

Teaching Parents Enhanced Milieu Teaching With Words and Signs Using the Teach-Model-Coach-Review Model

Topics in Early Childhood Special Education
2017, Vol. 36(4) 192–204
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DOI: 10.1177/0271121415621027
tecse.sagepub.com


Courtney A. Wright, PhD¹ and Ann P. Kaiser, PhD¹

Abstract

Measuring treatment fidelity is an essential step in research designed to increase the use of evidence-based practices. For parent-implemented communication interventions, measuring the implementation of the teaching and coaching provided to the parents is as critical as measuring the parents' delivery of the intervention to the child. Both levels of measurement are important in translating research into effective practice. In a single-case multiple-baseline design, the effectiveness of the teach-model-coach-review model for teaching Enhanced Milieu Teaching (EMT) Words and Signs to parents of young children with Down syndrome was evaluated. Implementation of parent training was completed with high fidelity. In addition, there was a functional relation between the implementation of the parent training and parents' use of the specific EMT intervention strategies. The findings of this study replicate and extend previous studies suggesting systematic teaching and coaching can be effective in improving parent use of naturalistic communication strategies.

Keywords

evidence-based practices, parent training, families, Down syndrome, genetic syndromes, communication/language, sign language, intervention strategies

Children with Down syndrome (DS) have language delays beyond what is expected based on their cognitive abilities (Miller, 1999). Because of marked delays in spoken language and persistent low intelligibility (J. E. Roberts, Price, & Malkin, 2007), early communication interventions that include the use of sign language and other augmentative and alternative communication (AAC) systems are often recommended for young children with DS. Access to partners who have been taught strategies to support communication and teach language is critical for children with DS because they may require more systematic instruction and more frequent learning opportunities to facilitate their language learning (Yoder, Woynaroski, Fey, & Warren, 2014). In addition, when the primary or auxiliary mode of communication is sign or another alternative communication system, young children with DS need partners who can teach the functional use of the mode in natural contexts. Teaching parents and caregivers to implement effective language teaching and interaction strategies with young children with DS who are AAC users is an important step in addressing these children's needs for effective intervention.

M. Y. Roberts and Kaiser (2011), in a meta-analysis of group design studies of parent-implemented communication interventions, found that children receiving parent-implemented language interventions showed significant gains in receptive language, expressive language, receptive vocabulary, expressive vocabulary, expressive morphosyntax, and rate compared with children in community control conditions. In a more recent meta-analysis of 26 studies of interventions measuring spoken language outcomes for young children with autism, Hampton, Kaiser, and Fuller (2015) found that therapist plus parent-implemented interventions resulted in greater gains in spoken language than therapist-only and parent-only social communication interventions.

Despite the positive outcomes of parent-implemented interventions, there are weaknesses in these studies related to the training and coaching of parents in the intervention strategies as well as in the measurement of fidelity of both the implementation of the parent training and the parents' use of the intervention. M. Y. Roberts and Kaiser (2011) reported that half (9/18) of the studies described

Parent-Implemented Language Interventions

There is evidence that parent-implemented language interventions are effective for children who use spoken language.

¹Vanderbilt University, Nashville, TN, USA

Corresponding Author:

Courtney A. Wright, Department of Special Education, Vanderbilt University, 314 One Magnolia Circle, Nashville, TN 37232, USA.
Email: courtney.a.wright@vanderbilt.edu

the strategies used to teach parents the intervention, and generally, the descriptions were not sufficient for replication or application by practitioners. Only five of the 18 studies measured fidelity of implementation of the parent training strategies. Hampton et al. (2015) also reported half (9/18) of the studies with parent-implemented interventions included a manualized protocol for teaching parents. Of those 18 studies, seven studies measured treatment fidelity for the strategies used during parent training. Most studies used multiple strategies to teach parents, with nine of 18 reporting coaching as an element of the training. Of the nine, only four described the procedures for training parents and no studies reported direct measures of the fidelity of coaching or provided data on the rate of use of any specific strategy used to teach parents (e.g., coaching, modeling).

Teach-Model-Coach-Review (TMCR)

One manualized protocol for teaching parents to use language strategies is the TMCR model (Kaiser & Roberts, 2013). The first element, *teach*, is made of up two components. The first is a one-on-one workshop in which the therapist describes, provides a rationale for, and shows video clips of the strategies being learned. The second component of the teach element takes place at the start of every intervention session. The therapist reviews the strategy with the parent, models the strategy, and role-plays with the parent to ensure understanding. The second element, *model*, takes place immediately following the teach element at the start of each session. During modeling, the therapist is interacting directly with the child while occasionally highlighting strategy use verbally to the parent without breaking attention from the child. The third element, *coach*, occurs following the therapist modeling with the child. The parent takes over the interaction with the child while the therapist watches and provides verbal coaching in the form of constructive feedback and specific praise related to the strategies of the intervention. The final element, *review*, involves a discussion between the therapist and the parent and occurs after the parent practices with the child. The therapist elicits reflection from the parent by asking open-ended questions. The therapist responds to these reflections as well as summarizes the parent's use of skills while relating their behavior back to the child's behavior (Kaiser & Roberts, 2013).

Kaiser and Roberts (2013) incorporated each element of the TMCR model to match the six primary adult learning methods as identified by Trivette, Dunst, Hamby, and O'Herin (2009). In this review, Trivette et al. synthesized the results of 79 studies to determine the relationship between adult learning method characteristics and learner outcomes. Adult learning method characteristics were extracted as main features of adult learning strategies (accelerated learning, coaching, guided design, and just-in-time training) and included introduce, illustrate, practice,

evaluate, reflection, and mastery. Introduction is the method used to preview the materials for training. This occurs during the *teach* element of the TMCR model during the one-on-one workshops. Illustration is the demonstration of the material or practice for the learner. This occurs during the *model* portion of the TMCR model. Practice takes place when the learner can engage in use of the material. This occurs during the coach portion of the TMCR model. Evaluation includes the process of the learner assessing their use of the strategy or practice and reflection occurs when the learner can self-assess their use of the skills. Both evaluation and reflection take place during the *review* element of the TMCR model. The final characteristic, mastery (i.e., when the learner can compare their work against a standardized set of expectations), is not addressed directly in the TMCR model. One of the core elements of the TMCR model that is not identified by Trivette et al. is the idea of live coaching in the form of direct constructive feedback and praise while the parent is practicing. Although feedback and practice are included in Trivette's characteristics, these do not necessarily include live coaching that is included in the TMCR model.

Results of the synthesis completed by Trivette et al. (2009) indicated that the presence of any of the six characteristics resulted in positive adult learning. However, more robust learner outcomes were attained when (a) multiple learning methods were combined, (b) methods were used with smaller groups of learners, and (c) methods were used with learners for more than 10 hr. In the TMCR model, five of the six learning methods are combined, training occurs one-on-one with the parent and the therapist, and methods are used in at least 24 one-hour sessions, which is well over the 10 hr recommended for robust outcomes.

In a recent single-case design study, four caregivers of young children with expressive and receptive language delays were taught the strategies of Enhanced Milieu Teaching (EMT; Hancock & Kaiser, 2006) using a TMCR parent training model (M. Y. Roberts, Kaiser, Wolfe, Bryant, & Spidalieri, 2014). Authors measured the fidelity of implementation of the TMCR model to teach the caregivers EMT as well as the caregiver's fidelity of use of EMT strategies with their children. In addition, child outcomes were measured throughout. Fidelity was high across both implementation and intervention levels of the study, and there was a functional relation between the caregivers' use of the intervention and child outcomes.

Nunes and Hanline (2007) conducted a single-case design study of parent-implemented language intervention including the use of an AAC system. This study involved a parent training intervention that utilized all six of the adult learning methods identified by Trivette et al. (2009). One parent was taught naturalistic intervention strategies for increasing her child's social communication, including the use of an AAC system, during home routines. Parent training sessions

included the following procedures: (a) defining, modeling, and discussing the teaching strategies during which the parent was expected to describe and provide examples of the strategy; (b) role-playing in which the parent was expected to demonstrate correct use of the strategies; (c) pointing out opportunities to use strategies with the child; (d) modeling use of the strategies with the child; and (e) providing feedback and answering questions that the parent may have. The study measured fidelity of the implementation of the parent training and the parent use of the intervention with the child; however, the design was not adequate for drawing conclusions about the effects of the intervention.

Present Study

The purpose of the present study was to replicate and extend previous studies using multiple adult learning strategies by assessing the effects of the TMCR parent-teaching model (Kaiser & Roberts, 2013) on parents' use of EMT strategies when teaching both spoken and signed words (EMT Words and Signs). Both the fidelity with which the TMCR model is implemented and the fidelity with which the parents implement EMT was measured. The study enrolled young children with DS who could potentially benefit from augmented communication and their parents. A single-case multiple-baseline design across parent behaviors replicated across four parent-child dyads was used to address the following research questions:

Research Question 1: Can the TMCR model be implemented at high levels of fidelity with parents of children with DS?

Research Question 2: Does training parents using the TMCR model result in parents using EMT Words and Signs at criterion levels of fidelity during intervention sessions?

Research Question 3: Does training parents using the TMCR model result in parents using EMT Words and Signs at criterion fidelity levels during generalization and maintenance observations?

Research Question 4: Does parent-implemented EMT Words and Signs result in changes in children's spoken and signed language?

Method

Participants

Four parents and their children with DS were recruited for this study after the children had participated in a previous study in which the children had been taught signed and spoken words using EMT Words and Signs by a therapist during 20 sessions in a clinic (see Wright, Kaiser, Reikowsky, & Roberts, 2013). Three mothers (Annie, Tara, and Lilah) and one father (Grant) who had not been trained in the previous

study were included in the current study. Their children (Ryan, Erin, Jay, and Gretchen) were between 28 and 33 months of age and each was diagnosed with DS. Participant characteristics are summarized in Table 1. Two therapists acted as parent trainers for this study. One was a speech-language pathologist and doctoral student in early childhood special education with 6 years of clinical experience. The second was a master's level research assistant with 7 years of experience as an early intervention outreach teacher and service coordinator. Both had 2 years experience implementing EMT Words and Signs with young children with DS.

Setting

Baseline and intervention sessions were conducted in the children's homes and in a clinic room at an inclusive preschool and pediatric therapy clinic. Sessions occurred twice weekly and alternated between clinic and home. At home, the sessions were conducted in the family's playroom or living room. The parent, child, and therapist sat on the floor in close proximity to each other with toys selected by the parent and therapist. Generalization and maintenance probes occurred at home in the same location as intervention sessions.

Materials

In the clinic, a set of age-appropriate cause-and-effect, manipulative, construction, and pretend-play toys was used in the baseline and intervention sessions. In homes, only toys owned by the family were used. Toys were selected based on child preferences and included items similar to those in the clinic sessions. During the generalization probes, the therapist provided a bag of toys that differed from the toys used in intervention with some similarities (different dolls, different vehicles). A video camera was present during all sessions. During the parent training sessions, a laptop computer was used to show videos and power point slides. Handouts describing specific EMT strategies and illustrating signs were provided to the parent.

Experimental Design and Conditions

A single-subject multiple-baseline across behaviors design was implemented (Gast & Ledford, 2010) and replicated across four parents. The behaviors were five EMT strategies: matched turns, target talk, expansions, time delays, and milieu teaching prompts. Data for each session were graphed for visual inspection. The criterion for moving to the subsequent behavior was based on the change in strategy use above criterion levels established in previous studies (M. Y. Roberts & Kaiser, 2012).

Baseline. Baseline sessions occurred two times per week, once in the clinic and once in the home, and lasted 10 min

Table 1. Participant Demographic and Assessment Information.

	Dyad 1	Dyad 2	Dyad 3	Dyad 4
Caregiver	Mother: Annie	Mother: Tara	Mother: Lilah	Father: Grant
Parent's age	34	30	38	46
Parent's education	4-year	4-year	4-year	Master's
Parent's employment	Full-time	Stay at home parent	Stay at home parent	Part-time; primary caregiver
Family income	>100,000	70–75,000	>100,000	NR
Child	Ryan	Erin	Jay	Gretchen
Age (months)	33	28	29	28
PLS auditory comprehension SS	57	71	75	61
PLS expressive communication SS	72	83	75	89
MCDI: No. of signs produced	27	30	21	7
MCDI: No. of words produced	33	33	43	26
Hours of therapy services received per month	0	6	12	18
Enrolled in center-based childhood program	Yes	No	No	No

Note. Therapy services include occupational, physical, speech-language, and feeding therapies. One child was enrolled in a center-based early childhood program. All other children were at home with caregivers. PLS = *Preschool Language Scale-4* (Zimmerman, Steiner, & Pond, 2002); SS= Standard score; MCDI = MacArthur Communicative Development Inventories (Fenson et al., 2006).

each. During baseline sessions, parents were instructed to choose toys and materials that their children enjoyed and play with their children as they typically would. No element of the TMCR model was implemented during baseline.

Intervention. Experienced therapists trained each parent in the EMT Words and Signs strategies at home and in the clinic through workshops and intervention sessions using the elements of TMCR model. Parents practiced each EMT Words and Signs strategy until they reached criterion levels at which point training on the next strategy was introduced. Training for each EMT strategy was introduced during an hour-long workshop in which the therapist taught the strategy by (a) defining it, (b) providing a rationale for its use, (c) describing how to use the strategy, (d) showing video examples of correct use of the strategy, and (e) discussing with the parent when and how to use the strategy at home. Handouts were provided for the parent that summarized the strategy being taught. When target talk was introduced, the therapist provided and reviewed a list of the words and signs the children had previously been taught along with illustrations of how to produce each sign. Following each workshop, the parent practiced the strategies in the home and clinic until fidelity criterion was reached. Each intervention session that occurred following the workshop included every element of the TMCR model. Once intervention began, during the model element of the training model, the therapist modeled

EMT Words and Signs in its entirety (including the strategies that the parent had not yet been trained to use) although only verbally highlighting the strategy the parent was currently learning. See Table 2 for details.

Generalization probes. Ten-minute probes were conducted to assess parents' use of EMT strategies with a novel set of play materials and without therapist's coaching. These probes occurred intermittently during baseline, after the parent reached criterion level of a strategy and before teaching the next strategy, and 4 to 5 weeks after completion of the five phases as a measure of maintenance. Maintenance was only measured in the context of generalization outside the TMCR model because we wanted to determine parents' use of the strategies without the support of the therapist. Parents were instructed to follow a general picnic routine (set up the picnic, wash hands with wipes, play with food and dishes, play with other toys, read a book, and clean up). The therapist was present but did not participate in the interaction or include any elements of the TMCR model during probes.

Procedural Fidelity

Procedural fidelity data for implementation of the TMCR model were collected for at least 25% of all sessions. Sessions coded for fidelity were selected randomly before

Table 2. Elements, Behaviors, and Examples of the Teach-Model-Coach-Review Model.

Element	Therapist and parent behavior	Example
Teach	Describe purpose of session Review EMT strategies Introduce new signs Therapist and parent role-play to practice	"Today we are going to work on target talk. We are focusing on modeling nouns, verbs, and requesting words for Jay. Let's look at the toys and make sure we know all the signs we may need to model while we play today"
Model	Therapist plays with child participant for 10 min using all EMT strategies Therapist points out the EMT strategy the parent is learning while using it with the child	"See how Ryan initiated by pointing? I <i>noticed and responded</i> to his communication by modeling the sign and verbal label for 'ball.'"
Coach	Therapist acknowledges parent's correct use of strategies with specific praise Therapist gives specific feedback on how to use a strategy when the parent does not use it Therapist helps parent set up situations to elicit communication with time delays or milieu teaching prompts	"Great job responding to his communication. Next time he says 'dog,' add a sign <i>and a word</i> to expand his communication. You could say and sign 'dog eats.'"
Review	Therapist summarizes parent's use of strategies Therapist asks open-ended questions to encourage parent reflection Therapist points out impact of parent's use of strategies on child's communication	"My favorite part of the session was when you imitated Erin pushing the dolls down the slide and you signed and said 'down' she looked right at you and imitated you! You taught her a new word today!"

Note. EMT = Enhanced Milieu Teaching.

the study began, and the therapists were blind to what sessions would be coded. A trained observer watched video tapes of workshops and completed a checklist of items specified for each phase. Checklists are available from the first author. Fidelity for implementation of the TMCR model during sessions was measured through completion of a checklist of 10 to 13 specific procedures to be implemented prior to, during, and after the session. Items included reviewing the specific EMT strategies that were being taught, pointing out the EMT strategies while modeling with the child, giving feedback on strategy use while the parent interacted with the child, and facilitating conversation about the parent's use of strategies and the effect on the child following the session. In addition to fidelity checklists for each element of the TMCR model, the 10 min of the therapist modeling EMT Words and Signs for the parent was transcribed and coded to measure the fidelity with which the therapist implemented EMT Words and Signs using criterion levels established in previous research for each behavior (e.g., M. Y. Roberts & Kaiser, 2012). Because the therapist modeling was part of the parent training intervention, the fidelity with which the therapist modeled EMT strategies was important.

To assess whether the therapist used the EMT strategies with fidelity, therapist and child language and communication behaviors were transcribed and coded using the Systematic Analysis of Language Transcripts (SALT) protocol and computer software (Miller & Iglesias, 2008) with behavioral codes for therapist EMT behaviors. Time delay episodes were scored on a 4-point scale and milieu teaching prompts were scored on a 10-point scale.

Interobserver agreement (IOA) on fidelity measures was collected for 25% of fidelity sessions across conditions and participants.

Measures

Parent EMT strategy use. Parent strategy use was measured across conditions to determine the effects of the TMCR model on parent use of the EMT strategies as a measure of intervention fidelity. All 10 min of each session were transcribed and coded using SALT (Miller & Iglesias, 2008); each parent behavior was coded with specific behavioral codes identical to the measures of fidelity coded for the therapist during the modeling segment. Parents' implementation of each episode of time delay and milieu teaching prompts was scored for accuracy.

Child language measures. Child's total use of words and signs was measured across conditions by transcribing and coding each 10-min session using SALT (Miller & Iglesias, 2008). Child utterances were coded for independence and form. Independence was coded as spontaneous, imitated, or prompted. Form included spoken words and signs.

IOA. Prior to beginning data collection, a graduate student was trained to criterion on transcription and coding using three successive practice videos. IOA was assessed for 33% of baseline, intervention, generalization, and maintenance sessions for each dyad and, sessions were selected randomly. Both coders were blind to the changes in phase throughout the study. Overall, agreement for parent EMT

strategy use averaged 91% (range 25%-97%). IOA was less than 80% in four instances of coding time delays and milieu teaching prompts where the base number of occurrences was low. In these instances, one coder identified an episode and the second coder did not, which resulted in low IOA. Agreement for child language measures averaged 96% (range 90%-100%).

Results

Fidelity of Parent Training

Fidelity of implementation of all elements of the TMCR model was above criterion levels during the intervention (see Table 3). The therapist modeled EMT above criterion levels for all dyads. The elements of the TMCR model as measured by the checklist items averaged 90% (range 71%-100%) fidelity and workshop fidelity levels averaged 81% (range 72%-88%).

Overall, IOA agreement on fidelity during therapist modeling sessions was 97% (range 48%-100%). Agreement was less than 80% in three instances in which the frequency of expansions was very low and disagreements resulted in low overall agreement. Overall, agreement of therapist implementation of teaching, coaching, and reviewing before, during, and after the parent practice sessions was 98% (range 95%-100%). IOA on workshops was 87.5% (range 87%-88%).

Parent Use of EMT

Data from four types of sessions (baseline, intervention, generalization, maintenance) are discussed for each parent participant. Graphs for parent-child dyads are in Figures 1 to 4.

Annie (Dyad 1). Annie's matched turns during baseline were low and stable. After the introduction of training for matched turns, there was an immediate change in level that maintained throughout the intervention. Annie's use of targets (one signed and spoken word) was low and stable for the first three baseline sessions. However, when the therapist began modeling the EMT intervention strategies (concurrent with the introduction of training for matched turns), her use of targets increased. Despite the increase, there was an immediate shift in level and reduced variability in her use of targets following the introduction of the intervention. Annie's use of expansions was low and variable in baseline. After the introduction of target talk, she had more variability with one instance of 100% of child communication expanded. In this case, the child only produced one utterance that was expandable and the parent responded with an expansion, thus giving her 100% for that session. Upon introduction of training on expansions, there was an overall increase in level although the data remained variable across

the remaining sessions. Annie did not use any time delay strategies and only attempted two milieu teaching prompts (one each in two different sessions) during the baseline conditions for these behaviors. After training to use time delay strategies and milieu teaching prompts, there was an immediate change in level with some variability.

Annie's use of the strategies during generalization probes generally matched her performance during baseline and intervention sessions. Annie maintained use of matched turns and milieu strategies at criterion levels but did not maintain criterion levels for target talk or expansions during the maintenance session. Annie did not use any time delay strategies during the maintenance session.

Tara (Dyad 2). Tara's use of the five EMT strategies during baseline varied across strategies and over time. Her data on matched turns were stable and below criterion levels during baseline. After training on matched turns, there was an immediate shift in level and decrease in variability for the remaining sessions. Concurrently, her use of targets and expansions increased although these behaviors were not yet trained. Once training on target talk was introduced, there was a slight shift in level, but there does not appear to be a shift in trend from baseline to intervention. Tara's initial baseline for expansions was low and stable. She showed an increasing trend in expansions after training on target talk. After introducing training on expansions, variability decreased although many intervention data points overlap with later baseline points. Tara did not use time delay strategies in baseline. After training on time delays, Tara demonstrated a clear shift in level of frequency and fidelity of use. There was a decrease in level concurrent with the introduction of training on milieu teaching prompts, although it increased again by the end of the intervention. During the last five intervention sessions, the level was stable at 100% correct use of time delays. She used a few milieu teaching prompts early in baseline before any intervention strategies were trained but returned to baseline levels for the remainder of the baseline condition. When training on milieu teaching prompts was introduced, Tara demonstrated an immediate shift in both the level of prompts and the fidelity with which the prompts were used.

Overall, Tara's use of the EMT strategies during generalization probes was similar to her performance during the baseline and intervention sessions for most strategies. The exception was that her use of expansions in the generalization probes was variable and there was overlap between the probes conducted during intervention and those conducted during baseline. During the maintenance probe, she used all strategies at criterion levels except for milieu prompts.

Lilah (Dyad 3). Lilah demonstrated immediate and consistent changes in behavior across four of the five strategies following the introduction of the parent training

Table 3. Means and Ranges for Procedural Fidelity of Implementation.

Dyad	Therapist modeling EMT in each session										Teach, coach, and review items in each session		Workshops
	% Responsive	% Matched turns	% Target talk	% Expansions	Average time delay score	Average milieu teaching prompt score	% Words modeled with signs	% Items addressed	% Items addressed	% Items addressed	% Items addressed	% Items addressed	
Criteria	>90	>80	>75	>40	>3.8	>8.0	>80	>85	>80	>80	>80	>80	
Dyad 1: Annie and Ryan	98 (95–100)	96 (94–98)	86 (76–99)	71 (53–85)	3.99 (3.92–4.0)	8.73 (6–10)	92 (81–100)	92 (75–100)	85 (84–85)	92 (75–100)	92 (75–100)	85 (84–85)	
Dyad 2: Tara and Erin	99 (98–100)	95 (87–100)	89 (82–95)	76 (47–95)	4.00 (—)	9.55 (9–10)	94 (88–98)	89 (75–100)	74 (72–76)	89 (75–100)	89 (75–100)	74 (72–76)	
Dyad 3: Lilah and Jay	98 (94–100)	96 (92–100)	90 (79–98)	75 (29–100)	4.00 (—)	9.55 (9–10)	95 (86–99)	86 (71–96)	81 (80–81)	86 (71–96)	86 (71–96)	81 (80–81)	
Dyad 4: Grant and Gretchen	96 (91–100)	95 (85–99)	90 (79–97)	61 (33–100)	3.89 (3.0–4.0)	8.78 (8.67–9.0)	88 (82–95)	92 (81–100)	87 (85–88)	92 (81–100)	92 (81–100)	87 (85–88)	
Overall	98 (91–100)	96 (85–100)	89 (76–99)	71 (29–100)	3.97 (3.0–4.0)	9.21 (6–10)	90 (81–100)	90 (71–100)	81 (72–88)	90 (71–100)	90 (71–100)	81 (72–88)	

Note. No parent training or trainer sessions took place during baseline conditions. EMT = Enhanced Milieu Teaching.

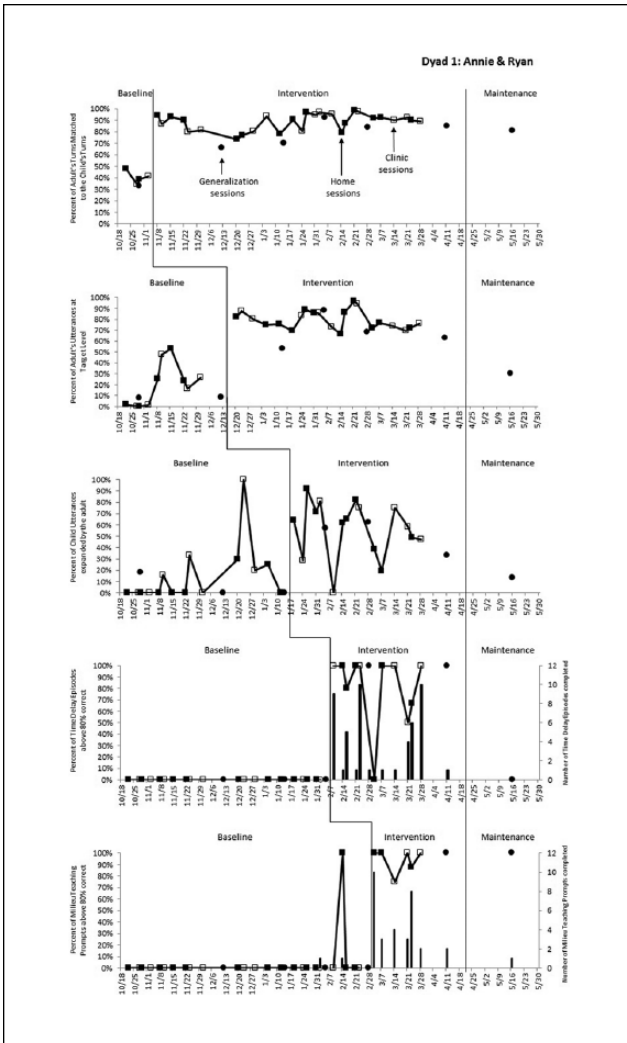


Figure 1. Percent fidelity across phases for Dyad 1: Annie and Ryan.
 Note. Bars of time delay and milieu teaching graphs represent the number of episodes the parent attempted.

intervention. In baseline, matched turns were at a moderate but stable level. After training on matched turns, there was an immediate increase in level that maintained throughout intervention. During baseline, Lilah's use of targets was low and stable until matched turns was introduced (and the therapist was modeling all strategies) at which point there was a clear shift in level. After parent training on target talk was introduced, there was a shift in level, although delayed one session. This increase in level was observed for the remainder of the intervention. Lilah's use of expansions was low and stable until target talk was introduced at which time there was a shift in level and increased variability. After introduction of the intervention, there was a slight shift in level and the data became less variable. Lilah demonstrated some correct use of time delay before this strategy was

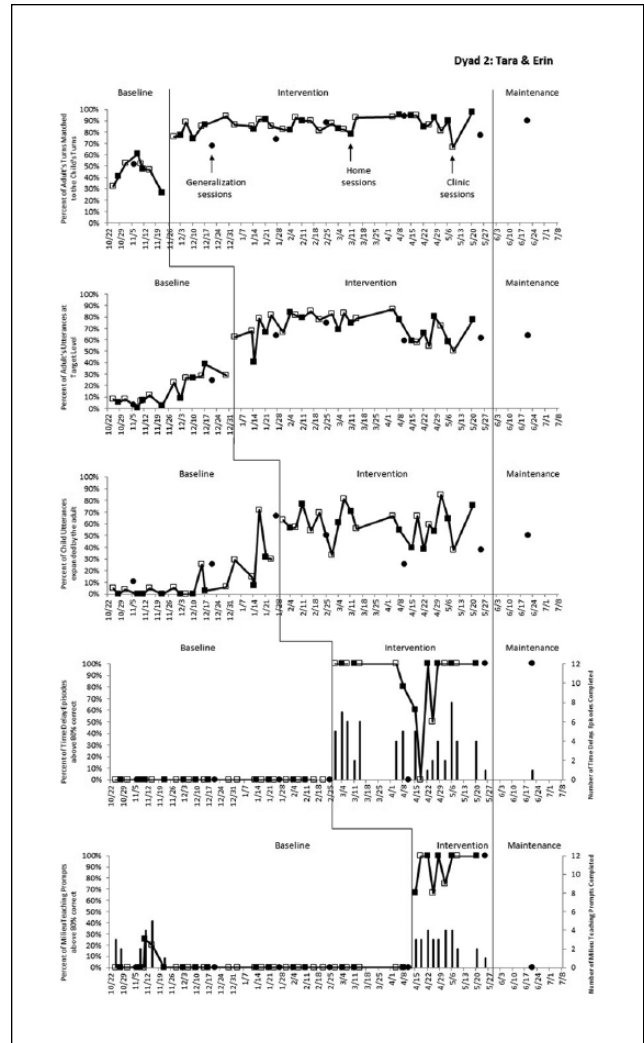


Figure 2. Percent fidelity across phases for Dyad 2: Tara and Erin.
 Note. Bars of time delay and milieu teaching graphs represent the number of episodes the parent attempted.

taught. She used no instances of time delay in the first 11 baseline sessions. After baseline Session 12, she demonstrated a shift in level although inconsistent across sessions. After parent training to teach time delay, she continued to demonstrate correct use of time delay strategies, increased the number of episodes per session, and maintained a high level. However, there was significant overlap, in terms of correct use, with the high points during baseline. During baseline, before any intervention strategy was introduced, Lilah attempted some milieu teaching prompts that were below criterion level. However, her data returned to zero and remained there until intervention was introduced. When milieu prompting training was introduced, Lilah demonstrated an immediate change in number and correct use throughout the intervention condition.

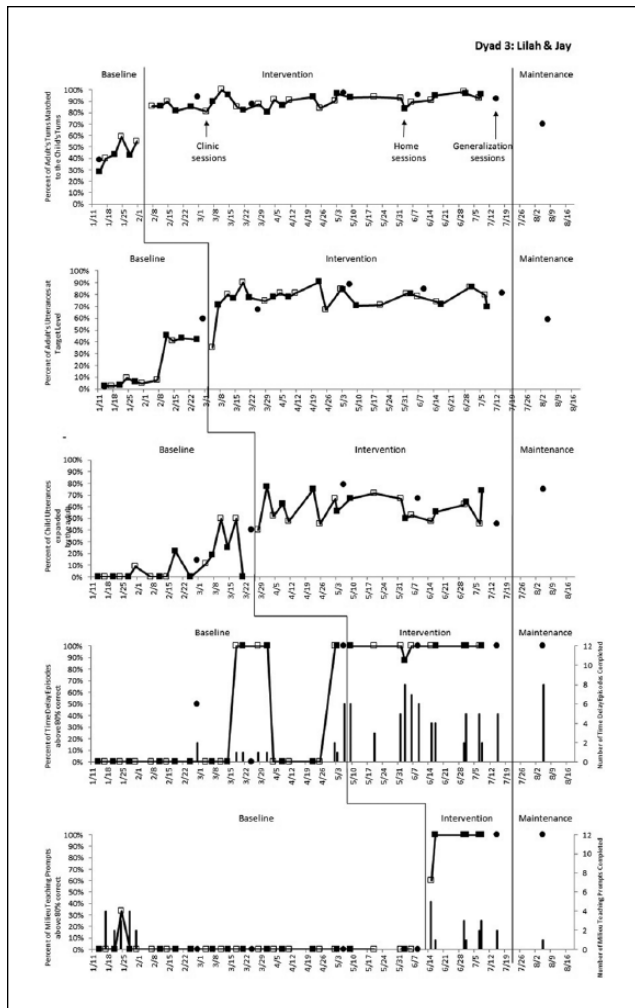


Figure 3. Percent fidelity across phases for Dyad 3: Lilah and Jay.
 Note. Bars of time delay and milieu teaching graphs represent the number of episodes the parent attempted.

During generalization probes, Lilah performed strategies at levels similar to those in baseline and intervention sessions. She showed generalized use of all five strategies at or near criterion fidelity levels, although the last probes for target talk and for expansions during baseline overlapped with intervention data. During maintenance, Lilah's percent matched turns and percent target talk decreased from her intervention levels but remained above baseline levels. During the maintenance probe, she used expansions, time delay episodes, and milieu teaching prompts at criterion levels. Lilah was the only parent to use both time delay and milieu teaching prompts in the maintenance probe.

Grant (Dyad 4). During baseline, Grant's data for matched turns were low and stable. After training on matched turns, there was an immediate shift in level of matched turns that

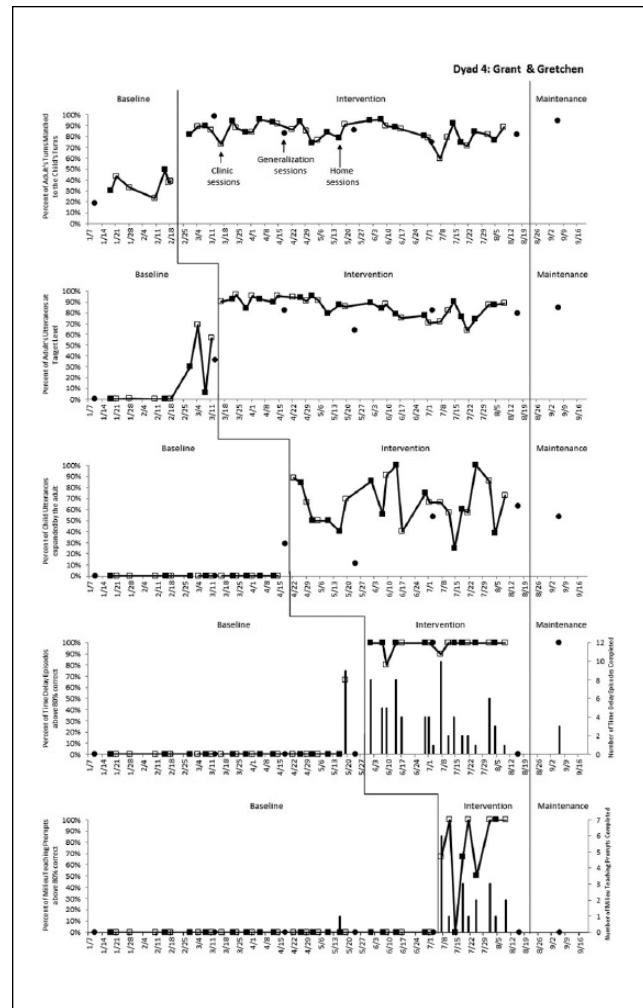


Figure 4. Percent fidelity across phases for Dyad 4: Grant and Gretchen.
 Note. Bars of time delay and milieu teaching graphs represent the number of episodes the parent attempted.

maintained throughout intervention. Grant had low levels of target talk until parent training for matched turns began. At that point, there was an increase in target talk but there was variability. After parent training began, Grant demonstrated an immediate shift in level of target talk with a slightly decreasing trend throughout intervention. Grant did not use expansions during baseline. Once expansions were taught, he demonstrated an immediate shift in level, although there was variability in his use of expansions. Grant did not attempt time delay or milieu teaching prompts in the majority of baseline sessions. He used nine time delays (at 67% fidelity) during one baseline session immediately before training. In this session, he repeatedly paused in a routine in which he placed cars at the top of a ramp and waited for Gretchen to say "go." Once time delays were taught, Grant demonstrated high levels of correct use of the

strategy in all intervention sessions with some variability in the number of time delay episodes. Grant used one milieu teaching prompt during one baseline session with low fidelity. After the parent training on milieu teaching prompts, Grant used prompting at criterion level for all but one intervention session in which he did not attempt any milieu teaching prompts.

During generalization probes, Grant used matched turns and target talk at levels similar to his performance in the baseline and intervention sessions. Grant’s use of expansions was variable in generalization probes during the intervention condition. Grant used time delays correctly in one of the two generalization probes after the strategy was taught but did not attempt any time delays in the second probe. Finally, he did not use milieu prompts in the one generalization probe at the end of intervention. In the maintenance probe, Grant used matched turns, target talk, expansions, and time delays at levels similar to what was observed during intervention. He did not attempt any milieu teaching prompts.

Summary. In 15 of the 20 tiers, across the four dyads, a functional relation between parent training and criterion-level use of the EMT strategies was demonstrated. In only one instance (time delay with Lilah) did a parent demonstrate consistent use of an EMT strategy at criterion levels before training. Parents’ generalization data were consistent with their performance during coached intervention sessions. All parents showed some maintenance of intervention strategies at levels similar to those observed in the intervention condition.

Child Language Use

Child language data are presented in Figure 5. Overall, there was not a clear functional relation between the parents’ use of the strategies and their children’s use of spoken words and signs. Two children (Ryan in Dyad 1; Jay in Dyad 3) showed a gradual increase in total language across the intervention phases while two children (Erin in Dyad 2; Gretchen in Dyad 4) were variable across parent training conditions with no marked increase in total language over time.

Ryan (Dyad 1). During baseline sessions, Ryan used zero to six words and signs. This level of communication remained stable during intervention sessions for matched turns and target talk. Following the introduction of expansions in parent training, Ryan’s use of signs and words increased and this trend continued throughout the milieu teaching phase. During the generalization sessions, Ryan’s use of words and signs increased from fewer than five words and signs during baseline to 10 words and signs during intervention. During maintenance, he used 25 words and signs.

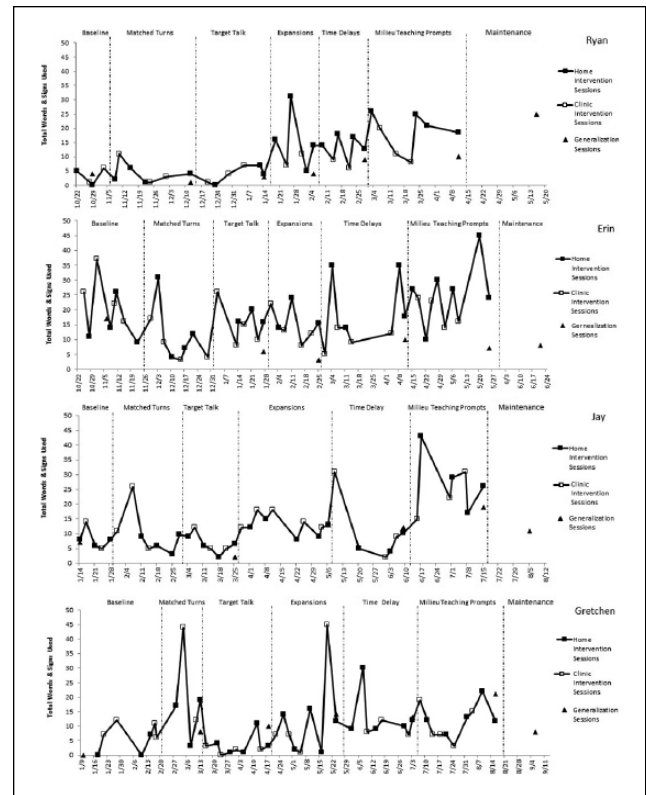


Figure 5. Number of total words and signs used by the child during the 10-min intervention session with their parents across phases of the intervention.

Erin (Dyad 2). During baseline, Erin used nine to 37 words and signs. After the introduction of parent training for matched turns, her use of signs and words decreased. Subsequently, Erin’s use of words and signs increased gradually across expansions, time delays, and milieu teaching, with the last data points in the range of her initial baseline points. There was variability within all phases of the intervention. Generalization data were stable across baseline, intervention sessions, and maintenance; her use of words and signs ranged between three and 17.

Jay (Dyad 3). During baseline, Jay used five to 14 words. His data remained stable throughout the first two strategies of the parent training intervention. When his mother was taught expansions, there was a slight increase in his use of words and signs. His use of words and signs decreased during the time delay phase and then increased in the milieu teaching phase. His use of words and signs during generalization probes remained relatively stable in level across baseline, intervention, and maintenance sessions and ranged between two and 19.

Gretchen (Dyad 4). Gretchen used zero to 12 signs and words during baseline sessions. Her data remained relatively low and stable throughout the first three tiers of the parent

training intervention. After the time delay strategy was taught to her father, Gretchen's use of signs and words became more stable. Gretchen showed a gradual increase in total use of words and signs during generalization probes increasing from zero to 21. During the maintenance session, her use of words and signs decreased to eight total words and signs.

Discussion

The purpose of the current study was to replicate and extend previous studies on using multiple adult learning strategies to train parents. The effects of the TMCR model (Kaiser & Roberts, 2013) on parents' use of EMT Word & Signs intervention strategies were evaluated. Results indicated that the TMCR model was used with fidelity and resulted in parents using the intervention strategies at criterion levels. The findings of this study extend the literature in several ways. First, this study contributes to the literature by clearly describing and measuring of the implementation of parent training and its effects on the parents' use of the intervention. In reviews of both group experimental studies (M. Y. Roberts & Kaiser, 2011) and single-case research design studies of parent-implemented interventions (Barton & Fettig, 2013), the lack of specific information about parent training procedures has been noted. The fidelity with which the components of the TMCR model were used was assessed, and findings indicated that these components were delivered with high levels of fidelity. Furthermore, parents' use of the five EMT language intervention strategies was measured in every session, and data indicated high levels of fidelity were achieved. All parents increased their use of specific EMT strategies when those strategies were taught. While parents sometimes increased their use specific strategies before the systematic training was implemented, they did not reach criterion levels of implementation until parent training on the specific strategy was introduced, with one exception.

Second, this study contributes to the literature about strategies for coaching parents. In this study, coaching was one of four elements in a training package that was used to teach parents EMT intervention strategies. In this study, it is difficult to separate the impact of coaching alone from the impact of the four-component training package. In the literature, coaching has been defined as a "cyclic process" that results in increases in both skill and relationship (Trivette et al., 2009). In studies identified by Kemp and Turnbull (2014), coaching was described as a shared process between the parent and the coach in which routines and interventions were decided on as a team and characteristics of the process included joint interaction, reciprocal feedback, and reflection. In the current study, coaching referred specifically to the therapist watching parents while they attempted to use the EMT strategies and providing specific praise and corrective feedback to shape parents' behavior. Other components of the intervention package addressed

some features that have been included in the definitions of coaching (e.g., relationship building, problem solving, and self-evaluation). In future research, it is imperative that coaching is defined and measured explicitly to allow for replication and comparison of across studies.

Third, this study contributes to the adult learning literature by demonstrating that the use of a parent training model that includes five of the six adult learning methods identified by Trivette et al. (2009) was positively associated with the planned parent behavior change. This study replicates the procedures and parent training results of the M. Y. Roberts et al. (2014) study with caregivers of toddlers and preschoolers with receptive language delays and typical cognitive development and extends the application of the TMCR model to parents of toddlers with DS. This study also extends the limited research on parent training on the naturalistic use of an AAC system. There were replicated effects on parent use of the AAC, but clear functional relations between parents' use of the intervention and children's language outcomes were not demonstrated. The reasons for the variable effects on child communication should be examined in future parent training studies. Factors such as duration of the training, providing adequate vocabulary content for the AAC use, and barriers to child use of the AAC should be investigated. In addition, due to the parent-mediated model, it is fair to expect that changes in language may occur slowly over a longer period of time after the direct intervention with the parents has ended.

Mastery was the one adult learning method identified by Trivette et al. (2009) that was not used explicitly in the TMCR model. Mastery was defined as having parents compare their performance against a standard. Trivette et al. concluded that the use of a mastery approach could help parents reach high levels of fidelity faster because the standard for their performance is clearly identified. In the current study, parents had opportunities to compare their performance implicitly with that of an expert therapist during the modeling component. There were criterion levels for each EMT strategy that were used in conjunction with visual analysis to make phase change decisions. Parents were given feedback about their performance in relation to criterion levels and sometimes shown graphs of their data, but parents were not invited to explicitly make comparisons between their implementation and the mastery criteria. Future studies should investigate the use of a more explicit mastery component to determine whether this method might strengthen parent implementation, help parents reach criterion levels more quickly, or contribute to maintenance of skills over time.

Limitations and Implications for Practice

A primary limitation of the TMCR approach is that it required the therapist to model all of the EMT strategies even before those strategies were introduced. It appeared

that this had an effect on parents' use of some strategies prior to when they were trained to use these strategies and made it difficult to establish a functional relation. Although there were still adequate replications to establish a functional relation, it would have been preferable to model only the EMT strategies that the parent was being taught or only those strategies already taught to maximize experimental control. The M. Y. Roberts et al. (2014) study also modeled the full intervention for parents while introducing training across the EMT strategies. Two of the four parents demonstrated increases in expansions prior to that strategy being trained and concurrent with the therapist beginning to model the full set of strategies. Modeling alone appeared to have some effect on parent use of skills but was not sufficient to teach parents to implement the skill at criterion levels. Thus, there may be both benefits and limitations to modeling all five EMT strategies throughout the intervention. If parents can learn some EMT strategies from modeling alone, it is possible that less time could be allocated to training those strategies and more time can be allotted to strategies that appear to be more difficult to learn (e.g., time delay, milieu teaching prompts). Modeling might make parent training briefer and more efficient for some parents. These might include video modeling as well as written and video-recorded teaching modules that introduce the strategies before explicit teaching begins.

The generalization and maintenance of parents' use of intervention strategies observed in this study have implications for practice. In the current study, parents generalized some of the strategies to activities that were different from those in which they had been trained. However, parent performance was more variable and below criterion levels in the generalization settings as compared with the intervention setting. Parents and children were less familiar with the materials in the generalization sessions. This affected the parents' modeling, expanding, and prompting of specific signs because they did not always know the appropriate signs to use when modeling or expanding language to represent the new toys. In practice, collaborating with parents to identify vocabulary for everyday routines and home play may be important to ensure generalization. Periodically updating vocabulary as part of the child's AAC system to reflect changes in child skill, new routines, and new activities will be important to ensure maintenance.

Parents were the most variable in their generalization and maintenance of time delays and milieu teaching prompts. The low level of correct use of time delays and milieu teaching prompts were always the result of parents not attempting the strategies rather than using the strategies incorrectly. Trivette et al. (2009) found that better learner outcomes occurred when parent training strategies were used for more than 10 hr. In this study, the five EMT skills were taught sequentially. Skills taught early in the intervention were practiced throughout the remaining sessions (e.g., parents continued to practice using matched turns and target

talk while learning expansions). Because of the design, parents practiced and got feedback on the time delay and milieu teaching skills during fewer sessions than they practiced responding, target talk, and expansions. In practice, it will be important to allow sufficient time to teach parents to use time delays and milieu teaching prompts to criterion levels. Some children with DS in particular are resistant to prompting and unlikely to respond. Planning ways to address this prompt resistant behavior and providing parents with sufficient training on how to use and adapt time delays and milieu prompting for the occasions when they are more likely to be successful may be important.

One last implication for practice relates to the fidelity with which the workshops were implemented. Fidelity of implementation was consistently lower for workshops than for other elements of the TMCR model. The overall fidelity ratings varied across workshops and families. These variations often were the result of adaptations that were made to fit the parent skills, interests, current performance levels, and immediate responses to the information as it was presented in the workshops. For example, some information was not presented when it was clear from parent performance and responses in the workshop that the parent had already mastered a specific skill or the information was not applicable to the child or family. Although covering core information with every parent should be required, fidelity protocols also must allow for adjusting the content and activities in workshops to address parents' current level of knowledge and to fit the intervention specifically to the children and parents. Based on recommendations from Trivette et al. (2009) and the definition of coaching as an interactive process (Kemp & Turnbull, 2014), workshops should be a shared, interactive process in which the parent and the coach practice the EMT strategies that the parents believe work best for their child in context of their family and home setting. Fidelity protocols should ideally reflect this dynamic process while adhering to what are considered core components of the intervention.

Conclusion

This study adds to the growing literature on parent training. Although the current study focused on training parents to use a specific intervention tailored to meet the needs of young children with DS, the findings regarding systematic approaches to parent training might be applied to teaching a range of skills to children with varied developmental needs. The study also illustrates the importance of assessing fidelity of both the implementation of the parent training intervention and the implementation of the parents' use of the intervention.

Acknowledgment

The authors thank Laura McCorkle for her participation as an interventionist on this project.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This work was supported by the Department of Education Office of Special Education and Rehabilitative Services Education (H325D070075 and H326M070004), the National Center for Research Resources (UL1 RR024975-01), and the National Center for Advancing Translational Sciences (2 UL1 TR000445-06).

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