2 seconds) a child communicative turn and were contingent to the child communicative turn. Adult communicative turns were considered not matched if they: (a) did not immediately follow a child turn, (b) were not contingent, or (c) were not related to what the child communicated. Adult communicative turns were considered unintelligible if the coder could not determine whether the communicative turn was matched or unmatched. All adult turns were categorized as matched, unmatched, or unintelligible. Criterion was set at 75% of adult communicative turns that were matched in each session.

Expansions. Expansions were defined as: (a) adding one or two content words to the child's previous utterance, (b) replacing a word in the child's previous utterance to make it grammatically correct, or (c) changing the verb tense in the child's previous utterance to make it grammatically correct. Words were considered to be content words if they were specific and matched the intent of the child's utterance. Criterion was set at 40% of child utterances that were expanded by the adult.

Time delays. Time delays were defined as adult attempts to: (a) elicit verbal and non-verbal requests from the child, and (b) label these requests with specific target language. Adult use of time delays was considered correct if the adult: (a) presented a time delay nonverbally without using language to prompt a child's response or recruit the child's attention (e.g., gave the child a small piece of play-doh), (b) waited for the child to make a request, (c) labeled or expanded the child request with target language (e.g., said "more play-doh" when the child reached for more

play-doh), and (d) gave the child access to the desired object or performed the desired action with the object (e.g., gave the child more play-doh). Adult use of time delays was considered incorrect if the adult failed to do any of these four steps. If the child failed to request in response to the presentation of a time delay, the caregiver's attempt to present a time delay was coded as loss of child interest and was not included in percentage calculations. Criterion was set at 1 to 10 time delays per session of which 80% were correctly implemented using the four steps outlined above.

Adults were taught the following time delay strategies: (a) Assistance, (b) Inadequate Portions, (c) Choice Making, (d) Sabotage, (f) Silly Situations, and (g) Waiting with a Cue. Assistance was defined as creating a situation in which the child needs the adult's help (e.g., putting a lid on a container that the child is unable to take off independently). Inadequate Portions was defined as providing a small amount of a desired material (e.g., only putting a small amount of paint on a tray so that the child cannot finish her picture). Choice Making was defined as holding up two or more objects as options and then waiting for the child to communicate (e.g., providing choices between colors of play-doh). Sabotage was defined as not providing all the material the child needs to complete a task or interrupting the child from completing a desired task (e.g., putting a hand in front of a car going down a ramp). Silly Situation was defined as the adult violating a child's expectations by doing something unexpected that the child might find interesting or amusing (e.g., putting a pot on the child's head as a hat). Waiting with a Cue was defined as waiting with an expectant look before completing a desired task (e.g., pouring a small amount of water into a bowl, pausing before pouring more, and then looking expectantly at the child to request more). Waiting with a Cue typically was presented within the context of a familiar routine or practiced sequence of actions (e.g., holding the nose in front of a Mr. Potato Head's face and looking expectantly at the child to request the action of putting on the nose).

Milieu prompting episodes. Milieu prompting episodes were defined as sequences of adult prompts in response to a child verbal or non-verbal request. Each prompting sequence received a score between 0 and 7 based on whether the episode: (a) was in response to a request, (b) included the child's communication target, (c) followed a sequence of least to most prompts (i.e., open question to "say" prompt), (d) maintained the child's engagement throughout the episode, (e) included adequate time for the child to respond to the prompts, (f) excluded the use of yes/no or test questions (i.e., questions with only one correct answer; What's your name?), (g) ended with giving the child the desired object and expanding the child's response if the child used the prompted target or giving a correction if the child did not use the prompted target. An episode was considered correct if it received a score of 6 or 7. An episode was considered incorrect if it received a score less than 6. If the child lost interest during the prompting sequence, the episode was scored as child loss of interest and not included in percentage calculations. Criterion was set at 1 to 5 milieu prompting episodes per session of which 80% were implemented correctly using the steps outlined above.

Caregivers were taught the following milieu prompting strategies, in order from least to most supportive: (a) open questions, (b) choice questions, and (c) the "say" prompt. An open question provided the least support and required the child to generate an answer based on his or her preferences or knowledge (e.g., "What do you want?"). A choice question provided a choice between two objects or actions (e.g., "Drive the car or drive the truck?"). A "say" prompt directly modeled the desired response and prompted the child to repeat (e.g., "Say 'drive the car'"). Caregivers were instructed: (a) to move from least to most support (open question < choice question < "say" prompt), and (b) to give two "say" prompts if the child had not used the prompted target. Additionally, the caregiver was instructed to pause 5 seconds between each

prompt and to expand the child's utterance if the child used the prompted target or to correct the child if the child did not use the prompted target after two "say" prompts.

Child communication targets. Communication targets were chosen for each child based on the number of different words spoken during the language sample prior to intervention. If the child had fewer than 50 words and fewer than 10 verbs, the following were designated as single word targets: (a) nouns (e.g., "ball"), (b) verbs (e.g., "throw"), (c) protoverbs (e.g., "in"), and (d) requesting words (e.g., "more"). Ethan, John and Sally had single word targets. Nancy, who had more than 50 words, but who was not yet regularly combining words, had the following two-word communication targets: (a) Agent + Action (e.g., "I eat"), (b) Action + Object (e.g., "eat the pizza"), (c) Modifier + Noun (e.g., "yummy pizza"), and (d) X + Locative (e.g., "in the box"). Each child utterance was coded for the presence or absence of the child's communication target. The total number of communication targets (spontaneous, prompted, imitated) were totaled and graphed for each session.

Inter-rater reliability. Reliability data were collected for each of the four EMT language support strategies and child use of communication targets for 25% of sessions for each condition and for each caregiver. Two observers independently coded each adult verbal turn for the presence of each language support strategy and coded each child verbal turn for the presence of a communication target. All transcripts were verified by a second observer, such that only utterances with perfect agreement were coded. Agreement of $Kappa = .60$ was considered to be acceptable (Horner, Carr, Halle, McGee, Odom, & Wolery, 2005). All sessions exceeded $kappa = .73$ (with a range of .73 to .81) for all variables.

Standardized Child Outcome Measures

In addition to data collected during each session, standardized language measures were collected. The *Preschool Language Scale-Fourth Edition* (PLS-4; Zimmerman, Steiner, & Pond,

2002), the *Expressive One Word Picture Vocabulary Test-Fourth Edition* (EOWPVT; Brownell, 2000), and a standardized language sample were administered prior to intervention, after intervention, and 3 and 6 months following the end of intervention. The PLS-4 is a global measure of expressive and receptive language skills and has a mean score of 100 and a standard deviation of 15. The EOWPVT is a measure of expressive vocabulary with a mean of 100 and a standard deviation of 15. All assessments were administered by an experienced speech-language pathologist who did not provide the intervention sessions.

Language samples were collected using a standard set of materials and a standardized protocol. Each 20-minute language sample included five segments: (a) adult-child conversation using a wordless picture book, *Good Dog Carl* (Day, 1997), and (b) free play with four sets of toys (play-doh, babies, cars, barn). Each segment lasted approximately 4 minutes. The language sample was video recorded and transcribed using SALT. Analyses of the following linguistic measures were completed using the automated analysis program of SALT: (a) number of different word roots (NDW), (b) total number of words (TNW), and (c) mean length of utterance in morphemes (MLUm).

Data Analysis

First, data for each caregiver behavior (matched turns, expansions, time delays, milieu prompting) and child use of communication targets were entered and graphed using Microsoft Excel. Decisions about condition changes were made based on the visual analysis of the coded data by the first and second author. Intervention on subsequent EMT language support strategies was introduced only after the caregiver reached or exceeded the criterion level for the targeted language support strategy for at least three consecutive sessions. A functional relationship was determined by examining whether the dependent variable increased when the intervention started and if this pattern of change was consistent across EMT language support strategies and caregiver-child dyads.

Results

Results are illustrated in Figures 2, 3, 4, 5, and 6. Figures 2 through 5 each represent a caregiver's use of the four EMT language support strategies: matched turns, expansions, time delays, milieu prompting. For example, Figure 2 illustrates Ethan's mother's use of these four EMT language support strategies. The first graph in Figure 2 is her use of matched turns at home, in baseline, in intervention, immediately after intervention at home, 3 months after intervention at home, and 6 months after intervention at home. These time periods are separated by a solid black line. Different symbols distinguish the different contexts in which these strategies were measured. The square, triangle and cross represent her use of strategies in book, play, and snack at home respectively. Each session is also marked as being above (+) or below (-) the criterion level for the specific language support strategy. For example, the minus sign above the first seven data points for Ethan's mom in the first graph of Figure 2 indicates that she was below the 75% criteria level for matched turns for all of these sessions. The plus sign above the eighth data point (the first day of intervention) indicates that she met the criterion for matched turns (75%) on the first day of intervention. In other words, the intervention had an immediate effect on caregiver behavior. The third and fourth graphs on each figure have two axes, the left axis is for the percentage of correct usage of the strategy and the right axis for the number of instances of the strategy. For example, on the first day of intervention for time delays (third graph of Figure 2), Ethan's mother used time delay strategies 12 times and she used the strategies correctly 100% of the time. Results for each dependent variable across all four caregivers are summarized below by variable.

Matched Turns

The criterion for matched turns was 75%. A functional relationship between the introduction of intervention on matched turns and caregiver use of matched turns was demonstrated for all four caregivers as shown in Figures 2, 3, 4, and 5. Ethan's mother had a low

stable baseline for matched turns. When intervention on matched turns was introduced, her use of matched turns immediately increased to criterion levels and remained above the criterion level for all intervention sessions. Nancy's grandmother's use of matched turns was variable during baseline. After introduction of intervention on matched turns, her use of matched turns immediately increased to criterion levels and remained above criterion except for one intervention session. Her matched turns were somewhat variable across intervention sessions. John's mother had a variable level of matched turns that declined over the course of baseline. Following intervention on matched turns, she demonstrated an immediate increase. Although she was variable in her use of matched turns during intervention, she was above the criterion level for all intervention sessions. Sally's mother's use of matched turns in baseline was relatively stable in baseline and increased immediately after intervention on matched turns was introduced. During intervention, Sally's mother's use of matched turns was stable and above the criterion level for all sessions.

Expansions

The criterion for expansions was 40%. A functional relationship between the introduction of intervention on expansions and caregiver use of expansions was demonstrated for all four caregivers as shown in Figures 2, 3, 4, and 5. Ethan's mother had a low and relatively stable baseline with the exception of one session. After the introduction of intervention on expansions, her use of expansions immediately increased and exceeded the criterion level for all except for one intervention session. Nancy's grandmother had a low and stable baseline. After intervention on expansions, her use of expansions increased. Her use of expansions exceeded the criterion level in the second intervention session and remained above the criterion level for the remainder of the intervention. John's mother's use of expansions during baseline began to increase slightly with the introduction of intervention on matched turns but remained below criterion. After intervention on

expansions, her use of expansions exceeded the criterion level in all intervention sessions. Sally's mother's use of expansions was variable with a slight increase in trend during baseline. Following intervention on expansions, her use of expansions exceeded the criterion level and remained above this level for all intervention sessions.

Time Delays

Criterion for time delays was 1 to 10 time delays per session of which 80% were implemented correctly. A functional relationship between the introduction of intervention of time delays and caregiver use of time delays was demonstrated for all four caregivers as shown in Figures 2, 3, 4, and 5. During baseline, none of the caregivers used any time delays. After intervention on time delays occurred, Ethan's mother's use of time delays immediately increased. The frequency and accuracy of her time delay use exceeded the criterion level for all intervention sessions. Nancy's grandmother also demonstrated an immediate increase in her frequency and accuracy of time delay use. She exceeded the criterion level for time delays in all intervention sessions. John's mother's use of time delays was variable during the first three intervention sessions following the introduction of intervention on time delays. After this initial variability, her frequency and accuracy remained above the criterion level for the remaining intervention sessions. Sally's mother's use and accuracy of time delays immediately increased following intervention on time delays. However, during the first session following intervention on time delays, her frequency of use was outside the criterion level range by 1 (i.e., she used 11 time delays). After this initial session, her frequency and accuracy remained at the criterion level for the remaining intervention sessions.

Prompting

Criterion for milieu teaching prompts was 1 to 5 prompting episodes per session of which 80% were correctly implemented. A functional relationship between the introduction of

intervention on prompting and caregiver use of prompting was demonstrated for all four caregivers as shown in Figures 2, 3, 4, and 5. During baseline, none of the caregivers used any prompting, as defined above. During intervention Ethan's mother immediately increased her frequency and accuracy of prompting. While her accuracy was not at the criterion level until the second day of intervention on prompting, her frequency and accuracy exceeded the criterion for the remaining intervention sessions. Nancy's grandmother had a similar pattern to Ethan's mother. She did not meet the criterion level for accuracy until the second day of intervention on prompting, but she exceeded the criterion level for all subsequent intervention sessions. John's mother's frequency and accuracy of prompting immediately exceeded the criterion level following intervention on prompting and remained high for all intervention sessions. Sally's mother's frequency and accuracy of prompting also immediately exceeded the criterion level following intervention on prompting and remained above criterion for all intervention sessions.

Generalization of Strategy Use

During the pre-baseline home generalization assessment, all four caregivers used matched turns and expansions at low levels similar to the baseline levels in the clinic. They did not use time delays or milieu prompts correctly. After intervention, all caregivers used all four strategies more frequently at home than prior to intervention. However, generalization of strategy use to the home varied by caregiver and by strategy. Caregivers used all four strategies more in play at home than in book and snack. Only Ethan's mother used all four strategies at criterion levels during play. Nancy's grandmother used expansions and prompting but not matched turns and time delays at criterion levels during play at home. While her use of matched turns and time delays were not a criterion levels, her use exceeded baseline levels. John's mother did not generalize criterion-level use of any strategy to play at home. Only her use of matched turns exceeded baseline levels. Her use of all other strategies at home was similar to her baseline levels. Sally's mother used all

strategies except for time delays at criterion levels during play at home. While her use of time delays was not a criterion levels, it was higher than her baseline levels.

Only Ethan's mother and Nancy's grandmother used any of the strategies at criterion levels in book. Ethan's mother used expansions and Nancy's grandmother used matched turns and expansions at criterion levels during book. Neither generalized their use of prompting to book and Nancy's grandmother did not generalize use of time delays to book. While Ethan's mother used time delays at a higher level than baseline, her use was not at the criterion level. John's mother and Sally's mother did not generalize the use of any strategy to book at home.

Generalization of strategy use to snack followed a similar pattern to that observed during book. Ethan's mother and Nancy's grandmother used expansions and time delays at criterion levels during snack. Ethan's mother also used matched turns but not prompting at criterion levels during snack and Nancy's grandmother used prompting but not matched turns at criterion levels during snack. John's mother and Sally's mother did not generalize the use of any strategy to snack at home.

Maintenance of Strategy Use at Home

All four caregivers maintained the use of previously-learned strategies with the introduction of a new strategy during intervention sessions in the clinic. Correct use of strategies varied over time and across contexts. Maintenance of strategy use was greatest for matched turns during play at home. All caregivers continued to use matched turns at criterion levels at 3 and 6 months after intervention. Only Ethan's mother used matched turns at the criterion level during snack 3 and 6 months after intervention. Use of matched turns did not maintain for any caregiver during book.

Maintenance of expansions followed a similar pattern to matched turns. All caregivers continued to use expansions above criterion levels during play at 3 and 6 months after

intervention, with the exception of John's mother. Ethan's mother and Nancy's grandmother maintained their use of expansions at criterion levels at 3 and 6 months after intervention in snack, but not in book. John's mother and Sally's mother did not maintain use of expansions in book or snack at 3 or 6 months after intervention. Time delays and milieu prompting returned to baseline levels for all caregivers during book, play, and snack at home at 3 and 6 months following the end of intervention, with one exception. Nancy's grandmother used time delays above baseline levels during play at home.

Child Use of Communication Targets during Intervention

A functional relationship between caregiver use of strategies and child use of communication targets was observed for three of the four children as shown in Figure 6. During baseline, children used an average of 4 communication targets with a range of 0 to 8. During intervention, children used an average of 17 communication targets with a range of 0 to 45. Child use of targets increased immediately when intervention began for Ethan, Nancy, and John. Further increases in target use were observed over the course of the intervention for each child, generally corresponding to teaching the caregivers to use successive EMT language support strategies. Three of the four children displayed the highest number of communication targets in the last stage of the intervention. Sally showed minimal increases in her use of targets after the introduction of intervention and her use of targets did not increase progressively during intervention.

Child Generalization and Maintenance of Communication Targets

Ethan, Nancy, and John generalized their use of communication targets to play at home at similar levels to those observed in the clinic. All children also used their communication targets in book and snack more frequently after intervention than during baseline. However, their use of communication targets in book and snack was lower than their use of targets during play in the clinic or play at home. In general, all four children maintained their use of communication targets

over time during book, play, and snack activities, with the exception of John whose use of communication targets decreased in book.

Child Language on Standardized Language Measures

All children made substantial gains in standardized measures of language, as shown in Table 3. Children gained between 9 and 31 standard score points on the PLS-4 and between 13 and 31 standard score points on the EOWPVT. Children continued to make gains in standardized scores 6 months after intervention. All children used a greater number of different and total words and longer sentences in the language sample following intervention. Ethan gained 46 different words, Nancy gained 87 different words, John gained 170 different words and Sally gained 7 different words in the language sample between the beginning and end of intervention. In addition, children increased their mean length of utterance in morphemes (MLUm) by .06 to 2.86. These changes should be interpreted with caution due to the absence of a non-treatment control group.

Discussion

The purpose of this study was to evaluate the effects of the Teach-Model-Coach-Review instructional approach on caregiver use, generalization, and maintenance of EMT language support strategies and subsequent changes in child use of communication targets. Results of the study indicate that the Teach-Model-Coach-Review instructional approach resulted in changes in caregiver use of all four EMT language support strategies during intervention. Caregiver use of EMT language support strategies generalized to play at home for 3 of 4 caregivers. Expansions were most easily generalized and maintained. Prompting was the most difficult to generalize and maintain. Caregivers had the most difficulty generalizing to reading a book, which may be due to the fact that book reading is the activity least similar to play. Furthermore, book reading is the most adult-directed activity, in which adults typically read the text and are less likely to wait for children to comment or take communication turns while reading. These results suggest that

caregivers may require additional teaching across activities and over time to successfully implement EMT language support strategies at criterion levels across activities.

Caregiver use of EMT language support strategies resulted in changes in child use of communication targets during intervention and at home after intervention. Children used an average of 13 more communication targets per session in intervention than during baseline. These increases in child use of communication targets maintained over time during play at home. The pattern of generalization was similar for caregivers and children. Children used fewer communication targets in activities (book, snack) in which the caregiver used the EMT language support strategies at lower levels.

In addition to changes in communication targets, children also made substantial gains in standardized measures of receptive and expressive language skills. Children gained between 9 and 31 standard score points, produced between 7 and 170 more words, and used longer utterances during a language sample. Three children (Ethan, Nancy, John) had scores within the typical range of language development at the end of the study. These data should be interpreted cautiously given the design of the study. It is difficult to determine if the child gains indicate learning or if child gains are only a response to changes in caregiver interaction patterns. However, data collected from intervention sessions, generalization sessions, and standardized language assessments consistently suggest that children made language gains greater than would be expected due to maturation alone.

These gains are similar to those found in other caregiver-implemented studies for children with primary language impairment. In prior studies, children's expressive vocabulary gains ranged from 2 (Law et al., 1999) to 101 words (Gibbard et al., 2004) over 12 weeks. Children in this study learned an average of 78 new expressive vocabulary words over the 12 week intervention period. The only other study examining the effects of a caregiver-implemented intervention for

children with receptive and expressive language delays (Law et al., 1999) failed to find significant results in child language skills. One possible explanation for the difference in results between the present study and the Law et al. study is the difference in caregiver use of EMT language support strategies.

This study extends previous research on caregiver-implemented interventions in several ways. First, caregivers received individual teaching sessions, as compared to the Hanen Parent Program which provides training in a group format. Second, this is the first study to establish targets for caregivers in addition to setting targets for children, such that caregivers did not learn another strategy until they had met the criterion level for the target strategy during three consecutive sessions. Third, caregivers' use of EMT language support strategies was measured during each intervention session as opposed to only measuring caregiver behavior before and after intervention. This continuous level of monitoring allowed for individualized and immediate adjustments to the methods used to teach the caregivers such that caregivers maintained a high level of strategy use throughout the duration of the study and also 3 and 6 months following intervention. The results of this study may be further optimized by providing intervention in the home rather than in a clinic setting. This would also improve the external validity of these findings as home-based early intervention is considered to be the current standard of care.

It is also important to note that in the context of a transactional approach to language intervention, such substantial gains in language skills may have impacted the caregivers' maintenance of strategy use. For example, John's mother did not maintain strategy use but her child scored a 115 on the PLS-4 at the end of the study, indicating above-average language skills. It is likely that some of the EMT language support strategies as taught during intervention were no longer appropriate. Because her child was spontaneously talking at a high rate (38 words per minute), it is likely that she did not need to use time delays or prompting to elicit language.

Furthermore, his MLUm was 3.86, indicating that the length of the majority of his utterances were between 3 and 4 words. During the language sample prior to intervention he only said words like (mom, no, oh, and uh-oh), which could easily be expanded to a complete sentence. However, after intervention he made statements like “I can’t get in the house” and “We can sleep on top of that house.” These longer utterances are complete and therefore it was not appropriate to expand such utterances.

Limitations and Future Research

These results should be interpreted within the context of the following limitations. First, while experimental control was demonstrated across all behaviors, a slight increase in expansions occurred before intervention for expansions was introduced. This change coincided with the introduction of an experienced interventionist who modeled all EMT language support strategies prior to intervention on expansions. Since no instruction was provided on expansions during the first condition, these data suggest that some observational learning may have occurred or that the first two behaviors, matched turns and expansions, are not completely independent. However, it is important to note that direct instruction was needed for every caregiver to reach the 40% criterion for expansions. Future research should investigate caregiver skill acquisition with and without modeling by an interventionist. Understanding which teaching strategies (teach, model, coach, review) are most effective for teaching caregivers to use each language strategy is essential for maximizing effectiveness and efficiency of this type of intervention.

Second, the overall language outcomes for the children in the study may have been the result of the combined dosage of the EMT intervention from the interventionist and their caregiver. Children received intervention from their caregiver during the clinic sessions and at home, and from the interventionist during the 10-minute session in which the interventionist modeled the strategies for the caregiver. While these modeling sessions were used to teach

caregivers to use EMT language support strategies, they also provided the children with an additional dose of the intervention delivered at high levels of fidelity. Future research should compare instruction of caregivers with and without live modeling in order to examine the additive effects of interventionist's use of EMT language support strategies.

Third, because a functional relationship between caregiver use of strategies and child use of communication targets could be evaluated only between baseline and intervention on matched turns, the unique effects of the introduction of each of the subsequent EMT language support strategies on child use of communication targets is not clearly controlled in the design. The analysis of this relationship is further mitigated by the interventionist's use of all four EMT language support strategies from the start of intervention. Future component analyses are needed to examine the relative effects of each language support strategy and the optimal combination of support strategies for optimizing language intervention outcomes.

Fourth, characteristics of interventionists and caregivers who chose to participate may have influenced the results. Interventionists were directly supervised by an experienced speech-language pathologist specializing in family-centered intervention. In addition, caregivers who agreed to participate in the study were highly motivated to help their child's language skills. Future research involving a population-based sample and community-based speech language pathologists is necessary to determine if similar results are possible in everyday clinical practice.

Last, because all children and caregivers were from mainstream American culture, it is unclear if these results will generalize to caregivers from other cultures that may have different beliefs regarding caregiver-child interactions (van Kleeck, 1994). While further research on teaching strategies that are most effective for non-mainstream cultures is needed, these teaching procedures and EMT language support strategies might be adapted to fit the individual needs of families from different cultural backgrounds. Adaptations might include gathering information

about caregiver cultural beliefs and practices that may affect the choice of language skills targeted during intervention (Hammer, 1998). Wing, Kohnert, Pham, Cordero, Ebert, Kan, and Blaiser (2007) provide recommendations such as using older siblings to model language targets or teaching language in additional routines that are of higher priority to the family (e.g., social greetings). It is important to consider individual family beliefs about communication and early intervention, preferences for interaction style, and their daily activities and routines when choosing how best to involve family members in the intervention process.

Conclusions

The results of this study indicate that the Teach-Model-Coach-Review instructional approach is a potentially effective way to teach caregivers to use EMT language support strategies within the context of play. However, caregivers had difficulty generalizing and maintaining their use of some strategies, indicating that teaching across routines and over time is necessary in order to achieve optimal outcomes. Nevertheless, high use of EMT language support strategies during intervention resulted in increases in child use of communication targets. These positive changes in language skills maintained 6 months after the intervention and generalized to the home. This study adds to the growing literature supporting the use of caregiver-implemented language interventions to improve young children's language outcomes and lays the foundation for the systematic analysis of effective strategies that ensure these outcomes.

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Table 1

Child, Caregiver and Interventionist Characteristics

	Ethan	Nancy	John	Sally
Child Characteristics				
Child age at entry (months)	26	38	34	25
Gender	Male	Female	Male	Female
Ethnicity	Caucasian	Caucasian	Caucasian	Caucasian
Siblings	0	0	2	0
Bayley Cognitive Standard Score	95	90	90	80
Bayley Receptive Scale Language	4	8	10	7
Bayley Expressive Scale Language	5	5	3	6
Bayley Total Language Standard Score	68	79	79	79
Combining words	No	Yes	No	No
Speech Therapy	0	60 min/week	0	0
Other Services	0	0	0	0
Caregiver Characteristics				
Caregiver	Mother	Grandmother	Mother	Mother
Caregiver occupation	Nurse	Bus Driver	Home Maker	Nurse
Caregiver's age	28	50	35	35
Caregiver's highest education	4 year	High School	4 year	Master's
Family income	70,000	50,000	>100,000	>100,000
Interventionist				
Child Interventionist	Carol	Amy	Cindy	Amy
Caregiver Educator	Jane	Carol	Martha	Jane

Table 2

Means and Ranges for Treatment Fidelity for the Teach-Model-Coach-Review Instructional Approach by the Caregiver Educator and For Use of EMT language support strategies by the Child Interventionist

	Ethan	Nancy	John	Sally
Caregiver Educator – Teach-Model-Coach-Review				
Baseline Phase	100% (B3 ^a)	100% (B3) 100% (B6) 100% (B7)	100% (B3) 100% (B5) 100% (B9)	100% (B3) 100% (B5) 100% (B7)
Matched Turns Phase (criteria > 85%)	100% (W ^b) 100% (I2 ^c) 97% (I6)	100% (W) 100% (I4) 100% (I5)	100% (W) 91% (I1) 95% (I6)	100% (W) 100% (I5) 100% (I6)
Expansions Phase (criteria > 85%)	100% (W) 100% (I10) 100% (I12)	100% (W) 100% (I9) 100% (I10)	100% (W) 100% (I10) 85% (I14)	100% (I8) 98% (I10)
Time Delays Phase (criteria > 85%)	100% (W) 100% (I16)	100% (W) 100% (I12)	100% (W) 97% (I17) 100% (I19)	100% (W) 100% (I13)
Prompting Phase (criteria > 85%)	100% (W) 100% (I21) 89% (I23)	98% (W) 97% (I20) 100% (I23)	100% (I22) 100% (I23)	100% (W) 100% (I16) 100% (I17) 97% (I18)
Child Interventionist – Use of EMT language support strategies				
Matched Turns across Phases Criteria: > 75%	97% (94-100%)	93% (92-97%)	89% (79-100%)	96% (91-100%)
Expansions across Phases Criteria: > 40%	69% (55-81%)	66% (52%-94%)	58% (40-84%)	79% (64-100%)
Prompting across Phases Criteria: 1-5 prompting episodes/session Criteria: > 80%	2 (1-5) 96% (80-100%)	3 (1-5) 100% (n/a)	2 (1-5) 100% (n/a)	2 (1-3) 100% (n/a)

Note. ^aB = Session number in baseline phase, ^bW = Workshop, ^cI = Session number in intervention phase

Table 3

Child Outcomes on Standardized Language Measures

	Ethan				Nancy				John				Sally			
	Pre	Post	3 mos.	6 mos.	Pre	Post	3 mos.	6 mos.	Pre	Post	3 mos.	6 mos.	Pre	Post	3 mos.	6 mos.
PLS-4 ^a	72	92	n/a	105	69	105	n/a	109	84	115	n/a	131	70	79	86	93
EOWPVT ^b	<55	80	n/a	96	62	93	n/a	92	<55	78	n/a	102	<55	68	80	76
MLUm ^c	1.0 7	1.82	1.99	3.21	1.62	2.98	4.10	3.55	1.0	3.86	5.39	4.84	1.00	1.06	1.84	2.32
NDW ^d	16	62	65	118	46	133	155	166	8	178	133	166	3	10	47	59
TNW ^d	60	181	245	551	132	626	881	703	33	767	832	906	18	29	117	205

Note. ^aPLS-4: Preschool Language Scale-4th Edition Standard Score, ^bEOWPVT- Expressive One Word Picture Vocabulary Test Standard Score, ^cMLUm= mean length of utterance in morphemes, ^dNDW= number of different word roots, ^eTNW = total number of words

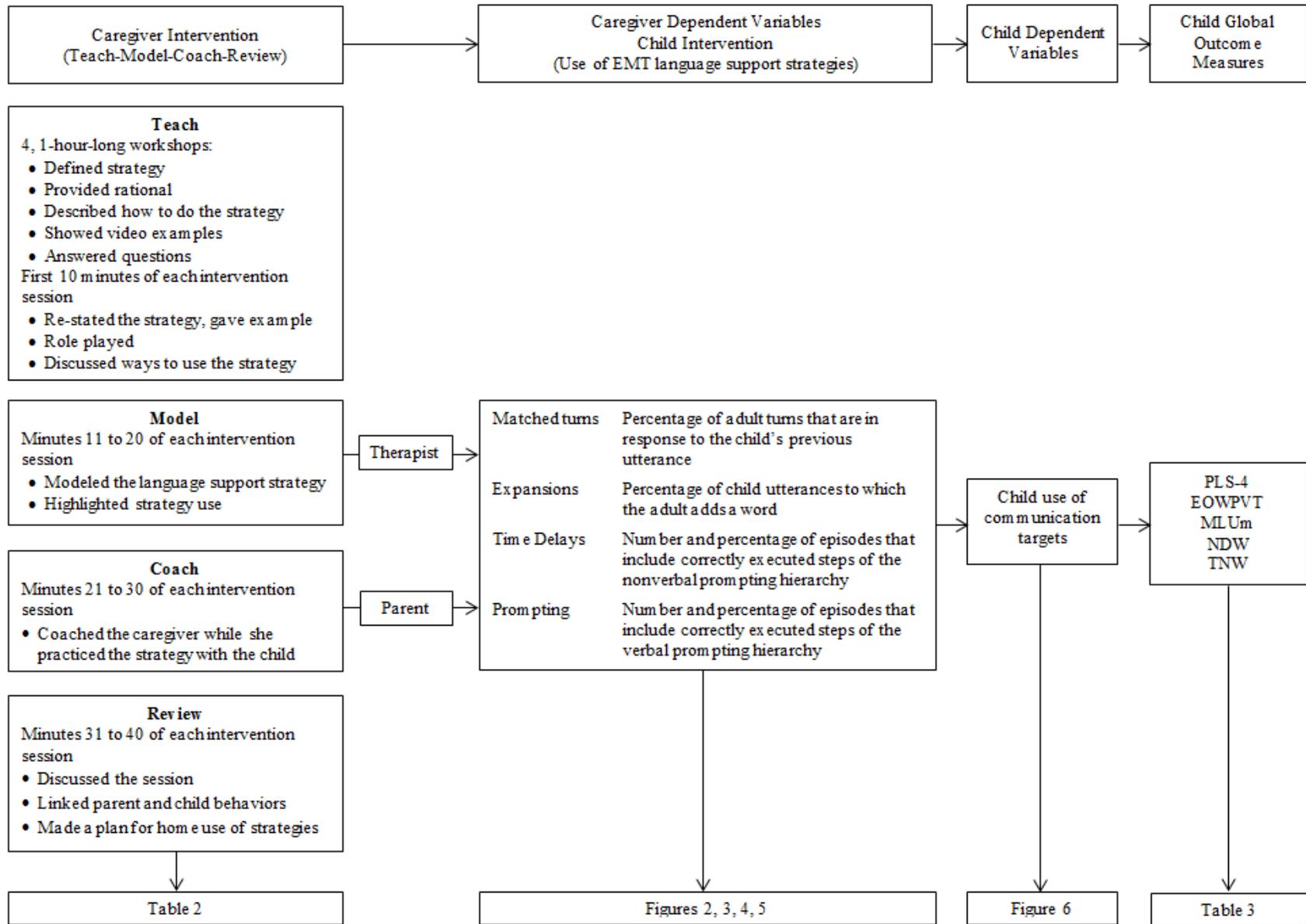


Figure 1. Summary of study components.

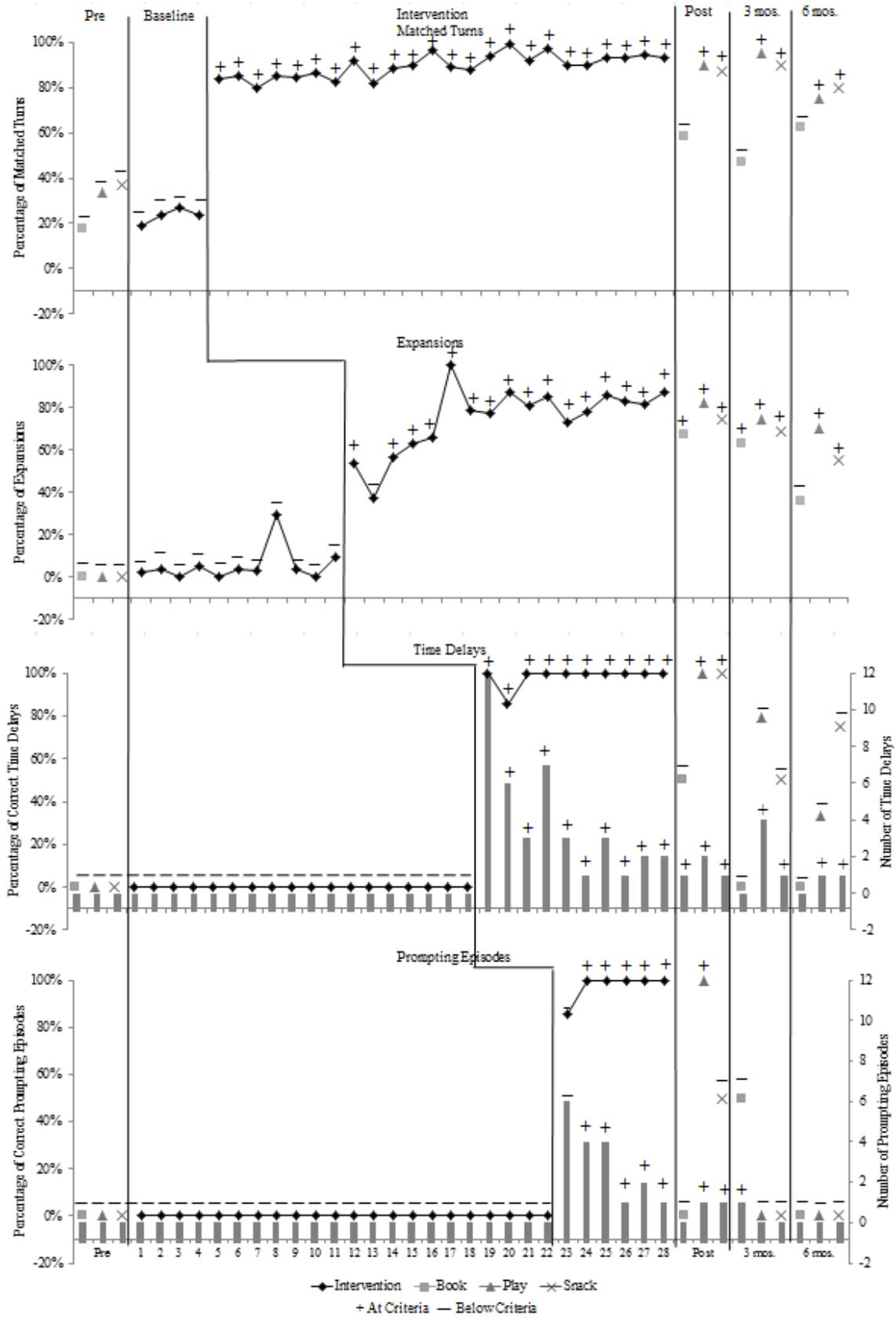


Figure 2. Use of language support strategies by Ethan's mother.

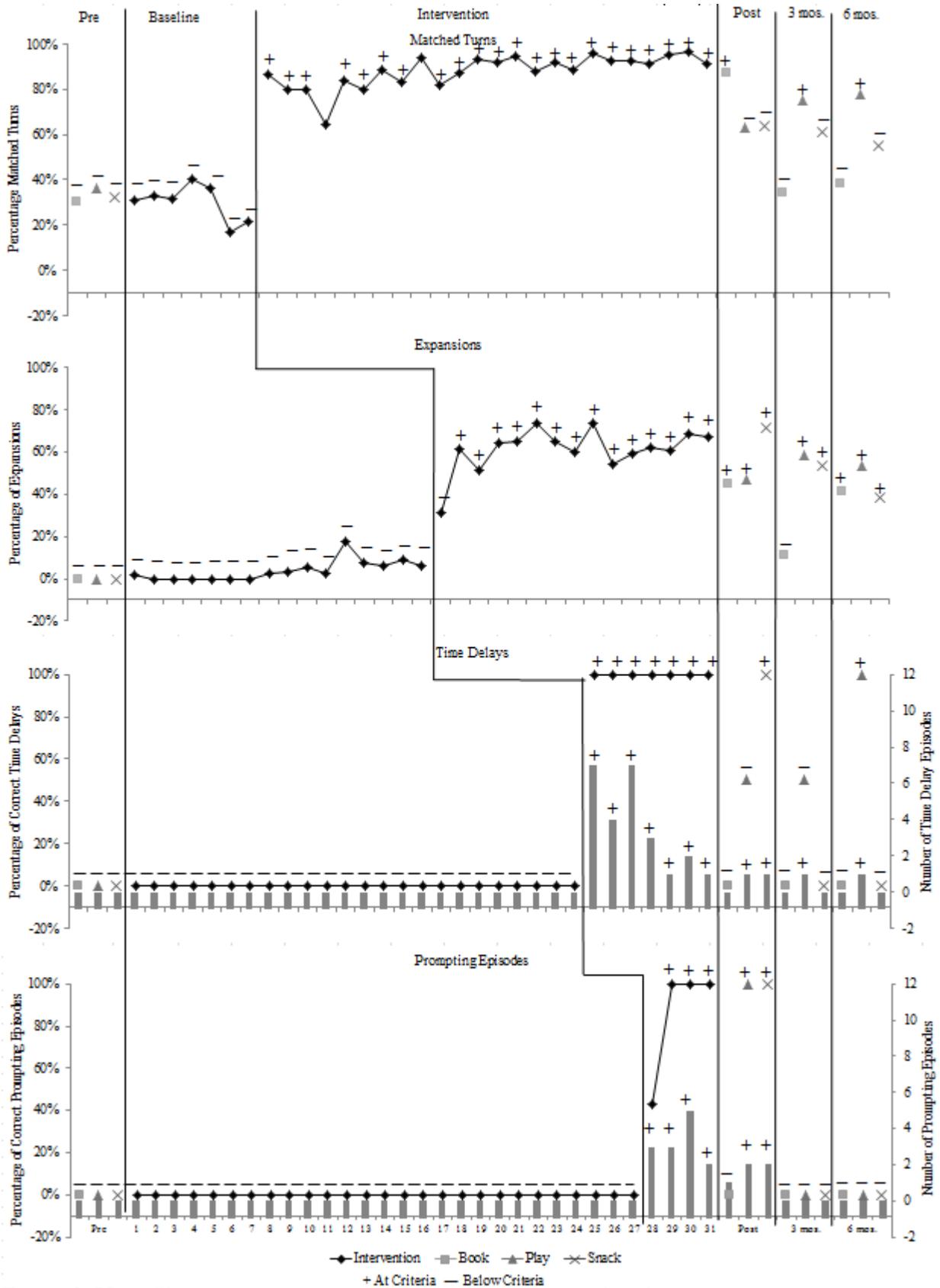


Figure 3. Use of language support strategies by Nancy's grandmother.

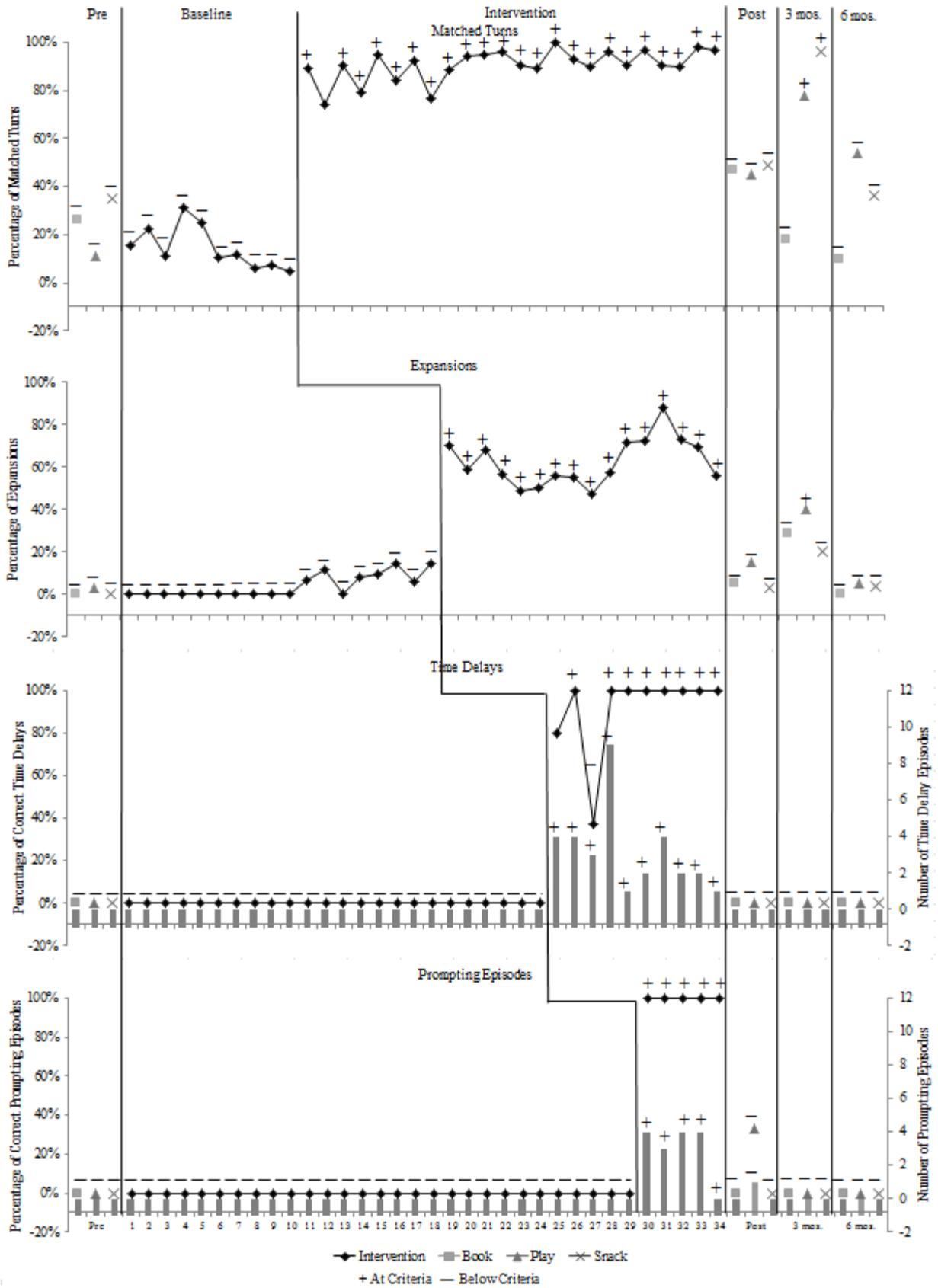


Figure 4. Use of language support strategies by John's mother.

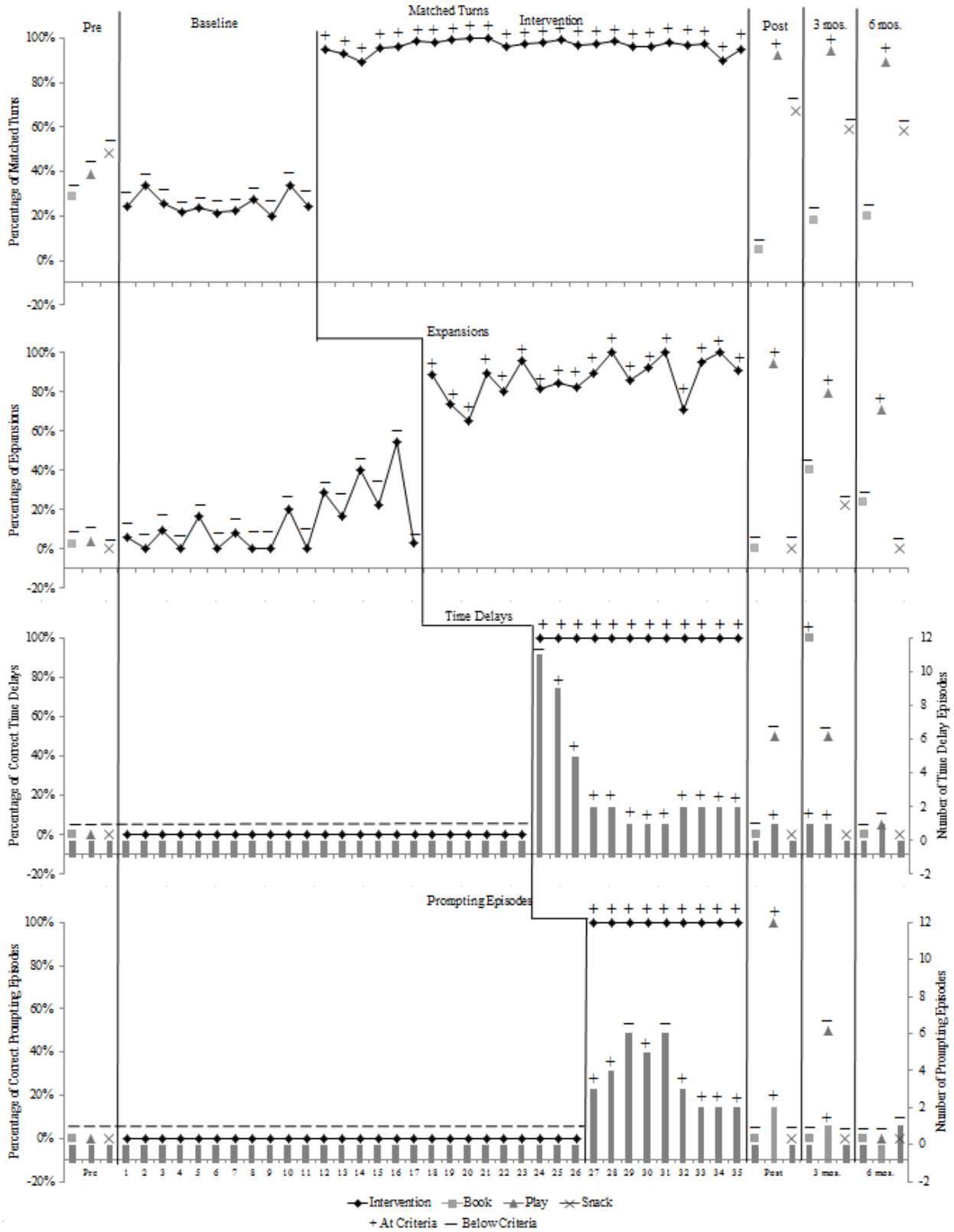


Figure 5. Use of EMT language support strategies by Sally's mother.

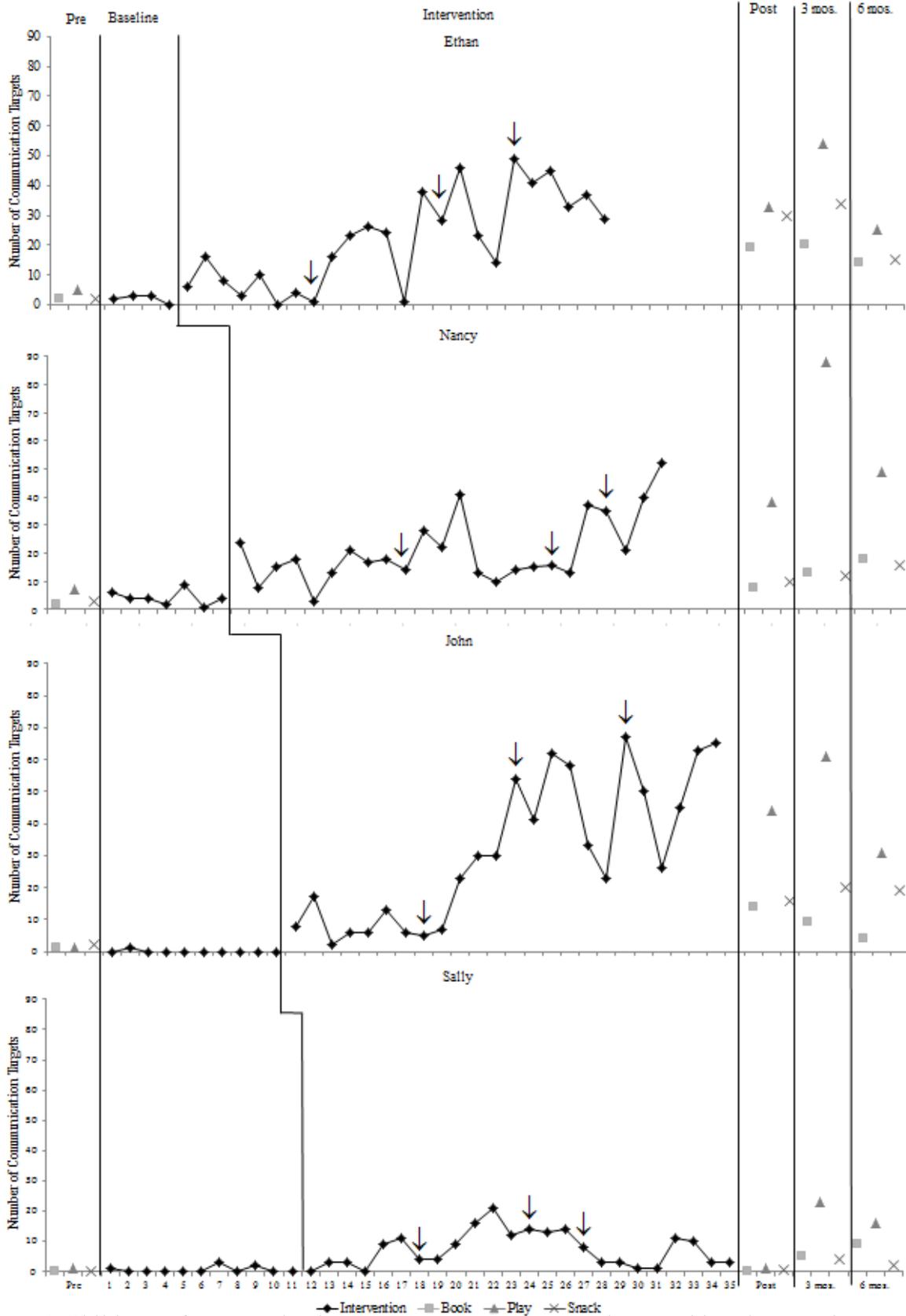


Figure 6. Child use of communication targets. Arrows denote when teaching the caregiver a new skill began.