Delivering Enhanced Milieu Teaching (EMT) Via Telepractice

By

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CHAPTER I

INTRODUCTION

Enhancing the service delivery of early language interventions is a key research and policy issue, given the prevalence and detrimental effects of persistent language impairments (Black, Vaharatian & Hoffman, 2015; Hoff, 2013; Justice, Bowles, Pence Turnbull, & Skibbe, 2009; Tomblin, Zhang, Buckwalter & O'Brien, 2003; U.S. Department of Education, 2015). Families with children under 36 months who have disabilities are eligible to receive early intervention (EI) services to support the development of language, communication, cognitive, adaptive, and gross motor skills through the Grants for Infants and Families Program (Part C) of the Individuals with Disabilities Education Act (IDEA, 2004). Although the prevalence of developmental delays is 13% in 24 month-old children (Rosenberg, Zhan & Robinson, 2008), less than 3% of children under 36 months were participating in Part C services in 2014 (US Department of Education, 2016). In Oregon, 2.61% of children younger than 36 months participated in Part C Services. This figure was below the state target as well as the national average (US Department of Education, 2015). These data suggest significant underutilization of EI services locally in Oregon and across the US (McManus, Magnusson & Rosenberg, 2014; Rosenberg, Robinson, Shaw & Ellison, 2013).

Oregon's large size and geographic diversity creates additional challenges for EI service delivery. The concentration of services in urban areas compounds geographic and logistic barriers faced by families living in rural and underserved communities (Machalicek et al., 2016; Oregon Office of Rural Health, 2018). Logistic barriers to service access include the need for EI providers to travel greater distances to deliver services to families in rural communities as well

as personnel shortages in EI programs (Cason, Behl & Ringwalt, 2012; Hebbeler, Spiker, & Kahn, 2011). Geographic barriers are natural barriers that contribute to the underutilization of EI services such as environmental barriers (e.g., mountain passes, coastlines, high deserts), extreme weather conditions (e.g., mudslides, forest fires, snow storms), and road infrastructure problems (e.g., unpaved roads, road closures).

Telepractice is one service delivery model offered as a solution to mitigate access barriers facing children with disabilities and their families. *Telepractice* involves the provision of clinical or educational consultation, intervention, and/or assessment via communication technology, such as video-teleconferencing (American Speech-Language Hearing Association ASHA, 2016; Bosivert, Lang, Andrianopolous & Boscardin, 2010). Telepractice is a promising service delivery model which addresses the underutilization of EI by (a) increasing access to services, (b) increasing the availability of providers with expertise in early language interventions, (c) enhancing service delivery in rural and underserved communities, and (d) reducing the costs of home visiting (Askvig, Liccini & Bossert, 2015; Baggett et al., 2010; Baharav & Reiser, 2010; Meadan & Daczewitz; 2015; Molini-Avejonas, Rondon-Melo, Amato, & Samelli, 2015; Theodoros, 2011).

Caregiver-Implemented Language Interventions

Caregiver-implemented interventions involve professionals teaching caregivers to use intervention strategies with their children in order to improve their child's developmental skills. Enhancing a family's capacity to meet the needs of their infants and toddlers with disabilities is a primary aim of EI services (IDEA, 2004). Caregiver-implemented interventions are an empirically supported method for building family capacity to support child language and

communication development (Kaiser, 1993; Kaiser & Roberts, 2013; Roberts & Kaiser, 2012; 2015; Romski et al., 2010, Salisbury et al., 2018). Caregiver-implemented interventions are in accordance with Part C since they (a) occur in natural environments, (b) provide family training and counseling, and (c) advance the family's understanding of child development (Division for Early Childhood, 2014; Salisbury, Woods & Snyder, 2018; Woods, Wilcox, Friedman & Murch, 2011). Including caregivers in language intervention facilitates generalization to daily interactions in family contexts (Kashinath, Woods, & Goldstein, 2006; Kaiser & Roberts, 2013) and is a recommended practice in EI (ASHA, 2008; Division of Early Childhood, 2014).

Caregiver-implemented interventions are effective approaches to early language intervention for young children with language and communication impairments (Carter et al., 2011; Kaiser & Roberts, 2013; Roberts & Kaiser, 2012; 2015; Romski et al., 2010). Empirically supported caregiver-implemented language interventions involve EI providers coaching caregivers to: (a) use specific language support strategies, (b) improve the quality of their linguistic input (e.g., responsiveness, lexical diversity), (c) increase the quantity of their linguistic input, and (e) adapt their everyday activities and routines to provide greater opportunities for child communication. The quality and quantity of speech directed to young children by their caregivers impacts language development (Hart & Risley, 1995; Hirsh-Pasek et al, 2015; Hoff, 2006; Landry, Smith & Swank, 2006; Rowe, 2012). EI providers can effectively coach caregivers to use language support strategies to increase the quantity and quality of linguistic input. For example, results from a meta-analysis of parent-implemented interventions indicated that parent training was positively associated with parent responsiveness ($g = 0.73$) and parent use of language models ($g = 0.38$; Roberts & Kaiser, 2011). Adult responsiveness and modeling are both measures of the quality of linguistic input. During coaching interventions,

caregivers are taught language support strategies, which increase the overall quality of linguistic input.

Both transactional and social interactionist theories of language development contribute constructs supporting caregiver-implemented interventions. These theories posit language is acquired during reciprocal interactions between parents and children (Bruner, 1975; Snyder-McLean & McLean, 1978; Sameroff & Chandler; 1975; Sameroff, 2009). In the context of interactions, parents provide linguistic input that matches the child's focus and actions. For a typically developing child, broad features of responsive interactions and linguistic input are sufficient for language learning. Children with disabilities may benefit more when their caregivers use specific language support strategies (e.g., noticing and responding to child communication, environmental arrangement) and model language that is proximal to their receptive and expressive language skills (Fey et al., 2006). Transactional and social interactionist theories support the use of caregiver-implemented language interventions that explicitly target changes in caregiver behavior to facilitate changes in child language and communication (Adamson, Kaiser, Tamis-LaMonda, & Dimitrova, 2018). Coaching interventions target proximal changes in caregiver behavior (e.g., adoption of language support strategies) to enhance distal changes in child outcomes (e.g., increased rate of communication, receptive language, expressive vocabulary). From this perspective, caregiver behaviors and child outcomes are malleable factors that can be improved when caregivers are taught to implement language support strategies.

Prior investigations demonstrated that caregiver-implemented interventions are effective for improving a variety of child language and communication skills including: rate of child communication, receptive language and vocabulary, expressive language and vocabulary, and

social communication skills in young children with language impairments (Aldred, Green & Adams, 2004; Hampton & Kaiser, 2016; Kaiser & Roberts, 2013; Roberts & Kaiser, 2012; 2015; Romski et al., 2010). In a meta-analysis, Roberts and Kaiser (2011) explored the effect of parent-implemented intervention for children aged 18 – 60 months with language impairments and found that parent-implemented intervention was positively associated with child gains in receptive language and vocabulary (g = 0.35 and g = 0.38, respectively) and expressive language and vocabulary (g = 0.61 and g = 0.48, respectively) when compared to no treatment control groups. A more recent meta-analysis (Heidladge et al., under review) expanded the results of Roberts & Kaiser (2011) by including studies conducted since 2010, restricting the meta-analysis to randomized controlled trials, examining the interventions in different contexts (shared reading and play routines), and including studies of children at-risk for language impairment secondary to low socioeconomic status (SES). Findings indicated that parent-implemented interventions had significant positive effects on parents' use of language facilitating behaviors (g = 1.20) and children's expressive vocabulary and language skills (g = 0.31 and g = 0.27 respectively). Results were positive but non-significant for assessments of children's receptive language and vocabulary. Treatment effects were examined for two intervention contexts: shared reading and play. Interventions involving shared reading activities had significant positive effects on children's expressive vocabulary (g = 0.37); effects for interventions involving play routines were similar in effect size (g = 0.29) but were not statistically significant. Additionally, treatment effects were examined for two subgroups of children: children with or at-risk for autism and children from low SES backgrounds. Findings from the subgroup analysis revealed differential effects, with significant positive effects on expressive vocabulary and language for children from low SES backgrounds (g = 0.78, g = 0.42 respectively) but not for children with or at risk for

ASD. In general, the positive findings of these meta-analyses were consistent and provide evidence supporting the use of caregiver-implemented interventions for facilitating expressive language skills in children with language impairments.

Research On Caregiver-Implemented Interventions Delivered Via Telepractice

One promising application of telepractice in EI involves using video-teleconferencing to deliver caregiver-implemented interventions (Boisvert et al., 2010; Hall & Bierman, 2015; Knutsen et al., 2016). Prior studies of telepractice evaluated consumer satisfaction or examined the feasibility of specific program approaches. However, few studies used rigorous methodology to evaluate the efficacy of language interventions for children aged 0 – 36 months (Quinn, Heidladge, Cunningham, & Kaiser, in preparation). Even though telepractice has been suggested as a promising model to improve access to EI services for children in rural and low resource communities, the efficacy of such interventions remains untested (McDuffie et al., 2016; Meadan et. al 2016). Consequently, there is an urgent and compelling need to explore innovative service delivery models with potential for wide-scale implementation such as telepractice (Blaiser, Behl, & Callow-Heusser, 2013; Cason, Behl, & Ringlwalt, 2012; Kelso, Fiechtl, Olsen & Rule, 2009; Vismara et al., 2016).

A recent systematic review and meta-analysis of single-case research was conducted to determine the efficacy of delivering caregiver-implemented interventions via telepractice (Quinn, Cunningham & Heidladge, in preparation). Included in the review were seven articles containing 28 single-case designs. Articles were included that: (a) enrolled caregivers who provided a language or communication intervention to children aged 0 – 8 years, (b) implemented the intervention using telepractice approaches, (d) measured caregiver

implementation of language strategies as the primary outcome, and (e) utilized single-case research design methodology. To provide a narrative summary, the study designs, participant characteristics, independent variables, and dependent variables were described. The primary analysis method was structured visual analysis, which examined the number of data points, level, trend, stability, and overlap of data (Ledford & Gast, 2018). To augment results from visual analysis and quantitatively synthesize results across studies, the non-overlap of all pairs (NAP; Parker & Vannest, 2009) and within-case standardized mean difference (WC-SMD; Pustejovsky & Ferron, 2017) with a Hedges' g sample correction were estimated (Hedges, Pustejovsky, & Shadish, 2012).

Participants included 42 caregiver-child dyads. Child participants ranged in age from 2;4 to 5;8 years with a mean age of 3;5 years. Child diagnoses included autism (n = 36) and Fragile X syndrome (n = 6). Study characteristics are described in Table 1 and intervention characteristics are described in Table 2. Over half of the designs (53.5%) trained caregivers via telepractice, and 46.5% of designs trained caregivers using a blended service delivery model. A blended service delivery model was defined as a portion of sessions conducted via telepractice and a portion of sessions implemented in-person. The following intervention programs were implemented: Telehealth Early Start Denver Model (Vismara et. al., 2012; 2013), Reciprocal Imitation Training (Wainer et al., 2013; 2015), Naturalistic Parent-implemented Intervention (McDuffie et al., 2013; 2016) and the Internet-based Parent-implemented Communication Intervention (i-PICS; Meadan et al., 2016). Common caregiver instructional methods were workshops (60.7% of designs), online modules (39.3% of designs), and coaching (100% of designs). None of the studies used a specific caregiver instruction or coaching framework. Treatment intensity varied across studies (0 – 31 sessions) with a mean of 14.5 intervention

sessions. Dosage of caregiver coaching varied across the studies (0 – 25 sessions) with a mean of 13.8 coaching sessions. Procedural fidelity was assessed using a Likert Rating Scale (68.9% of designs) and an observational checklist (31.1% of designs). Caregivers were taught a wide range of language support strategies including environmental arrangement, language modeling, mand-models, time-delays, choices, follow in comments, expansions, prompting, reinforcement, imitation, and linguistic mapping.

< Tables 1 and 2 >

Table 1.

Telepractice Parent- Implemented Intervention Study Design Characteristics

Study	Design Type	Number of designs	Caregiver	Child Age	Child Diagnosis
McDuffie et al. 2013	Series A-B	8	8 mothers	3;7	Autism
McDuffie et al. 2016	Series A-B	6	6 mothers	2;9	Fragile X
Meadan et al. 2016	MBD-B	3	3 mothers	3;0	Autism
Vismara et al. 2012	MBD-P	1	7 mothers	range = 2; 4- 3;2	Autism
			2 fathers		
Vismara et al. 2013	Series A-B	8	7 fathers	2; 3	Autism
			1 mother		
Wainer & Ingersoll 2013	MBD-P	1	3 mothers	5;1	Autism
Wainer & Ingersoll 2015	MBD-P	1	5 mothers	3;6	Autism

Table 2.

Telepractice Parent Implemented Intervention Characteristics

Study	Intervention	Setting	Average number of intervention sessions	Coaching Sessions	Caregiver Instructional Method
McDuffie et al. (2013)	Naturalistic Parent-Implemented Intervention	H, UC	16	16	I, C, VTC,
McDuffie et al. (2016)	Naturalistic Parent-Implemented Intervention	H, UC	17	range = 16-17	I, C, VTC
Meadan et al. (2016)	Internet-based Parent Implemented Communication	H	25	Range = 16= 25	I, C, VF, VTC
Vismara et al. (2012)	Telehealth Early Start Denver Model	H	12	12	C, OM, VTC
VIsmara et al. (2013)	Telehealth Early Start Denver Model	H	12	12	C, OM, VTC
Wainer & Ingersoll (2013)	Reciprocal Imitation Training	H	not reported	Range = 0 – 1	OM, VTC
Wainer & Ingersol (2015)	Reciprocal Imitation Training	H	5	3	C, OM, VTC

Note. Setting, H= home, UC=university clinic. Instructional components: C=coaching session, I=instructional session, O=online module, VF=video feedback, VTC=video teleconferencing

Methodological quality of the study designs varied. The majority of designs (78.6%) were a series of A-B designs, which did not have sufficient experimental control to determine the presence of a functional relation. Three studies, which included five designs, had adequate experimental control to determine the presence of a functional relation. Meadan et al., (2016) included three multiple-baseline across behaviors designs and Vismara et al. (2012) and Wainer and Ingersoll (2015) each included one multiple baseline across participants design. Results of visual analysis indicated a positive functional relation for three of the five (60%) designs with adequate experimental control. NAP and WC-SMD estimates were calculated for those designs with adequate experimental control. To address the potential for positively biased NAP estimates for multiple baseline designs, the cutoff for large estimates was drawn at 0.96, and the cutoff for small estimates was drawn at 0.93 (Peterson-Brown et al., 2012). Estimates of < 0.50, 0.50 – 0.93, 0.93 – 0.96, and > 0.96 were considered non-effects, small, medium, and large estimates respectively. NAP estimates ranged from 0.85 – 1.00. WC-SMD estimates ranged from 1.55 – 7.88. Currently, there are no empirically derived and interpretable criterions for small, medium, and large WC-SMD effect size estimates (Shadish et al., 2015). NAP estimates and WC-SMD estimates were consistent but generally more positive than results of visual analysis. Results from the three studies that met contemporary design standards (Council for Exceptional Children, 2014; Horner et al., 2005; Ledford, Barton, Severini, & Zimmerman, 2017; Tate et al., 2013;What Works Clearinghouse, 2014) suggested telepractice is potentially effective for increasing caregiver language strategy use. However, the methodological quality of several designs limited the strength of conclusions that could be drawn from extant research. Thus,

additional rigorous experimental designs are needed to further examine the potential efficacy of telepractice caregiver-implemented language interventions.

In all seven studies, the authors reported child behavior as a secondary dependent variable. Measures of child behavior were exploratory; decisions to move from one experimental condition to the next were made based on caregiver performance only, not child behaviors. Visual analysis of child data demonstrated that positive, consistent changes in child communication outcomes were present in two of the five designs that met contemporary design standards. No functional relations were observed. None of the interventions with adequate experimental control had (a) consistent effects across all child participants or child behaviors, (b) demonstrated a functional relation, or (c) indicated large, immediate changes in level for child communication outcomes. The NAP estimates for the child language and communication skills ranged from 0.67 – 0.97 and WC-SMD estimates ranged from 0.62 – 2.56. Overall, findings from this review indicated that there is insufficient evidence regarding the effects of telepractice caregiver-implemented interventions on child language and communication skills.

Using a telepractice service delivery model allows for EI providers to deliver treatments to families from a wide geographic area who may not otherwise have access to language interventions (Askvig, Liccini, & Bossert, 2015; Blaiser, Behl, & Callow-Heusser, 2013; Cason, Behl, & Ringlwalt, 2012; Meadan & Daczewitz, 2015). Importantly, additional research is needed in order to (a) demonstrate the efficacy of telepractice for improving caregiver strategy use and child language outcomes, (b) examine moderators of treatment efficacy, and (c) optimize existing empirically supported caregiver-implemented interventions for telepractice service delivery (Baggett et al. 2010; Knutsen et al., 2016; Hall, Culler, Frank-Webb, 2016; Molini-Avejonas, et al., 2015). Potential moderators of treatment efficacy may include caregiver and

child characteristics (e.g., age, gender, etiology, socioeconomic status, experience with technology), characteristics of the intervention approach, (e.g., naturalistic, shared reading, direct instruction), language support strategies taught to parents (e.g., modeling, expansions, recasts), coaching strategies and instruction methods (e.g., supportive feedback, video-examples), service delivery methods (e.g., in-person, telepractice), and dosage (Quinn et al., in preparation). Future studies should carefully describe and examine the contribution of potential moderators of treatment efficacy.

Enhanced Milieu Teaching Telepractice Program. The current study extended extant research on telepractice interventions in several critical ways. First, it examined the telepractice service delivery of Enhanced Milieu Teaching (EMT; Kaiser & Hampton, 2016), an empirically supported caregiver-implemented intervention. EMT is a naturalistic early language and communication intervention that uses every day interactions between adults and children to teach functional communication and language (Kaiser, 1993; Kaiser & Hampton, 2016). Findings from over 50 empirical studies established the efficacy of EMT for children with various etiologies including: developmental delays, language delays, autism spectrum disorders, Down syndrome, intellectual disabilities, and children at-risk for language impairments. EMT strategies enhance naturally occurring teaching episodes, which are adapted to a child's individual strengths and weaknesses. EMT is a fully developed intervention with a treatment manual, treatment intensity recommendations, empirically supported caregiver-instructional framework (Teach-Model-Coach-Review; Roberts et al., 2014), and procedural fidelity measures. It has empirically derived learning criterions for caregiver EMT strategy use, which informed formative visual analysis (Ledford, Lane & Severini, 2017). This study expands the intervention research on EMT by

evaluating the effectiveness of using video-teleconferencing to train caregivers to use language support strategies from a distance. It is the first study to adapt the EMT in-person service delivery model to a blended service delivery model. Utilizing an empirically supported intervention, minimizes the risk that null or negative results are due to an ineffective intervention program.

Second, caregiver training utilized the Teach-Model-Coach-Review (TMCR) instructional framework (Roberts et al., 2014). TMCR is a research-based instructional framework that has been used to instruct and coach caregivers in five studies of caregiver-implemented EMT (Kaiser & Roberts, 2013; Roberts & Kaiser, 2015; Roberts, et al., 2014; Wright, et al., 2013). In each study, the use of TMCR resulted in caregiver-implementation of EMT at or above criterion levels. The instructional framework uses principles of adult learning to teach caregivers (Dunst & Trivette, 2009; Trivette, Dunst, & Hamby, 2010). For example, the *teach* component involves an introduction to the EMT strategy, the *model* component involves an illustration of the EMT strategy through interventionist modeling or video modeling, the *coach* component involves an iterative process of practice and performance feedback, and the *review* component, involves evaluating the session reflecting on strengths and weaknesses as well as developing a plan of action for the next home visit (Roberts et al., 2014). None of the previous telepractice caregiver-implemented interventions utilized an empirically supported instructional framework to educate and coach caregivers. Applying the empirically supported TMCR framework and examining procedural fidelity data, minimizes the risk that null or negative results are secondary to ineffective caregiver instructional methods.

Third, the current study provided the telepractice intervention at a higher dosage than previous studies, and used a blended service delivery model. The investigator adhered to the

recommended treatment intensity for EMT (2x per week, over 4 months), which minimizes the risk that null or negative results are due to inadequate treatment intensity. Using a blended service delivery model, combined the benefits of in-person instruction, modeling, and coaching, with the efficiency and flexibility of telepractice service delivery (Baggett et al., 2010; Cohn & Cason, 2012; Knutsen et al., 2016).

Fourth, the investigator used a rigorous single-case design, which met contemporary design standards, to evaluate the effects of the EMT Telepractice Program. Few previous studies used rigorous single-case design methodologies that demonstrated experimental control sufficient to determine the presence of a functional relation. Using rigorous experimental designs minimizes threats to internal validity and increases the confidence in the intervention results.

Purpose And Research Questions

The purpose of the current study was to examine the efficacy of using video-teleconferencing to teach caregivers of young children with language impairments to implement EMT. The study addressed two research questions regarding caregiver-implementation of the EMT strategies: (RQ1) Is there a functional relation between delivery of the EMT Telepractice Program and caregiver use of EMT strategies during caregiver-child interactions? (RQ2) Do caregivers continue to use EMT strategies during caregiver-child interactions at levels consistent with the learning criterion (10% below the learning criterion or greater) for each strategy several weeks (e.g., 2 – 6) after completion of the intervention? In addition, the study addressed two exploratory questions regarding child communication skills: (RQ3) Is caregiver use of EMT strategies during telepractice instruction associated with increases in the number of child communication acts during caregiver-child interactions? (RQ4) Is caregiver use of EMT

strategies during telepractice instruction associated with increases in the child's lexical diversity (number of different words) during caregiver-child interactions? Last, the study included two questions about the cost of the intervention: (RQ5) What are the costs of delivering EMT via a blended telepractice model? (RQ6) Are the costs of delivering EMT through an in-person service delivery model greater than the costs of delivering EMT though a blended service delivery model?

CHAPTER II

METHOD

Participants

The Vanderbilt University Institutional Review Board (IRB) approved this study and the research was conducted in the Portland Metropolitan and Willamette Valley regions of Oregon. Children and caregivers were recruited across the state of Oregon through: (a) the Oregon Early Intervention System, (b) Oregon Health & Science University Clinics, (c) Multnomah County Education Service District, (d) Columbia Regional Program, (e) Portland Public Schools Early Assessment Team, and (f) David Douglas Schools Early Assessment Team. Recruitment announcements were emailed and mailed to early intervention providers. The principal investigator contacted caregivers who indicated a desire to participate in the intervention research through email or phone correspondence.

Inclusion criteria were: (a) child age between 18 – 36 months, (b) developmental age of 18 months or greater as measured on the Visual Reception Scale of the Mullen Scales of Early Learning (MSEL; Mullen, 1995), (c) total score of at least 1.33 standard deviations below the mean on the Preschool Language Scales-5th Edition (PLS-5; Zimmerman, Steiner, & Evatt-Pond, 2011), (d) hearing (with or without amplification) reported at 25 dB HL or better confirmed by audiological testing or medical record, and (e) the primary language spoken at home was English per caregiver report on a home language survey. Exclusion criteria were: (a) medical or educational diagnosis of an autism spectrum disorder, (b) concomitant sensory impairments (e.g., hearing loss greater than 25 dB HL, corrected visual acuity of 20/70 or less, without visual field

restrictions), and (c) results indicating a "high risk" for autism (e.g., scores of 8 or higher) on the Modified Checklist for Autism In Toddlers-Revised with Follow-up (MCHAT-R/F; Robins, Fein & Barton, 2009).

Seven caregiver-child dyads completed eligibility assessments. Two dyads were excluded because the child's language skills were within age expectations and one dyad was excluded because the primary language spoken at home was Portuguese. Four caregiver-child dyads met the inclusion criteria: Jameson with his mother Jessica, Ira with his mother Elena, August with his mother Alyssa, and Ambyr with her grandmother Terry. One of the four caregiver-child dyads (August and Alyssa) left the study after the second baseline session because Alyssa was returning to work and initiating speech-language therapy for August with a private provider.

Family demographic characteristics are shown in Table 3. Three mothers and one grandmother participated in the EMT Telepractice Program. None of the caregivers were employed outside the home when the study began, but all four caregivers were employed in full-time positions before becoming a stay-at-home parent or grandparent. All families were White and none of the families were Hispanic or Latinx. None of the families met the 2017 Census Bureau Poverty Threshold (U.S. Cenus Bureau, 2018). All four families received Early Intervention (Part C) services. Two dyads, Jameson/Jessica and Ambyr/Terry, received monthly services from a developmental therapist and physical therapist. One dyad, August/Alyssa, received twice-monthly services from a developmental therapist. One dyad, Ira/Elena, received monthly Part C services from a certified speech-language pathologist. All families had experience with mobile device technology and video-teleconferencing; each family had wireless internet access at home sufficient to support video-teleconferencing. According to the U.S.

Census Bureau (2018) and Oregon Office of Rural Health (2018), two families lived in urban areas and two families lived in rural areas. Distances between families' homes and the research center ranged from 9 – 89 miles.

< Table 3>

Table 3.

Child and Family Demographics

Child and Family Demographics	Participants			
	Jameson	Ira	August	Ambyr
Sex	Male	Male	Male	Female
Age[1]	25	19	27	22
Etiology or Diagnosis	Pre-mature birth, extremely low birth weight, Developmental delay	Language impairment	Developmental delay	Trisomy 21
Race	White	White	White	White
Ethnicity	Not Hispanic or Latino	Not Hispanic or Latino	Not Hispanic or Latino	Not Hispanic or Latino
Primary Language Spoken at Home	English	English	English	English
People living at home	4	5	4	3
Annual Family Income	$40,000- $50,000	Above $100,000	$50,000- $60,000	--
Income to Needs Ratio[2]	2.01	> 3.42	2.41	--
Distance from Research Center	32 miles	12 miles	9 miles	89 miles
County Designation	Rural	Urban	Urban	Rural
Receiving Early Intervention (Part C) Services	Yes	Yes	Yes	Yes
Receiving Speech and Language Therapy from a speech-language pathologist	No	Yes	No	No
Caregivers	Jessica	Elena	Alyssa	Terry
Relationship to child	Mother	Mother	Mother	Grandmother
Age	33	38	32	--
Employment Outside the Home	None	None	None	None
Experience with mobile digital devices	Yes	Yes	Yes	Yes
Experience with video-teleconferencing	Yes	Yes	Yes	Yes
Reliable wireless internet access at home	Yes	Yes	Yes	Yes

Note: 1= Age at study onset, 2= Estimated from 2017 Census Bureau Measures of Povert

Child developmental characteristics are shown in Table 4. Three boys and one girl and their caregivers participated in the EMT Telepractice Program. Participating children ranged in age from 19 – 27 months (Mean = 23.3 months, SD = 3.5 months). All children had language skills significantly below age expectations. Ira had primary language impairment. The other three children had language impairments secondary to other diagnoses. Jameson and August had developmental delays and Ambyr had Trisomy 21. Jameson, August, and Ambyr had scores significantly below age expectations on the MSEL, while Ira had scores within age expectations. Ira and Ambyr had scores within the typical range on the Child Behavioral Checklist for ages 1.5 – 5 (CBCL, Achenbach, & Rescorla, 2000). Jameson and August had scores within the clinical range for internalizing behavior and externalizing behavior respectively. According to the Structured Play Assessment (SPA; Ungerer and Sigman, 1981), all four children demonstrated some developmental play skills at the combination level, which involves using two toys or two related parts of toys together. Examples of combination play actions included, stacking cups, placing shapes in a shape sorter, putting animal puzzle pieces in a wooden puzzle, and stacking blocks. Three children's (Jameson, August, and Ambyr) most frequent play action was manipulative or basic exploration of toy materials. Manipulative play actions included, mouthing toys, throwing toys, and carrying toys.

<Table 4>

Table 4.

Child Developmental Skills

Measures	Jameson	Ira	August	Ambyr
PLS-5				
Auditory Comprehension[SS]	67	81	69	66
Expressive Communication[SS]	74	72	82	76
Total Score[SS]	69	74	74	69
Mullen Scales of Early Learning				
Visual Reception[T]	40	54	32	39
Fine Motor[T]	32	64	41	20
Receptive Language[T]	20	36	20	26
Expressive Language[T]	36	27	32	30
Early Learning Composite[SS]	67	91	65	61
MacArthur Bates CDI Words and Gestures Vocabulary Checklist				
Total Words Understood	58	86	371	213
Total Words Produced	22	8	65	39
Total Verbs Understood	10	9	52	38
Total Verbs Produced	0	0	5	4
Structured Language Sample				
Rate (Communication Acts/Min)	0.97	1.10	1.80	0.46
NDW	7	0	11	0
M-CHAT R/F Score	6	0	2	4
M-CHAT R/F Risk Description	Medium Risk	Low	Low	Medium Risk
Child Behavioral Checklist T Scores < 60 Typical Range				
Internalizing Behavior[T]	71	43	60	51
Externalizing Behavior[T]	58	43	64	55
Total Problem Behavior[T]	68	38	61	52
Structured Play Assessment				
Most Frequent Play Level	Indiscriminate actions	General combinations	Discriminate Actions	Discriminate Actions
Highest Play Level	Take Apart combinations	Specific combinations/ conventional attributes	General combinations	Take apart combinations

Note. SS= Standard Score with a mean of 100 and standard deviation of 15. T= T score, for the Mullen T Scores have a mean of 50 and a standard deviation of 10. For the CBCL, T scores of less than 60 are considered typical and are within age expectations.

One interventionist, a certified speech-language pathologist conducted all evaluation, baseline, intervention, and maintenance sessions. She had 11 years of experience working with children with disabilities in a clinical setting, eight years of experience practicing speech-language pathology, and six years of research experience investigating language and social communication interventions for children with language impairments. She was trained on delivering EMT and caregiver-implemented EMT using the Teach-Model-Coach-Review (TMCR) instructional framework at the Vanderbilt University Kid Talk Lab under the direction of Dr. Ann P. Kaiser. She achieved research reliability on both delivering caregiver instruction using the TMCR framework and providing EMT to children with language impairments and neurodevelopmental disabilities. She delivered the intervention in person to approximately six caregiver-child dyads and the EMT intervention alone to three children prior to this study.

Setting And Materials

In accordance with recommended practice guidelines, the interventionist provided all services in the children's natural environments (DEC, 2014). All assessment and intervention sessions occurred in families' homes. All families practiced the intervention in their living rooms adjacent to kitchens. The caregivers practiced the intervention and received coaching in the same setting across in-person and video-teleconferencing sessions. Two families practiced mealtime routines in the kitchen (e.g., Ira/Elana and Ambyr/Terry). During all sessions, the television and mobile devices (excluding those used for the telepractice training) were turned off. Two dyads (e.g., Ira/Elena and Jameson/Jessica) had siblings who were at home during some of the home-visits. If siblings were home during home-visits, the caregivers set up activities in a separate space for the siblings. Even though their caregiver planned activities for siblings, the siblings

occasionally joined Ira and Jameson during play activities. Table 5 describes the number and percentage of EMT sessions delivered in-person, across participants, and study phases. Across all three participants, the interventionist conducted an average of 39% of sessions in-person and 61% of sessions via video-teleconferencing. During in-person sessions, the interventionist provided instruction and coaching, seated with the caregiver and child in the family's living room and kitchen. During telepractice sessions, the interventionist provided instruction and coaching from a separate office, using a Dell Computer Workstation, with internet access, Zoom Teleconferencing Software, Logitech web-cam, and Blue Snowflake portable high-fidelity USB microphone.

<Table 5>

Table 5.

Number of Sessions Performed in Person and Via Telepractice

Participants	EMT Strategies	Baseline	Intervention	Maintenance
DT1001	Matched turns	3/6 50.0 %	9/23 39.1 %	2/7 28.6%
	Target talk Expansions	6/14 42.9 %	6/15 40.0 %	
	Time delay	8/18 44.4 %	4/11 36.4 %	
	Milieu episodes	10/23 43.5 %	2/6 33.3 %	
	All		14/36 38.9 %	
DT1002	Matched turns	2/5 40.0 %	11/28 39.3 %	1/5 20.0%
	Target talk Expansions	6/15 40.0 %	7/18 38.9 %	
	Time delay	8/21 38.1 %	5/12 41.7 %	
	Milieu episodes	10/26 38.5 %	3/7 42.9 %	
	All		14/38 36.9%	
DT1004	Matched turns	3/5 60.0%	10/26 38.4	2/5 40%
	Target talk Expansions	5/10 50.0%	8/21 38.1 %	
	Time delay	8/18 44.44%	5/13 38.5%	
	Milieu episodes	11/25 44.0%	2/6 33.3%	
	All		15/36 41.7%	

Several technologies facilitated data collection. All sessions were video-recorded. For sessions conducted in person, a camera (Sony Handycam HDR-CX580V) and tripod (Sunpak 2001 UT) were used to video-record sessions. For sessions conducted at a distance, an iPad Mini with built-in camera was used to video-record sessions. Adult EMT strategy use and child communication were transcribed, coded, and analyzed using the System of Analysis of Language Transcripts (SALT; Miller & Iglesias, 2012). Study data were managed using Research Electronic Data Capture (REDCap) hosted at Vanderbilt University (Harris et al., 2009). REDCap is a secure, web-based application designed to support data capture and management for research.

Multiple technologies were used to deliver the EMT Telepractice Program including: an iPad with built-in camera, Zoom™ video-teleconferencing software, and a Kubi™ telepresence robot. Zoom video-teleconferencing software was downloaded to the iPads to facilitate the distance training. Caregivers used iPads to videotape themselves interacting with their child and to video-teleconference using Zoom. Zoom™ software was selected for it's built in privacy features, screen sharing capability, video recording functions, and integration with Kubi. It is Health Insurance Portability and Accountability Act (HIPAA) secure. Built in privacy features ensured the confidentiality of the data transmission through password protection and end-to-end 128-bit advanced encryption. Zoom enabled screen sharing, which the interventionist used to share video-examples of EMT strategies and implementation supports such as personalized tip sheets and graphic representations of the previous session's data (See Appendix A for screenshots of EMT implementation supports shared with caregivers). To enhance the quality of the telepractice interactions, a Kubi remote controlled iPad stand was provided to families. It allowed the interventionist to control the video angle, with 300 degrees of pan and 90 degrees of

tilt without being physically present in the room. Remote controlled access insured that caregivers could focus on implementing EMT strategies and were not distracted by adjusting the iPad camera. To support adherence to the EMT intervention, caregivers also received an abbreviated treatment manual. The treatment manual included a set of tip sheets written in caregiver friendly language, which provided ideas to support the use of the EMT language strategies at home during typical routines. Tip sheets were provided to families following a brief workshop introducing each EMT language strategy (See Appendix B for abbreviated treatment manual).

Measures

Table 6 summarizes the measures administered during screening, pre-and post-treatment, and during the baseline, intervention, and maintenance phases. The interventionist conducted all of the standardized and observational measures at pre and post treatment.

< Table 6 >

Table 6.

Measures

Construct	Variables	Measure	Schedule
	Pre and Post Intervention Descriptive Measures		
Child and Family Characteristics	Child and Family Demographic Variables	Family Demographic Questionnaire Family Interview	T1
Non-verbal IQ	Visual reception subscale	MSEL	T1
Developmental Play skills	Highest and Most Frequent Play Level	SPA	T1
Expressive and Receptive Vocabulary	Number of words understood Number of signs and spoken words produced	MCDI	T1, T2
Receptive Language	Total auditory comprehension raw score	PLS- 5	T1, T2
Expressive Language	NDW expressed during language sample MLUm Total child utterances Total expressive communication raw score	LS LS LS PLS-5	T1, T2
Pro-social skills and Problem Behavior	Total Score	CBCL	T1, T2
	Outcome Measures		
Parent use of EMT Strategies	*Matched Turns:* Number/ Percentage of caregiver turns that are in response to the child's previous utterance *Target Talk:* Number/ Percentage of caregiver turns that are at child target level *Expansions:* Number/Percentage of child utterances to which the caregiver adds a word *Time Delays and Prompting*: Number/percentage of episodes that include correctly executed steps of the nonverbal and verbal prompting hierarchy	CCX	H
Child Communication Acts	Number of spontaneous communication acts Weighted count of communication acts Number of different words	CCX	H
Social Validity	Satisfaction with Intervention Goals Satisfaction with Intervention Procedures Satisfaction with Intervention Effects	Social Validity Assessment	H

Note. CBCL=; MSEL= Mullen Scales of Early Learning, MCDI= MacArthur Bates Communicative Development Inventories; PLS-5= Preschool Language Scales-5th edition; SPA= Structured Play Assessment H=All home visits 1-2 times per week, 3-5 times per phase, T1= Study Entry, T2= post-intervention

Child And Family Characteristics. Caregivers completed a health and demographic questionnaire about their family and child to gather information on the child's functional impairment, disability diagnosis, medical history, race, ethnicity, intervention services received, and the caregiver's educational history, employment status, home language use, and socioeconomic status. Health information and community services were updated monthly to monitor changes in number of hours of intervention as well as major health events that could affect the outcomes of the study. A copy of the demographic form is in Appendix C.

Mullen Scales Of Early Learning (MSEL; Mullen, 1995). The MSEL was administered to assess the children's overall developmental skills including expressive and receptive language, motor skills, and visual perceptual ability. Age-equivalency scores from the Visual Reception subscale were used to determine eligibility for the study. Three additional subscales were administered to obtain an Early Learning Composite Score: Fine Motor Scale, Receptive Language Scale, and Expressive Language Scale. The MSEL has high criterion-related validity with other assessments of nonverbal intelligence and language, including the Bayley Scales of Infant Development ($r = 0.70$).

Structured Play Assessment (SPA; **Ungerer and Sigman, 1981).** The SPA was administered to measure the children's developmental play skills. During the SPA, the child and interventionist sat facing each other while the interventionist presented five standard toy sets including: (1) puzzles, nesting cups, and blocks; (2) babies, a mirror, a brush, and a toy telephone; (3) babies, cups, plates, utensils, and play-food; (4) dolls, doll furniture, doll linens,

and tissue paper; (5) a barn, animals, a farmer, blocks, and a dump-truck. SPA Administration lasted approximately 15 – 20 minutes. The frequency, type, and level of spontaneous play acts were coded from the videotaped interactions. Scores for the highest and most frequent spontaneous play level were used to describe participants. The complete protocol and scoring sheet for the SPA are included in Appendix D.

Macarthur-Bates Communicative Development Inventories: Words And Gestures (MCDI; Fenson Et Al., 2007). Caregivers completed the MCDI, a caregiver-report instrument that describes a child's understanding and use of early gestures as well as receptive and expressive vocabulary. Caregivers indicated the words the child (a) understood and (b) understood and produced. Scores for the number of total words understood and produced and the number of verbs understood and produced were summarized to describe participants. The internal consistency of this measure is $r = 0.96$ and the test-retest reliability is $r = 0.80$ (Fenson et al., 2007).

Preschool-Language Scales-5th Edition (PLS-5; Zimmerman, Steiner & Pond, R; 2011). The PLS-5 was administered to evaluate the children's receptive and expressive language skills. Total scores were calculated to determine study eligibility. Receptive and expressive language skills were assessed through the Auditory Comprehension and Expressive Communication subscales respectively. The internal consistency of this measure ranges from $r = 0.85 – 0.94$ and test-retest reliability ranges from $r = 0.83 – 0.93$ depending on child age (Zimmerman et al., 2011). Split half reliabilities range from $r = 0.80 – 0.97$. Sensitivity for the total language score is $r = 0.83$ and specificity is $r = 0.80$ (Zimmerman, et al., 2011). The PLS-5

has a high degree of criterion-rated validity with the previous version—PLS-4 (adjusted $r = 0.85$) and the Clinical Evaluation of Language Fundamentals-Preschool – 2 (adjusted $r = 0.79$).

Language Sample (LS). A semi-structured language sample was administered to evaluate the children's expressive communication and language skills. During the language sample the child and interventionist sat facing each other while the interventionist presented six different toy sets including (1) babies (e.g., play food, kitchen utensils, cups, and plates) (2) play dough (e.g., playdough, cookie cutters, stamps, rolling pins, scissors, and playdough press) , (3) bubbles (e.g., large and miniature bubble containers) (4) a farm (e.g., barn, wind-mill, blocks, animals, little people, tractor, and crops), (5) cars (e.g., vehicles, car ramp, and garage elevator), and (6) a picture book (e.g. *Where's spot?, Spot's snowy Day*). Language sample administration lasted approximately 20 minutes. The rate of spontaneous communication acts, mean length utterance, and number of different words communicated were coded from the videotaped interactions. The protocol for the language sample is included in Appendix D.

Child Behavior Checklist Ages 1.5 – 5 (CBCL; Achenbach, & Rescorla, 2000). Caregivers completed the CBCL to measure the children's internalizing, externalizing, and overall problem behaviors. T scores for total problem behavior, internalizing, and externalizing behavior were calculated to describe participants. The CBCL has test-retest reliability of $r = 0.85$ and has criterion related validity with the Infant Toddler Social and Emotional Assessment (ITSEA, Briggs-Gowan & Caret 1998) of $r = 0.46 – 0.72$ for externalizing scales and $r = 0.48 – 0.62$ for internalizing scales (Achenbach & Rescorla, 2000).

Caregiver Child Interaction (CCX). Caregiver use of EMT language strategies and child communication acts were observed and coded from videos of a 10-minute caregiver-child interaction (CCX). During the CCX, caregivers were instructed to play as they normally would with toys from their homes that their child was interested in for 10 minutes. Primary and secondary dependent variables were coded from the CCX during baseline, intervention, and maintenance phases. Coders were trained to a minimum of 0.90 point-by-point inter-observer agreement (IOA) on three consecutive video media files prior to coding study data. Each coder independently coded caregiver strategy use and child communication acts from video media files. Error on unitizing and classifying caregiver and child behaviors were estimated through point-by-point IOA at the dependent variable level. The process for training coders and estimating the reliability of dependent variables is described in the IOA section below. Coders used definitions based on the EMT manual for CCX coding (See Appendix E). This code was entered and extracted using the Systematic Analysis of Language Transcripts software (SALT; Miller & Iglesias, 2012). Caregiver and child utterances were transcribed following the SALT protocol. Behavioral codes were attached to each utterance. SALT automatically calculated (a) linguistic variables (number of utterances, number of different words, mean length of utterance) (b) number of caregiver strategies used, and (c) number of child communication acts. Additional calculations including percentage of matched turns, percentage of target talk, percentage of time delays, percentage of milieu episodes, and weighted count of child communication acts, were conducted using algorithms designed in RedCAP.

Response Definitions And Data Collection For Dependent Variables

Caregiver EMT Strategy Use. The percentage of EMT strategy use was the primary dependent variable and the number of EMT strategies used was a secondary dependent variable. Caregiver EMT strategies were conceptualized as a context-dependent behaviors (Yoder, Lloyd, & Symons, 2018). EMT strategy use was conceptualized a dyadic variable, since the caregiver's responses were shaped in part by the child's communicative and play behaviors. Caregiver strategy use was coded during each baseline, intervention, and maintenance session from 10-minute video-recordings of the CCX. Each coder independently reviewed the video media files and used SALT to transcribe caregiver utterances and record whether EMT strategies were used. This coding scheme has been applied in several intervention studies with IOA of 0.80 – 1.00 (Peredo, Zelaya & Kaiser, 2018; Roberts & Kaiser, 2012; 2015). The investigator graphed the percentage and number of turns in which caregivers used EMT strategies. Decisions about phase changes (e.g., moving from baseline to intervention) were made following visual analysis examining the percentage of EMT strategy use across tiers.

Caregivers were taught five EMT strategies: (1) matched turns, (2) target talk, (3) expansions, (4) time delays, and (5) milieu-teaching episodes. Table 7 briefly summarizes the definitions for each of the EMT strategies. Operational definitions and learning criteria for each of the five EMT strategies are described below. Caregiver learning criteria corresponded with empirically derived implementation fidelity standards for each EMT strategy (c.f., Roberts & Kaiser, 2015).

<Table 7>

Table 7.

Strategy Examples and Fidelity Expectations

Strategy	Behaviors	Examples	Fidelity Expectations
Matched Turns	Imitate the child's non-verbal actions (mirror) and model (map) language targets	Child vocalizes while shaking a blanket and the caregiver shakes the blanket and says "shake!"	Percentage of child verbalizations followed by a contingent related response > 90%
Target Talk	Model target words	Caregiver models "go" while pulling the child in a laundry basket.	Percentage of caregiver utterances at the child's target language level (> 50%)
Expanding Communication	Expand the child's verbal communication by repeating his/her utterance and adding 1-2 words.	Child says "kiss" Caregiver kisses baby doll and says "Kiss the baby!"	% of child expandable utterances the caregiver expands (> 40%)
Time Delays	Caregiver looks at child expectantly, pauses and waits for a child response.	Caregiver holds up a ball and a dog stuffed animal and waits for the child to make a choice.	Percentage of correctly executed time delay episodes (> 80%)
Prompting	Response to non-target requests with prompting sequence using a least to most prompting hierarchy.	Child reaches for her fruit puree pouch, and caregiver says, "Say *pouch*!"	Percentage of correctly executed prompting episodes (> 80%)

Teaching matched turns encouraged caregivers to adopt a responsive interaction style, in which adult turns are contingent on child communication. A matched turn was a defined as a responsive utterance contingent on the child's communicative or play behavior that occurred immediately after (≤ 2 seconds) the child's play or communication act (Kaiser & Hampton, 2016; Roberts et al., 2014). For example, a matched turn occurred when a child handed the caregiver a toy car and the caregiver labeled the toy, *"Car!"* Caregiver turns were coded as unmatched when they (a) followed a child turn after a pause of > 2 seconds, (b) were utterances spoken independent of child communication, or (c) were unrelated to the child's communication or play act. An extra turn was defined as an adult turn that included a language target and visual referent taken after an interval of at least 5 seconds when the child did not take a play turn or communicate with the adult. The purpose of an extra turn was to re-engage the child in play. Caregiver turns were coded as extra turns when the adult (1) initiated a choice time delay, *or* (2) made a statement at the child's target mean length utterance, *and* (a) modeled a corresponding play action (e.g., "drive" while driving a car), *or* (b) modeled a joint attention gesture while pairing the word with an object (e.g., points to car , "car"). All caregiver utterances were categorized as matched, unmatched, extra turns, or unintelligible. The learning criterion was met when caregivers responded to child communication with 80% or greater matched turns across three of four consecutive sessions.

Target Talk was taught to encourage caregivers to use language at the child's target level based on his/her goal mean length of utterance (MLU). Target talk was a spoken verbal response containing the same number of content words as the child's target MLU. For example, if the child's target MLU was one-word, target talk involved the caregiver making single word statements such as "*Crash.", "Drive.",* and *"Slide."* All participants in the current study had a

target MLU of one-word because the children entered the study with fewer than 20 different words during the language sample administered at study entry. Table 8 provides examples of target talk for children with different MLUs. The learning criterion was met when caregivers used target talk during at least 50 % of their turns across three of four consecutive sessions.

<Table 8>

Table 8.

Target Talk

Current Performance	Target Level	Examples
0 – 50 Words	Single word utterances, emphasis on verbs. Proto-verbs, or prepositions that function as a verb in isolation or in two-word phrases, in addition to nouns. To ensure grammatically correct sentences, articles are used (e.g., the, an, a) but are excluded in the target word count.	Caregiver: Eat! Caregiver: Car! Caregiver: A bus! Caregiver: In!
50 – 100 Words	Two word utterances, emphasizing vocabulary rich combinations. These combinations may include, agent—action, action—object, modifier—noun types. To ensure grammatically correct sentences, articles are used (e.g., the, an, a) but are excluded in the target word count.	Caregiver: The tower falls! Caregiver: The bear drinks! Caregiver: The car drives! Caregiver: Push the wagon!
Spontaneous two-word phrases	Three word utterances, emphasizing syntactic combinations (e.g., agent—action—object, action—object—location, modifier—noun—action). To ensure grammatically correct sentences, articles are used (e.g., the, an, a) but are excluded in the target word count.	Caregiver: The baby eats a cookie! Caregiver: The big tower falls! Caregiver: Drive the bus to school! Caregiver: The car drives in the tunnel!

Expansions were taught so that caregivers would provide grammatically and/or semantically complex models for their children. Expansions were defined as adult spoken responses contingent on the child's verbal communication act (spoken or manually signed) that included all or part of the child's communication with an addition of one to two content words (Haebig et al., 2013). Thus, expansions consisted of caregiver turns that (a) added one or two content words to a child's verbal communication act, (b) replaced a word in the child's previous spoken utterance to make the statement grammatically correct or more specific, or (c) changed the verb tense in the child's previous spoken utterance to make the statement grammatically correct. For example, an expansion occurred when a child said "*baby*" and the adult responded with "*The baby drinks*". Expansions were well-formed, short utterances but not telegraphic; articles, pronouns, and verb tense were included. Table 9 provides additional examples of verbal expansions. The learning criterion for expansions was met when the caregiver expanded more than 40% of the child's utterances across three of four consecutive sessions.

<Table 9>

Table 9.

Verbal Expansions

Child Target Level	Child Turn	Caregiver Verbal Expansion Response
One word	Baby	The baby eats
Two words	Eat apple.	We eat apples and pears
Three words	My ball rolls.	Your ball rolls down the slide

Time delays were taught as a simple method for caregivers to elicit child communication. Time delays were defined as naturalistic nonverbal prompts for eliciting child communication. Time delays involved a pause and expectant look that indicated to the child that a communicative response was required. After the child communicated, the caregiver provided access to the object, performed the action of the child's interest, or prompted for specific language using milieu teaching (Kaiser & Hampton, 2016). Four time delay strategies were taught including: (1) nonverbal choice, (2) pause-in-routine, (4) assistance, and (5) inadequate portions. Nonverbal choices involved the caregiver holding up two items that a child might want and waiting with an expectant look until the child communicated. For example, the caregiver held up a toy spoon and blanket and waited for the child to select one of the toys through eye-gaze, vocalizations, gesture, manual sign, or a spoken word. Pause-in-routines occurred after two or three predictable repetitions in a routine when the caregiver paused with an expectant look until the child communicated. For example, the caregiver put three dolls on the bus, while modeling "on." Then, for the fourth doll, the caregiver paused holding the doll in the child's line of sight while waiting for the child to communicate. Opportunities for assistance involved providing a child with an activity that they needed assistance to gain access to or operate (e.g., toy in a closed jar) and waiting until the child communicated. For example, while playing with a toy pizza, the caregiver placed the remaining pepperoni on the plate, handed the child a closed container of pizza toppings, and waited for the child to communicate. When the child communicated, the caregiver completed the action and repeated the target word. If the child gestured or did not vocalize, the caregiver said the word and completed the action. Unlike milieu-teaching episodes, (described below), time delays did not result in a series of prompts to further elicit the child response. The goal was to reinforce child attempts to communicate while keeping the demand for

communication natural (routines, pause as cue) but relatively low. Table 10 summarizes the operational definitions and provides additional examples of the time delay strategies. All time delay strategies were scored on a three-point scale, with considerations for the caregiver's adherence to the strategy steps and the child's interest. The score represents the quality and accuracy of the time-delay. For the purposes of this study, time delays were executed incorrectly if they were not scored as a TD3: Outstanding Performance. Figure 1 summarizes scoring procedures for the time delay strategies. The learning criterion for time delays was met when more than 80% of the time delay episodes were executed correctly across three of four consecutive sessions.

<Table 10, Figure 1 >

Table 10.

Time Delay Strategy

Strategy	Description	Example
Pause in Routine	After two or three predictable repetitions in a routine, pause with an expectant look until the child uses any form of communication or 5-seconds elapse.	Caregiver stacks one block. Caregiver stacks a second block. Caregiver stacks a third block. As the caregiver stacks the fourth block he/she pauses before placing the block on top of the first three and waits for child communication.
Visual Choice	Hold up two items that the child might want and wait with an expectant look until the child uses any form of communication or 5-seconds elapse.	Caregiver holds up spoon and bottle, and waits for child communication.
Assistance	Provide the child with an activity that they need assistance to gain access to operate (e.g., a wind-up toy in a jar) and wait until the child uses any form of communication-or 5 seconds elapse.	Caregiver blows bubbles then tightly closes the bubble container. Caregiver hands places the tightly closed container on a nearby surface and waits for the child to communicate.
Inadequate portions	Provide the child with less than what might be needed or desires for an activity (e.g., a small ball of playdough, only a few blocks, a small portion of snack and wait until the child uses any form of communication of 5 seconds elapse.	Caregiver places 2 goldfish crackers on the child's snack plate during snack time turns toward the child, and waits for the child to communicate.

Time Delay Scoring Guidelines
Outstanding Performance **[td3]**
The caregiver demonstrates a high quality Time Delay. The caregiver must: 1. Start the Time Delay naturally so that it does not disrupt play. 2. Wait for a clear request from the child before giving the object/action. 3. Give the requested object/action at the end of the Time Delay. 4. Label the object/action with a language target within one second of giving it. 5. CHOICE ONLY – present two objects that have distinctly different language targets at the child's target level.
Not Great Teaching **[td2]**
The caregiver demonstrates a Time Delay with one of the following issues: 1. Does not wait for a clear request (accepts {look} only) – EXCEPT CHOICE. 2. Gives the requested object/action before using a language target.
Confusing to the Child **[td1]**
The caregiver demonstrates a Time Delay with one of the following issues: 1. The caregiver does not label the requested object/action with a language target OR does not repeat/expand when the child requests using a language target. 2. CHOICE ONLY - Does not wait for a clear child request (accepts {look} only). 3. CHOICE ONLY – does not present two objects that have distinctly different language targets at the child's target level.
Punishing to the Child **[td0]**
The caregiver demonstrates a Time Delay with one of the following issues: 1. The time delay is NOT natural and interrupts play. 2. The caregiver does not give the requested object/action to the child at the end of the Time Delay.
Child is Not Interested **[tli]**
The child is not interested in the object/action and the caregiver abandons the Time Delay appropriately by not giving the child the object/action.

Figure 1. Time delay scoring guidelines.

Milieu teaching episodes provided opportunities for children to practice their specific communication targets during a highly motivating context. A milieu-teaching episode was defined as a prompting procedure, which used the child's interest in an object, action, or person, to teach specific communication targets. Caregivers applied milieu teaching when a child requested but did not communicate at their target MLU. All children had single-word spoken response targets. After the non-target request (e.g., eye gaze, point, show, give, vocalization) the caregiver followed a prompting hierarchy to guide practice communicating a specific target. Three types of milieu teaching episodes were taught: model prompts (e.g., *Say 'open'.*) open question prompts (e.g., *What do you want ?*) and choice prompts (e.g., *Baby or Blocks?*) Model prompts involved giving a spoken direction to the child to do or say something (e.g., *Say 'help'*!). Open question prompts involved caregivers asking an open-ended question with no single answer (e.g., *Where should the cars go?*). Choice prompts involved caregivers asking a question about the two choices presented to the child (e.g., *Boats or Trains?*). All three milieu-teaching episodes used a least-to-most prompting hierarchy and they required caregivers to prompt twice at each level of the hierarchy if the child was not responding using his/her communication target. After the child said what the caregiver wanted him/her to say, the caregiver expanded the communication target. After the child was given two model prompts and he/she did not say the target, the caregiver repeated the target. Table 11 summarizes the operational definitions and provides additional examples of the milieu teaching episodes. All milieu teaching episodes were scored on a three-point scale, with considerations for the caregiver's adherence to the prompt sequence and the child's interest. For the purposes of this study, milieu-teaching episodes were executed incorrectly if they were not scored as a MT3: Outstanding Performance. All caregivers were taught to use model-prompts and targeted single

word spoken responses. One caregiver, Elena was taught to use choice prompts, which targeted single word spoken responses. Figure 2 summarizes scoring procedures for the milieu teaching episodes. The learning criterion for milieu teaching episodes was met when more than 80% of the prompts were executed correctly across three of four consecutive sessions.

<Table 11, Figure 2>

Table 11.

Milieu-Teaching Episodes

Strategy	Description	Example
Open question	Question or statement that requires a verbal communication response from the child that provides information that the adult does not already have (e.g. not a test question, there is no correct answer).	Child: reaches for baby doll. Caregiver asks: "What should we do?"
Choice prompt:	An either or questions that requires a verbal communicative response from the child that provides information that the adult does not already have (e.g., not a test question, there is no correct answer).	Child: Vocalizes to caregiver, who is holding up a bottle and spoon. Caregiver holds up bottle and spoon then asks: "Do you want the bottle or spoon?"
Model prompt	A word, phrase, or sentence that the adult directs the child to imitate. For example, the adult may say, " Say pizza!" or emphatically state the words (e.g. PIZZA!) to be imitated so it is clear to the child that the adult is prompting the child to imitate the words.	Child: Reaches for pretend pizza slice in caregiver's hand. Caregiver holds the pizza and says, "Say Pizza!"

Milieu-Teaching Episodes
Outstanding Performance +[me3]
The adult demonstrates a high-quality Milieu Episode. The adult must 1. Begin the Milieu Episode naturally and in response to a non-target child request. 2. Prompt a language target at the child's target level. 3. Prompt the same words throughout the episode. 4. Use the correct prompting sequence. 5. Give the child adequate time to respond. 6. Stop prompting when the child loses interest, says the prompted words, or responds to an open question with a target request. 7. Give the child the prompted and requested object/action at the end of the Milieu Episode. 8. Label the object/action with the prompted language target.
Not Great Teaching +[me2]
The adult demonstrates a Milieu Episode with one of the following issues: 1. Begins the Milieu Episode at a time when the child is NOT requesting. 2. Prompts below the child's target level or using a non-target word. 3. Does not model target language when ending the episode (giving the object/action).
Confusing to the Child +[me1]
The adult demonstrates a Milieu Episode with one of the following issues: 1. Changes the prompted words during the Milieu Episode. 2. Uses the incorrect prompting sequence 3. Gives the object inappropriately or loses control of the object.
Punishing to the Child +[me0]
The adult demonstrates a Milieu Episode with one of the following issues: 1. Prompts above the proximal target level. 2. Continues prompting after the child responds with the prompted words. 3. Continues prompting after the child has lost interest in the prompted object/action. 4. Begins the Milieu Episode in response to a child target request. 5. Does not give the object at the end of the episode. 6. Does not give the child adequate time to respond. 7. The Milieu Episode begins in a way that is NOT natural and disrupts play.
Child Loses Interest +[mli]
The child loses interest in the object/action and the adult abandons the Milieu Episode appropriately by not giving the child the prompted object/action
Milieu Abandoned Correctly +[mac]
The child was NEVER interested in the Milieu Episode, and the adult realizes it after ONE PROMPT and abandons the episode appropriately by not giving the prompted object/action

Figure 2. Milieu teaching episodes scoring guidelines.

Child Communication Acts. The number of child communication acts and number of different words were exploratory dependent variables. Child communication acts and number of different words were conceptualized as context-dependent behaviors. A child communication act was defined as a signaling behavior, which was socially directed toward a communication partner (Brady, 2015). Each communication act was classified as a potentially communicative vocalization, conventional gesture, manually signed word, or spoken word. Potentially communicative vocalizations were defined as child vocalizations that were non-word or unintelligible utterances and socially directed to the caregiver. For example, a potentially communicative vocalization occurred when the child vocalized, "*ahhbah*" while looking at a container of playdoh™ and turning toward his mother. Vocalizations included animal (e.g., *roar, meow)* and transportation sounds (e.g., *beep-beep, vroom*). The following were not coded as vocalizations: (a) laughing, crying, or screaming, (b) involuntary noises such as hiccups, and (c) utterances that included a recognizable word or word combinations. Conventional gestures were defined as purposeful nonverbal movements used to signal toward an object or event of interest. Conventional gestures included reaches, headshakes for no and yes, pointing (proximal or distal) showing, and giving. For example, gestures were coded when a child pointed to a duck in a book. Manual signing was coded when a child used a clearly defined manual sign with a consistent hand shape. For example, a manual sign was coded when a child placed his thumb on his chin to sign *"mom"*. Spoken words were defined as the child using the same sounds for the same referent consistently. Words did not have to be clearly articulated, however, to be counted as a word, the word had to be an acceptably close approximation to an adult pronunciation. Specifically, words needed to contain at least one accurate phoneme occurring in the correct position and have the same number of syllables as the adult pronunciation, or the same number

of syllables as a common diminutive of the word (e.g., jamas for pajamas). Multiple word combinations were defined as utterances that combined two or more different words expressed by the child that were spontaneous, communicative, and occurred with less than one second between words. Multiple word combinations included a manual sign and a word (e.g., signs *"more"* and says *"tea"*), two manual signs (e.g. signs *"more"* and *"banana"*) or two spoken words (e.g., says *"hide"* and "m*onkey*"). Child communication acts that included a multiple-word combination were assigned an additional code, to enhance estimation for mean length utterance and to capture semantic and syntactic growth.

Each communication act was transcribed and coded from video media files of CCX sessions during the baseline, intervention, and maintenance conditions. Coders independently used the SALT protocol to record the number of communication acts and to indicate which form of communication the child used (word, gesture, sign, and potentially communicative vocalization). The coding scheme has been applied in several intervention studies with average IOA ranging from 0.87 – 0.91 (Quinn & Kaiser in preparation; Wright, Kaiser, Reikowsky, & Roberts, 2013). The total number of child communication acts and a weighted count of communication acts were graphed for visual analysis using Microsoft Excel. Learning criteria were not designated for child communication because it was a secondary dependent variable.

A weighted communication count was estimated using the Infant Toddler Growth Indicator: Early Communication Index (IGDI-ECI) procedures (Carter, Greenwood, Walker & Buzhardt, 2010; Greenwood, Walker, & Buzhardt, 2010). The IGDI-ECI total score, which is a weighted count of total communication acts, has criterion-related validity of $r = 0.62$ with the Expressive Communication subscale of the Preschool-Language Scales 3rd Edition. The EMT operational definitions for a word, manual sign, gesture, and multi-word combinations were

consistent with the operational definitions used in the IGDI-ECI. To calculate a weighted count, the interventionist multiplied the number of vocalizations and gestures by 1, spoken and manually signed words by 2, and multiple word combinations by 3 before summing the communication acts. Multiplying selected communication forms by a larger number effectively "gives more weight" to communication forms that are theoretically more complex or developmentally within age-expectations (Yoder et al., 2018). Child communication acts were measured using a weighted count in addition to a standard count because research on early social communication skills indicated that weighted counts may be more sensitive to change and predictive of later social communication skills in young children at risk for autism (Yoder, Stone, Walden & Malsea, 2009).

The number of different words (NDW) produced, defined as the total number of different word roots used during caregiver-child interactions was obtained from transcripts coded using SALT. Words produced using different modes (e.g., manual sign, spoken words) were counted as one word root. NDW produced was used to measure the lexical diversity of the children with language impairments.

Design And Procedures

A single-case multiple-baseline across behaviors (i.e., EMT component strategies) design replicated across three caregiver-child dyads was used to examine the effect of delivering the EMT Telepractice Model, on caregivers' EMT strategy use and concomitant changes in child communication. Within each multiple baseline design, there were four opportunities to demonstrate an intervention effect for caregiver EMT strategy usage. One demonstration and two potential replications across caregiver-child dyads were planned. The intervention was

implemented with each caregiver-child dyad as an independent multiple baseline design. For each dyad, concomitant changes in communication skills were examined in the context of a simple time series design (A-B comparison). The study involved three phases, baseline, intervention, and maintenance. Procedures for each study phase are described in the sections below.

Baseline Sessions. Baseline sessions ranged from 36 – 106 minutes (mean = 58.8, SD = 17.3). During baseline sessions, the variability in session length was related to child-care activities which interrupted the planned session activities (e.g., dressing, diaper changing, and toileting). Table 12 outlines the activities completed during the baseline sessions. Baseline included four elements: (1) *setting the stage* (e.g., reviewing the child's developmental progress and family events), (2) *instruction* (e.g., discussion of developmental skills and milestones), (3) *observation* (e.g., interventionist observed 15-minute caregiver-child interaction) and (4) *session summary* (e.g., interventionist summarized session activities and confirmed future schedule). First, the interventionist asked the caregivers about changes that occurred, updates on recent successes, current challenges, and new concerns. Second, the interventionist shared information about developmental skills and milestones for the following areas: social-emotional, physical and motor skills, self-regulation, behavior, and cognitive development. No instruction was provided regarding early language and communication development. The interventionist provided information to caregivers from the Centers for Disease Control (CDC) Learn the Signs—Act Early public awareness campaign. Example materials are included in Appendix F. Third, the interventionist asked caregivers to select toys from those available in the home and play with her child as she typically would for 10 minutes; the interventionist then asked the caregiver to

complete a typical home routine with her child for 5 minutes. No coaching or feedback was provided during baseline sessions. Fourth, the interventionist summarized the session and provided general, positive feedback to the caregiver after the CCX and home routine.

<Table 12>

Table 12.

Baseline Session Activities

Procedure	Description
Setting the stage	Interventionist gathers updates on child and family, listens and encourages caregiver reflection. Interventionist reviews the days plan (toys, routines, session order)
Instruction	Interventionist shares information related to development and family interests, connects learning targets to functional outcomes and priorities to increase caregiver knowledge and resources. Interventionist introduces CDC learn the signs act early lessons.
Observation	Interventionist observes 15-minute parent-child interaction No coaching or feedback will be provided.
Session Summary	Interventionist provides general feedback on caregiver and child behaviors. Interventionist engages the parent in reflective discussion by using at least 1 probing question, or if the parent initiates reflective talk, therapist gives reflective feedback in response.

Intervention Sessions. Intervention sessions ranged from 34 – 111 minutes (mean = 60.6, SD = 18.5). During baseline sessions, the variability in session length was related to (a) child-care activities which interrupted the planned session activities (e.g., feeding, dressing, diaper changing, and toileting) and (b) the four workshop instructional sessions. Table 13 outlines the intervention sessions, which included four elements: (1) setting the stage, (2) instruction, (3) observation, and (4) session summary. In contrast to the baseline sessions, the interventionist applied the TMCR instructional framework during the *instruction*, *observation,* and *session summary* segments of the session. The interventionist provided instruction to caregivers in person and via video-teleconferencing regarding five EMT language support strategies: (1) matched turns, (2) target talk, (3) expansions, (4) time delays, and (5) milieu teaching episodes. The interventionist used the TMCR instructional framework to facilitate caregiver learning across four workshop sessions and during the twice-weekly training and coaching sessions. Treatment intensity (e.g., dose frequency and session duration) was consistent with prior studies of EMT implemented with caregivers and young children with language impairments (Roberts & Kaiser, 2015). A summary of study components and the sequence for teaching the five EMT language support strategies are provided in Figure 3.

< Table 13, Figure 3>

Table 13.

Intervention Session Activities

Procedure	Description
Setting the stage	Interventionist gathers updates on child and family, listens and encourages caregiver reflection.
	Interventionist asks caregiver to update intervention implementation since last visit, listens, encourages caregiver reflection and sets up problem solving as needed.
	Interventionist shares information related to development and family interests—connects learning targets to functional outcomes and priorities to increase caregiver knowledge and resources.
	Interventionist reviews the days plan (toys, routines, session order)
Instruction	Interventionist shares information related to development and family interests, connects learning targets to functional outcomes and priorities to increase caregiver knowledge and resources.
	Interventionist introduces EMT strategy and uses Teach Model Coach Review Framework to support instruction.
Observation	Interventionist observes 15-minute parent-child interaction
	Interventionist provides active coaching and feedback during 15 minute parent child interaction.
	Interventionist highlights modeling targets of the day at least twice.
	Therapists gives caregiver specific positive feedback or training feedback at least one time every minute.
Session Summary	Interventionist provides general feedback on caregiver and child behaviors.
	Therapist engages caregiver to lead development of a “best plan of action” for embedding intervention in multiple routines and activities throughout the day to facilitate caregiver leadership and decision making.
	Interventionist engages the parent in reflective discussion by using at least 1 probing question, or if the parent initiates reflective talk, therapist gives reflective feedback in response.

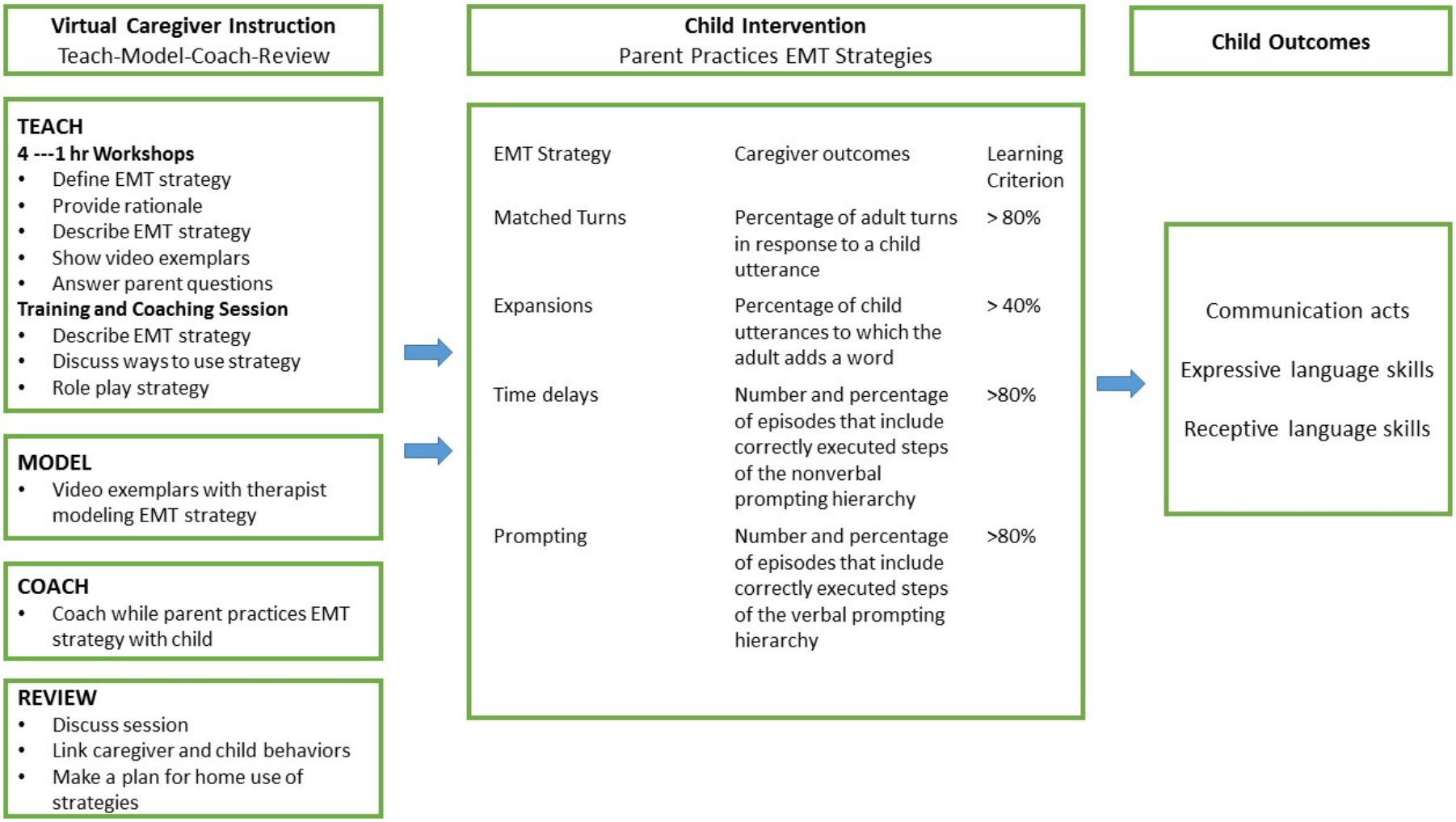


Figure 3. Summary of intervention procedures, caregiver outcomes and child outcomes.

The interventionist taught five EMT strategies across four tiers: (1) Tier 1: matched turns, (2) Tier 2: target talk and expansions, (3) Tier 3: time delays and (4) Tier 4: milieu-teaching episodes. Each strategy was introduced in a training workshop approximately 45 minutes in duration. During the training workshops, the interventionist (a) introduced and defined the EMT strategy, (b) provided a theory and rationale for the EMT strategy, (c) explained strategy implementation using video exemplars, (d) role played the strategy with the caregiver, (e) answered the caregiver's questions, and (g) developed a plan for strategy use during the home visit. After completing the training workshop, caregivers participated in twice-weekly training and coaching sessions. Each training session focused on a target EMT strategy and followed the Teach-Model-Coach-Review instructional approach. First, the interventionist spent 10 minutes teaching the target strategy by (a) reviewing the strategy, (b) providing examples, (c) role-playing with caregivers, and (c) discussing ways the caregiver could use the strategies with selected toys and home routines. Second, interventionists spent 10 minutes reviewing graphed data of the previous session's performance, video examples of the caregiver's strategy use, and/or transcripts of the caregiver-child interaction, which illustrated the target EMT strategy. Third, interventionists coached caregivers while they practiced the target EMT strategy with their children for 10 minutes during toy play and 5 minutes during a typical routine (e.g., snack, book reading, music). Coaching consisted of the following four key behaviors (a) reminding the caregiver to use a specific strategy or specific component of a strategy (e.g., mirror-and-map, respond to gestures), (b) suggesting a specific target word or phrase to model (e.g., "go," "stack blocks"), (c) suggesting an action to increase play or engagement (e.g., hand him a the car, roll the car on the ramp), (d) recommending environmental arrangement strategies (e.g., clear your space, hold out a choice), (e) providing knowledge of performance feedback (e.g., "perfect

mirroring and mapping, great play model but try again when he is looking right at you") and (f) delivering general praise (e.g., "well timed" "good idea"). Coaching statements were brief, positive in tone, and intended to support EMT strategy use during the immediate interaction. Occasionally, the interventionist made suggestions about positive behavior supports for the child's behavior if needed ("let's clean up now [to prevent throwing]"). Coaching was planned to occur no more than once per minute, based on caregiver need for support and performance. Additional coaching for positive behavior support occurred as needed, but generally fewer than four times per session. For example, the coach offered suggestions around environmental arrangement (e.g., "If you position Jackson in the corner with the toys in front of you and your legs as a barrier, it will give him a cue to stay in that part of the rug during play) and ignoring unwanted behaviors. Fourth, the interventionist led a 10-minute discussion, which reviewed caregiver use of the target EMT strategy, child responses to caregiver use of the strategies, answered caregiver questions, and supported the caregiver in planning how she would use the EMT strategies outside the training sessions. New EMT strategies were taught after the caregivers met criterion (See Figure 2) on his/her target EMT strategy. The sequence of teaching EMT strategies was the same for all caregivers. First caregivers learned matched turns, second they learned target talk and expansions, third they learned time delays, and fourth they learned milieu-teaching episodes.

Maintenance Sessions. Maintenance sessions occurred between two and eight weeks following the completion of the intervention phase. Procedures for the maintenance sessions were similar to those in the baseline sessions. They included three elements (1) *setting the stage* (e.g., reviewing the child's developmental progress and family events), (2) *observation* (e.g.,

interventionist observed 15-minutes caregiver-child interaction) and (3) *session summary* (e.g., interventionist summarized session activities and confirmed future schedule). First, the interventionist asked the caregivers about changes that occurred, updates on recent successes, current challenges, and new concerns. Second, the interventionist asked caregivers to select toys from the home and play with her child as she typically would for 10 minutes. Then the interventionist asked the caregiver to join their child in a typical home routine for 5 minutes. No explicit teaching, coaching, or feedback was provided during maintenance sessions. Third, the interventionist summarized the session and provided general, positive feedback to the caregiver after the CCX and home routine.

Post Intervention Assessments. The interventionist administered a post-intervention assessment battery including a structured language sample, PLS-5, SPA and MCDI to describe child language and communication growth over the course of the intervention. These assessments occurred immediately after the maintenance phase was completed.

Inter-Observer Agreement (IOA) For Dependent Variables And Procedural Fidelity

A senior research assistant in the Kid Talk Lab, who was not involved in the conduct of the current study, supervised the initial coder training for observing dependent variables. First, coders read the coding manual, completed web-tutorials on coding procedures, and met with the senior research assistant to discuss coding procedures. Prior to coding data for the current study, the two coders were trained to 90% point-by-point IOA on transcription and coding for (a) caregiver use of EMT strategies and (b) child communication acts on three consecutive video media files. One graduate research assistant, a master's degree student in special education, acted

as the primary coder and coded all session data. The investigator was the secondary coder. She coded a randomly selected sub-sample of 33% of all baseline, intervention, and maintenance sessions across all tiers for each participant to examine the reliability of the dependent variables. The primary coder was unaware of which coded sessions were randomly selected and assessed for IOA.

An equivalent, two-step process was used to estimate the reliability of the dependent variables. First, each coder independently transcribed then coded sessions using SALT software via repeated viewings of video media files of the session. Second, the investigator compared the independently coded samples to calculate point-by-point IOA for the dependent variables. This two-step process ensured that unitizing and classifying errors were included within the calculation of IOA at the dependent variable level. In the few instances where IOA for the dependent variables fell below the 80% criterion, the investigator met with the primary coder and (a) reviewed and refined operational definitions, (b) specified the coding manual if needed, and (c) completed consensus coding to minimize observer drift. Consensus coding was only used for instructional purposes. Table 14 includes the average IOA for EMT strategy use across each caregiver and study phase. For all caregivers, the average IOA was above 91% for matched turns (range = 81% – 95%), 89% for target talk (range = 77% – 94%), 92% for expansions (range = 81% – 98%), 90% for time delays (range = 50% – 100%), and 93% for milieu teaching episodes (range = 67% – 100%). Table 15 includes the average IOA for child communication skills across each caregiver and study phase. For all children, the average IOA was above 90% for child communication acts (range = 80% – 95%) and 94% for number of different words (range 33% – 100%). IOA was less than 80% when the base number of occurrences was low (less than 5), or when coders segmented adult statements differently.

< Table 14 and 15>

Table 14.

Reliability of Dependent Variables for EMT Strategy Use

Phase	Jessica and Jameson Mean (Range)	Elena and Ira Mean (Range)	Terry and Ambyr Mean (Range)
Baseline			
Matched turns	93 % (91% – 94%)	88% (83% - 94%)	91% (86% – 95%)
Target talk	89% (85% – 93 %)	86% (77% – 93)	91% (80 - 97%)
Expansions	93% (85 % – 94%)	91% (81% – 98 %)	90% (81% – 98)
Time delays	N/A	100%	N/A
Milieu-teaching episodes	N/A	N/A	N/A
Total	92%	92%	91%
Intervention			
Matched turns	91 % (88% – 94 %)	90% (81%- 95%)	88% (85% - 92)%
Target talk	89% (81% – 94%)	88% (80 – 92%)	87% (82- 93%)
Expansions	90 % (88% – 94%)	92% (89% – 95%)	89% (86%- 91%)
Time Delays	100%	96% (50% – 100%)	91% (80 - 100%)
Milieu-teaching episodes	100%	91% (67% – 100%)	94% (75% – 100%)
Total	94%	90%	90%
Maintenance	93%	87%	90%

Table 15.

Percentage of Inter-Observer-Agreement Across Phases and Dependent Variables

Participant	Condition	Child communication acts	Number of different words
Jameson	Baseline	92% (81% – 92%)	100%
	Intervention	90% (84 – 94%)	93% (83% – 100)
	Maintenance	89% (86 – 92%)	90% (87 - 100%)
lra	Baseline	91 % (89 – 93%)	94% (86% – 100%)
	Intervention	89% (79% – 91%)	96% (33% - 100%)
	Maintenance	92% (87 – 95%)	91% (75% – 100)%
Ambyr	Baseline	91% (80 – 94%)	90% (80% - 100%)
	Intervention	86% (80- 91)	96% (67% - 100%)
	Maintenance	88% (83- 93)	94% (88% - 100%)

The investigator supervised the coder training for measuring procedural fidelity. First, the coders reviewed the procedural fidelity observational checklists, completed practice sessions with exemplars, and met with the investigator to discuss procedural fidelity processes. Prior to assessing procedural fidelity for the current study, two coders were trained to 90% point-by-point IOA on three consecutive video media files of baseline, intervention, and maintenance sessions. Research assistants, graduate students in master's degree programs in special education and child studies, acted as the primary and secondary coders respectively. Each coder independently assessed the sessions via repeated viewings of video media files of the session. The coders used an observational checklist (direct systematic observational recording alongside a procedural fidelity checklist) to assess the interventionist's adherence to study procedures during baseline, intervention, and maintenance sessions. Procedural fidelity was measured during at least 33% of all sessions across phases, tiers, and participants. Inter-observer-agreement for procedural fidelity was assessed on 20% of sessions selected for procedural fidelity assessment. The investigator randomly selected a sub-sample (20% of sessions) to examine the reliability of the procedural fidelity assessment. Both coders were unaware of which sessions were assessed for IOA.

Data were analyzed separately for each participant, phase and tier, and are summarized in Table 16. Results of the procedural fidelity assessment indicated that across participants, the study procedures were implemented with an average of 99% accuracy for baseline sessions (range = 86% – 100%), 98% accuracy for intervention sessions (range = 86% – 100%), and 96%% accuracy for maintenance sessions (range = 68%– 100 %). Maintenance session fidelity was very low (68%) for a single session, where the caregiver and interventionist decided to discontinue the routine session since the child was too fatigued to continued. Average inter-

observer-agreement (IOA) for procedural fidelity data was greater than 98 % IOA for all participants (range = 91% – 100%). Appendix G contains example procedural fidelity measures.

< Table 16>

Table 16.

Procedural Fidelity Across All Phases and Participants

Phase	Jessica and Jameson	Elena and Ira	Terry and Ambyr
	Mean (Range)	Mean (Range)	Mean (Range)
Baseline			
Matched turns	100%	99% (95% – 100%)	100%
Target talk/ expansions	97% (95% – 100%)	99% (95% – 100%)	98 % (91% – 100%)
Time delays	97% (95% – 100%)	99% (95% – 100%)	97 % (86% – 100%)
Milieu-teaching episodes	97% (95% – 100%)	99% (97% – 100 %)	97 % (86% – 100%)
Total	98%	99%	98%
Intervention			
Matched turns	96% (86% – 100%)	99% (95 – 10%)	96 % (86% – 100%)
Target talk/ expansions	96% (86% – 100%)	99 % (95- 100%)	97% (86% – 100%)
Time Delays	97% (91% – 100%)	99% (95% – 100 %)	97% (86% – 100%)
Milieu-teaching episodes	95 (91% – 100%)	98 % (95- 100%)	100
Total	96%	99%	98%
Maintenance	100%	100%	96 % (86% – 100 %)
Overall procedural fidelity	98%	99%	97%
Inter-observer agreement for procedural fidelity	100 %	99% 95-100	97% 91-100

Visual Analysis And Statistical Analysis

Caregiver Outcomes. To address RQ1 and RQ2, data for all five EMT strategies were graphed after each session using Microsoft Excel. Decisions about phase changes were made based on structured visual analysis of the coded data. During the baseline condition, the interventionist conducted at least five sessions in which caregiver responses were stable. A stable baseline was defined as a series of at least four data points where the two most recent data points did not indicate a therapeutic (accelerating) trend. Once the caregiver demonstrated a stable baseline, the intervention was applied to the EMT strategy in the first tier. No training was provided for the EMT strategies in the remaining three tiers. Caregiver instruction for subsequent EMT strategies was introduced after (a) at least five intervention sessions were completed, and (b) the caregiver met or exceeded the learning criterion during three of four consecutive sessions. Caregiver performance of the specific EMT strategy was evaluated through visual analysis with an expectation of an immediate increase in level and an accelerating (therapeutic) trend to criterion. A functional relation (intervention effect) was determined by first examining the number of data points, level, trend, stability, and overlap of data (Ledford & Gast, 2018). Second, the data were reviewed to determine whether caregiver use of EMT strategies increased when and only when the intervention was implemented. Third, the investigator evaluated the patterns of change to determine if the pattern of change was consistent across EMT language support strategies and caregiver-child dyads.

Statistical analyses were conducted to complement and quantify results of visual analysis across participants. Non-overlap metrics and parametric effect sizes were calculated in R studio

using the SingleCaseES R package (Swan & Pustejovsky, 2018). The non-overlap of all pairs (NAP; Parker & Vannest, 2009) was selected as the non-overlap metric because of all overlap based methods, NAP is least sensitive to variability in procedural factors such as baseline and intervention phase length. In addition, NAP allows for calculation of confidence intervals (Pustejovsky & Ferron, 2017). NAP quantifies non-overlapping data by evaluating the extent to which all possible pairs of data overlap in adjacent conditions. Thus, it estimates the probability that a randomly selected observation from the intervention phase improves in comparison to a randomly selected observation from the baseline phase (Pustejovsky, 2016). The natural log of the ratio of the conditional mean or log response ratio (LRR; Pustejovsky, 2015) was selected as the parametric effect size estimate. LRR was selected because it is (a) appropriate for behaviors measured as counts or proportions, (b) robust to differences in the measurement system, and (c) not influenced by session length.

Child Outcomes. To address RQ3 and RQ4, the number of child communication acts, weighted count of child communication acts, and number of different words were graphed after each session using Microsoft excel. In this study, child communication acts and NDW were a secondary and exploratory dependent variables. While the study design type for caregivers was a multiple-baseline across behaviors (EMT strategies) design, the study design type for children was a simple time series design or A-B comparison. Increases in child communication acts were evaluated with visual analysis with an expectation of a latent increase in level and/or a gradual, accelerating (therapeutic) trend within a month of the caregiver meeting the learning criterion for matched turns. No decisions regarding phase changes were made based on child performance All decision about condition changes were made based on visual analysis of caregiver use of EMT

strategies. Statistical analysis was not conducted because there was not sufficient experimental control for the child dependent variables.

Costs Of The Intervention

To answer RQ5 and RQ6, several costs were estimated. First, the investigator calculated the general costs associated with the EMT telepractice program including: assessment measures, evaluation materials, and telepractice equipment (e.g., iPads, Zoom, Kubi). Second, the investigator calculated the actual cost of the EMT Telepractice Program for each family. These costs included (a) personnel costs for clinical services provided in person ($ 36.00 an hour), (b) personnel costs for clinical services provided via telepractice ($36.00 an hour), (c) personnel costs for travel ($36.00 an hour), and (d) mileage reimbursement (0.53 per mile). Third, the investigator calculated the anticipated cost of delivering EMT to each family entirely in-person including: (a) personal costs for clinical services provided in person, (b) personnel costs for travel to conduct in person sessions, and (c) mileage reimbursement. Fourth, the investigator calculated the difference in costs between delivering the EMT Telepractice Program using a blended service delivery model and delivering EMT entirely in-person.

Social Validity

Caregivers completed a questionnaire to describe the perceived feasibility and acceptability of the EMT Telepractice Program Procedures. The questionnaire included eight questions; two questions addressed intervention goals, three questions addressed intervention procedures, and three questions addressed intervention effects. Responses to each question were scored on a 1 to 5 Likert scale, with 1 = Strongly Disagree and 5 = Strongly agree. A copy of the social validity questionnaire is in Appendix H.

CHAPTER III

RESULTS

Research Question 1

Is There A Functional Relation Between The EMT Telepractice Program And Caregiver Use Of EMT Strategies During Caregiver-Child Interactions? For all three caregiver-child dyads, the percentage of EMT strategy use increased immediately after the interventionist delivered the EMT Telepractice Program for four EMT strategies: matched turns, expansions, time delays, and milieu teaching episodes. Visual analysis indicated there were 12 actual demonstrations of effect out of 12 potential demonstrations of effect. The consistency of behavior changes across conditions, and replication across tiers, suggested a functional relation between the introduction of the EMT Telepractice Program and EMT strategy use for all three caregiver-child dyads. A summary of the structured visual analysis and statistical analysis for each dyad is included below.

Jessica And Jameson. Figure 4 depicts Jessica's data for the primary dependent variable, percentage of EMT strategy use. During the baseline condition, Jessica had a stable baseline for four EMT strategies: matched turns, expansions, time delays, and milieu teaching episodes. For matched turns, her strategy use was moderate with a variable, zero-celerating trend (range = 14% – 46%). For expansions, she showed stable, low-level strategy use with a zero-celerating trend (range = 0 – 20 %). For time delays and milieu teaching episodes, her strategy use was stable at zero throughout the baseline condition. In contrast, Jessica showed an immediate increase in

level and a steep, accelerating (therapeutic) trend during the baseline condition for target talk. This increase in level occurred after EMT was implemented in Tier 1 for matched turns (session 7). She met the learning criterion for target talk prior to instruction on that EMT strategy. Even though Jessica met the learning criterion for target talk during the baseline condition, the interventionist formally introduced the strategy, provided performance feedback on strategy use, and continued data collection in order to observe potential changes in strategy use over time.

<Figure 4>

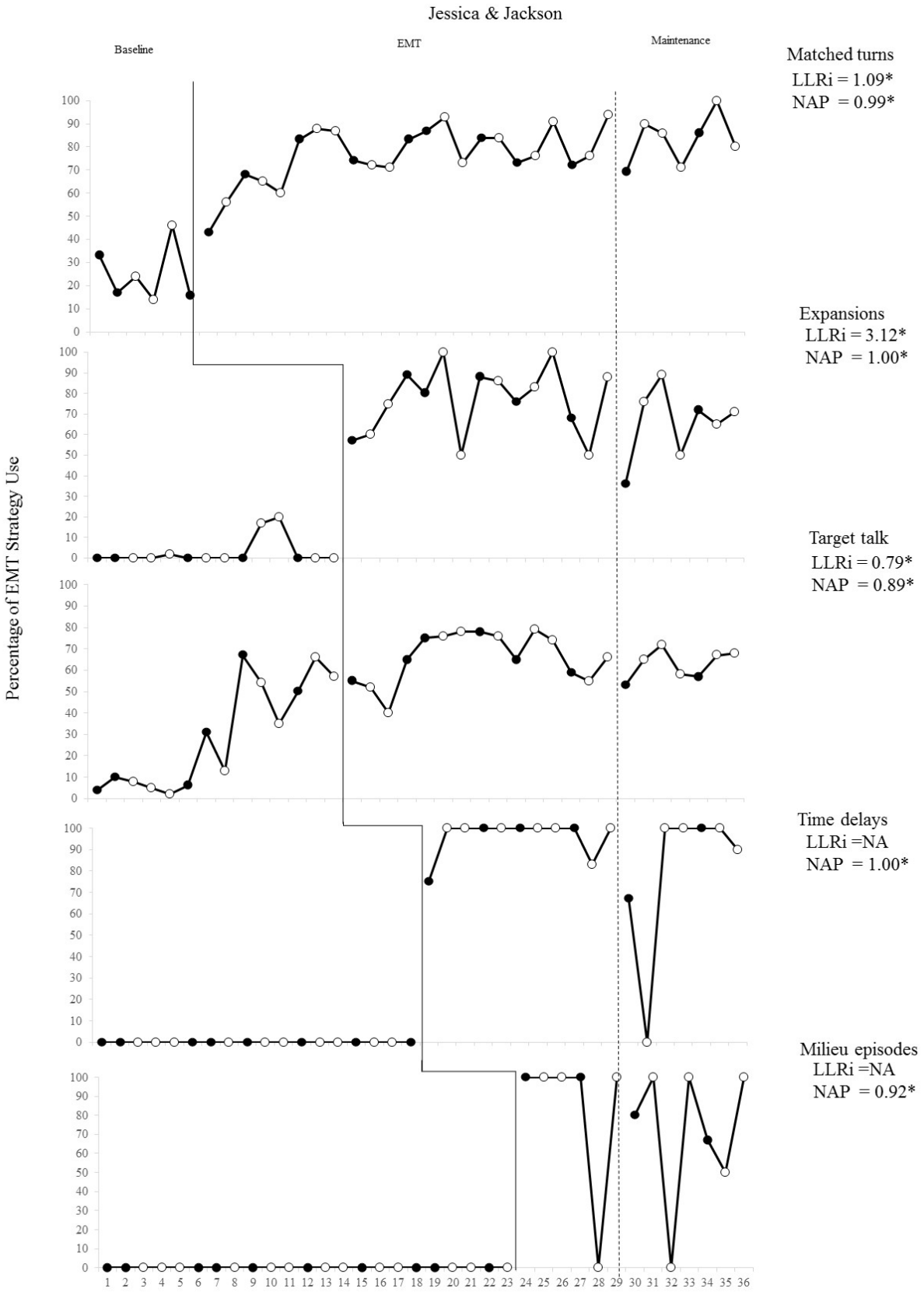


Figure 4. Jessica's percentage of EMT strategy use. Sessions provided in person are indicated by filled circles. Sessions delivered via telepractice are indicated by open circles.

During the intervention condition, Jessica demonstrated an increase in level for four EMT strategies: matched turns, expansions, time delays, and milieu teaching episodes. For matched turns, she showed an immediate, moderate increase in level with a gradual, accelerating (therapeutic) trend. Her performance remained stable once she met the learning criterion (range = 71% – 94%). For expansions, Jessica exhibited a large, abrupt increase in level with a steep, accelerating (therapeutic) trend, which continued until she met the learning criterion. After she met the learning criterion, her expansion use remained at a high level with some variability (range = 50% – 100%). For time delays and milieu teaching episodes, Jessica showed a large, abrupt increase in level and a stable, zero-celerating trend near the strategy ceiling (time delays range = 75% – 100%; milieu teaching episodes range = 0 – 100%). For milieu teaching episodes, data point 28 represented an outlier because no milieu teaching episodes were attempted during that session. Jessica met the learning criterion for matched turns, expansions, time delays and milieu teaching episodes during the intervention condition. For target talk, Jessica did not show a clear change in level, since her percentage of target talk overlapped with her performance during the baseline condition. Although, her percentage of target talk stabilized after the intervention was applied in Tier 2 for expansions and target talk. Jessica met the learning criterion for the four EMT strategies taught during the intervention condition. A functional relation was established between the EMT Telepractice Program and increases in caregiver strategy use, since Jessica's behavior changed at four different points in time across all four tiers.

NAP and LRR estimates were calculated to complement the results of structured visual analysis. NAP estimates quantified the degree of overlap for all five EMT strategies. All NAP estimates were significant. According to Peterson-Brown et al. (2012), NAP estimates were

large for matched turns (NAP = 0.99, SE = 0.00, 95% CI = 0.78 – 1.00), expansions (NAP = 1.00, SE = 0, 95% CI = 1.00 – 1.00), and time delays (NAP = 1.00, SE = 0, 95% CI = 1.00 – 1.00). They were small for milieu teaching episodes (NAP = 0.92, SE = 0.09, 95% CI = 0.67 – 1.00) and target talk (NAP = 0.89, SE= 0.06, 95% CI= 0.69 – 0.96). LLR quantified the magnitude of changes between conditions for three EMT strategies: matched turns (LRR = 1.09, SE = 0.21, 95% CI = 0.69 – 1.49), expansions, (LRR = 3.12, SE = 0.65, 95% CI= 1.84 – 4.35), and target talk (LRR= 0.79, SE = 0.24, 95% CI = 0.32 – 1.25). LRR estimates were not possible to calculate for time delays and milieu teaching episodes because strategy use was consistently at zero during the baseline condition.

Figure 5 depicts the graphed data for the secondary dependent variable, number of EMT strategies used. In this figure, a secondary axis with a smaller range is included for time delays and milieu teaching episodes to illustrate performance for low rate behaviors. Specifically, time delays and milieu teaching episodes occurred at a lower frequency than matched turns, target talk, and expansions. Overall, visual analysis of Jessica's number of EMT strategies revealed response patterns consistent with her percentage data.

<Figure 5>

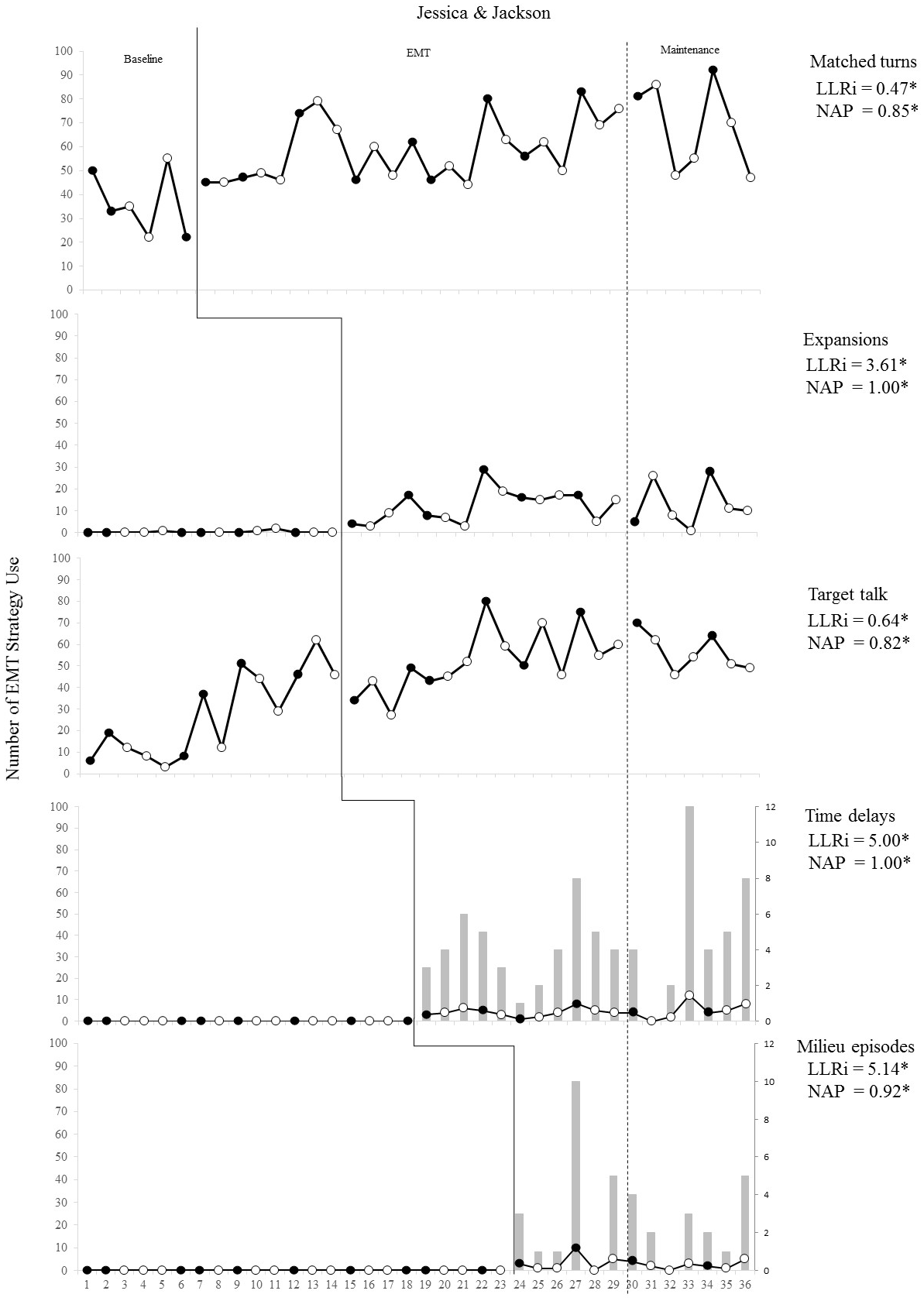


Figure 5. Jessica's number of EMT strategies used. Sessions provided in person are indicated by filled circles. Sessions delivered via telepractice are indicated by open circles.

During the baseline condition, Jessica had stable responses for four EMT strategies: matched turns, expansions, time delays, and milieu teaching episodes. For matched turns, Jessica's strategy use was at a moderate level with some variability and a zero-celerating trend (range = 22 – 50). For expansions, time-delays, and matched turns, her strategy use was stable at or near zero. For target talk, Jessica's strategy use began at a moderate level (range = 6 – 19). However, after the intervention was applied in Tier 1 (session 7) she demonstrated an abrupt increase in level with a steep, accelerating (therapeutic) trend (range = 37 – 62).

During the intervention condition, Jessica demonstrated a clear increase in level for four EMT strategies: matched turns, expansions, time delays, and milieu teaching episodes. For matched turns, she showed a modest increase in level immediately after the intervention was applied. A close examination of the trend revealed patterns of zero-celeration (e.g., data points 7 – 12) and gradual acceleration (e.g., data points 12 – 14 and 21 – 29). For expansions, Jessica exhibited an abrupt increase in level with some variability (range = 3 – 29). Her performance also showed a gradual, accelerating (therapeutic) trend which plateaued to a zero-celerating trend after data point 22 (range = 17- 29). For time delays and milieu teaching episodes, Jessica displayed an abrupt increase in level with a variable, accelerating (therapeutic) trend (time delays range =1 – 8; matched turns = 0 – 10). For target talk, she did not demonstrate an increase in level. The accelerating trend established during baseline plateaued to a variable, zero-celerating trend.

All NAP and LLR estimates for number of EMT strategies used were significant. According to Peterson-Brown et al. (2012) NAP estimates were large for expansions and time delays (NAP = 1.00, SE = 0, 95% CI = 1.00 – 1.00). They were small for matched turns (NAP =

0.85, SE= 0.10, 95 % CI = 0.59 – 0.95), target talk (NAP = 0.82, SE = 0.08, 95% CI = 0.61 – 0.92), and milieu teaching episodes (NAP = 0.92, SE= 0.09, 95% CI = 0.67 – 0.98). LRR estimates were calculated for all five EMT strategies: matched turns (LRR = 0.47, SE = 0.16, 95% CI = 0.15 – 0.79), expansions (LRR = 3.60, SE = 0.59, 95% CI = 2.45 – 4.77), target talk (LRR = 0.64, SE = 0.21, 95 % CI = 0.22 – 1.04), time delays (LRR = 5.00, SE = 0.14, 95% CI = 4.72 – 5.28), and milieu teaching episodes (LRR = 5.15, SE = 0.46, 95% CI = 4.24 – 6.03).

Elena And Ira. Figure 6 depicts Elena's data for the primary dependent variable, percentage of EMT strategy use. During the baseline sessions, Elena showed stable responses for four EMT strategies: matched turns, expansions, time delays, and milieu teaching episodes. For matched turns, her percentage of strategy use was low, stable, and had a zero-celerating trend (range = 21% – 26%). For expansions and milieu teaching episodes, Elena's strategy use was low and stable at zero. For time delays, her strategy use was low and stable at zero aside from one outlier (data point 13). For target talk, she showed an immediate increase in level and an accelerating (therapeutic) trend after the intervention was applied in Tier 1 (session 6). Elena's use of target talk had high variability during the baseline condition (range = 2% – 60%).

<Figure 6>

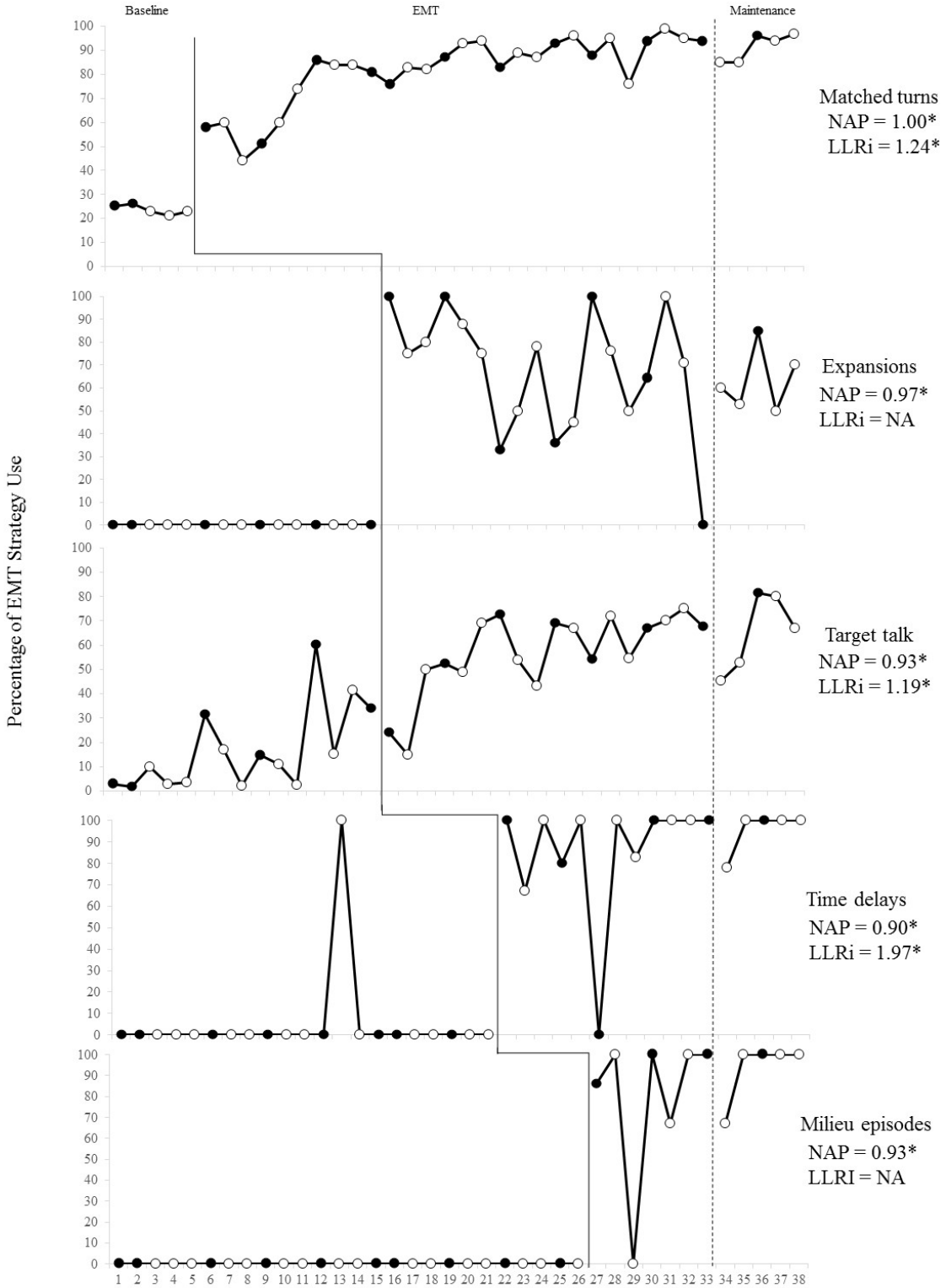


Figure 6. Elena's percentage of EMT strategy use. Sessions provided in person are indicated by filled circles. Sessions delivered via telepractice are indicated by open circles.

During the intervention condition, Elena exhibited an immediate increase in level for four EMT strategies: matched turns, expansions, time delays and milieu teaching episodes. For matched turns, she demonstrated an abrupt increase in level with a gradual, accelerating (therapeutic) trend (range = 58 % – 86%). In addition, her strategy use remained stable at a high level (> 80%) after she met the learning criterion (sessions 14 – 33). For expansions, Elena showed a large, abrupt increase in level, which maintained at moderate to high levels (range = 33% - 100%). Her expansion use was above the learning criterion in 72% of intervention sessions (13/18). She had one outlier (data point 33), which overlapped with her performance during the baseline condition. During this session, Ira did not use a spoken word or manual sign which Elizabeth could expand. For time delays and milieu teaching episodes, Elena had large and abrupt increases in level which she maintained a high level throughout the intervention (range = 67% – 100%). However, she had two outliers for each strategy, data point 27 for time delays and data point 29 for milieu teaching episodes. For target talk, Elena did not show an immediate increase in level. Instead, she showed initial overlap with the baseline phase, followed by a moderate increase in level and a stable, zero-celerating trend after she met the learning criterion (range = 55% – 75%). Elena met the learning criterion during the intervention condition for all five EMT strategies taught. A functional relation was established between the EMT Telepractice Program and increases in caregiver strategy use because, Elena's behavior changed at four different points in time across all four tiers.

NAP and LRR estimates were calculated to complement the results of structured visual analysis. NAP estimates quantified the degree of overlap for all five EMT strategies. All NAP estimates were significant. According to Peterson-Brown et al. (2012), NAP estimates were large for matched turns (NAP = 1.00, SE = 0.00, 95% CI = 1.00 – 1.00) and expansions (NAP =

0.97, SE = 0.03, 95% CI = 0.83 – 1.00). They were small for target talk, (NAP = 0.93, SE = 0.04, 95 % CI = 0.77 – 0.98) time delays (NAP = 0.89, SE = 0.06, 95% CI = 0.71 – 0.97), and milieu-teaching episodes (NAP = 0.93, SE = 0.07, 95% CI = 0.71 – 0.98). LRR quantified the magnitude of changes between conditions for three EMT strategies: matched turns (LRR = 1.25, SE = 0.05, 95% CI = 1.14 – 1.34), target talk, (LRR = 1.19, SE = 0.28, 95% CI = 0.64– 1.73), and time delays (LRR = 1.97, SE = 0.70, 95% CI = 0.61– 3.33). LRR estimates were not possible to calculate for expansions and milieu-teaching episodes since the percentage of strategy use was at zero during the baseline condition.

<Figure 7>

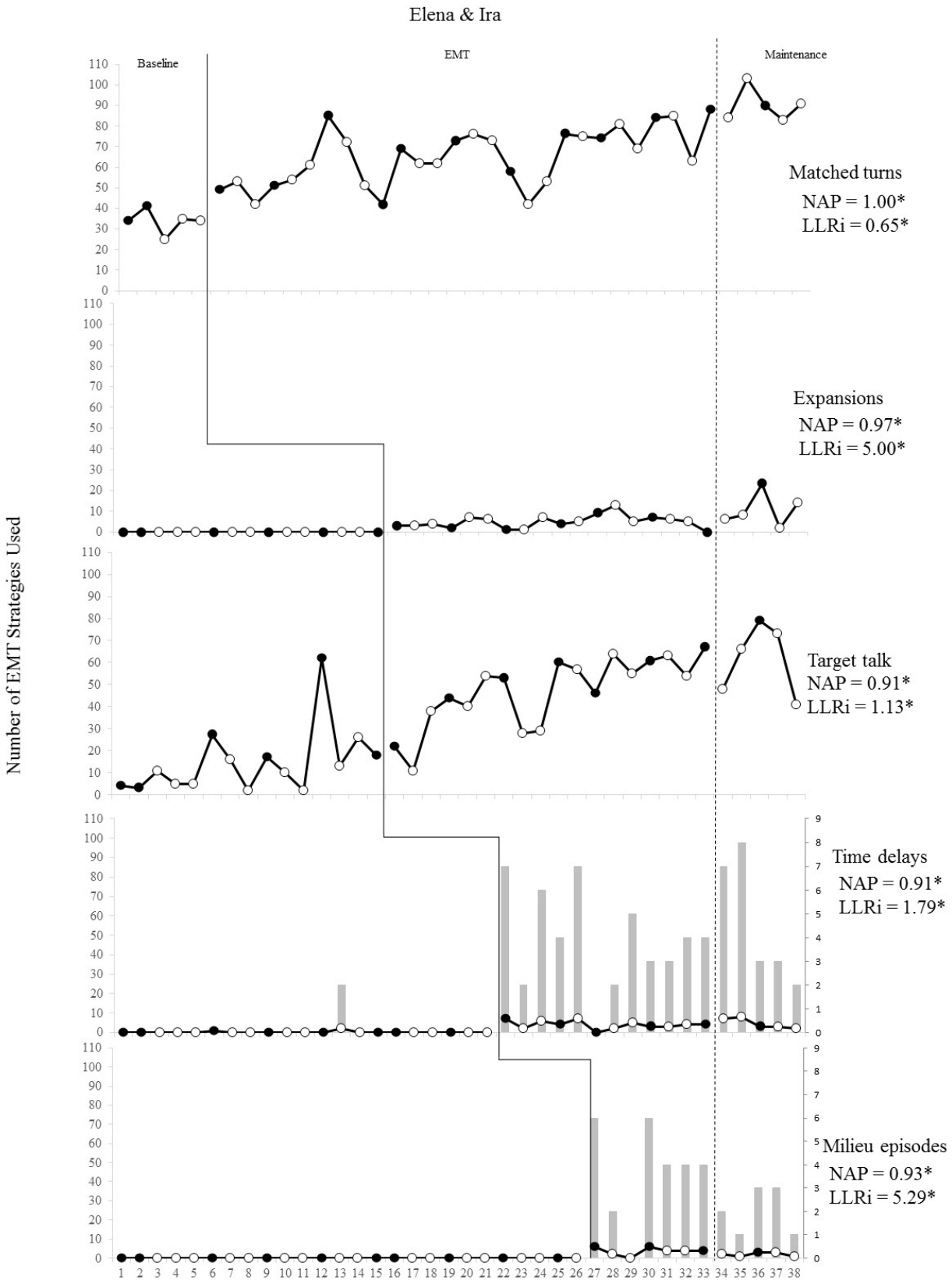


Figure 7. Elena's number of EMT strategies used. Sessions provided in person are indicated by filled circles. Sessions delivered via telepractice are indicated by open circles.

Figure 7 depicts the graphed data for the secondary dependent variable, the number of EMT strategies used. Overall, visual analysis showed response patterns consistent with percentage data. During the baseline condition, Elena exhibited stable responding for four EMT strategies: matched turns, expansions, time delays, and milieu teaching episodes. For matched turns, Elena's strategy use was at a moderate level with a stable, zero-celerating trend (range = 25 – 41). For time delays, expansions, and milieu teaching episodes her baseline performance was low and stable at or near zero. For target talk, Elena's strategy use began at a moderate level with some variability (range = 5 – 11). After the interventionist delivered the intervention in Tier 1 (session 6) Elena showed an accelerating (therapeutic) trend for target talk.

During the intervention condition, Elena demonstrated an immediate increase in strategy use after the intervention was applied for four EMT strategies: matched turns, expansions, time delays, and milieu teaching episodes. For matched turns, she showed a modest increase in level and a gradual, accelerating (therapeutic) trend, which stabilized after she met the learning criterion (session 15). For expansions, time delays, and milieu-teaching episodes, Elena showed an small increase in level, with a variable, zero-celerating trend (expansions range = 1 – 13; time delays range = 0 – 7; milieu teaching episodes range = 0 – 6). For target talk, there was no clear increase in level. The accelerating trend, which began during the baseline sessions continued into the intervention condition.

All NAP and LLR estimates were significant for number of EMT strategies used. According to Peterson-Brown et al. (2012) NAP estimates were large for matched turns (NAP = 1.00, SE = 0, 95% CI = 1.00 – 1.00) and expansions (NAP = 0.97, SE= 0.03, 95% CI = 0.83 – 1.00). They were small for target talk (NAP= 0.91, SE= 0.06, 95% CI = 0.74 – 0.97), time delays

(NAP = 0.91, SE = 0.06, 95% CI = 0.73 – 0.97) and milieu teaching episodes (NAP = 0.93, SE= 0.07, 95% CI = 0.71 – 0.98). LRR estimates were calculated for all five EMT strategies: matched turns (LRR = 0.65, SE = 0.09, 95% CI = 0.49 – 0.82), expansions (LRR = 4.99, SE = 0.15, 95% CI = 4.70 – 5.30), target talk (LRR = 1.13, SE = 0.28, 95% CI = 0.57 – 1.68), time delays (LRR = 1.79, SE = 0.73, 95% CI = 0.35 – 3.32), and milieu teaching episodes (LRR = 5.28, SE = 0.22, 95% CI = 4.86 – 5.71)

Terry And Ambyr. Figure 8 depicts Terry's data for the primary dependent variable, percentage of EMT strategy use. During the baseline sessions, Terry's performance was stable for four strategies: matched turns, expansions, time delays, and milieu teaching episodes. For matched turns, her strategy use was at a moderate level with a variable, decelerating (contra-therapeutic) trend (range = 15% – 41%). For expansions, her strategy use was low and at zero for 70% (7/10) of baseline sessions. However, for three baseline sessions (data points 4 – 6) Terry's expansion use was at a moderate level (range = 20% – 50%). Her performance had some variability (range = 0 – 50%) but returned to zero and was stable prior to delivering EMT. For time delays and milieu teaching episodes, Terry's strategy use was low and stable at zero. For target talk, she showed an immediate increase in level and an accelerating (therapeutic) trend, after the intervention was applied in Tier 1 (session 6). Terry's use of target talk was at a high level during the last five baseline sessions (range = 63% – 90%). She met the learning criterion for target talk during the baseline condition. Even though, she met the learning criterion, data collection continued in order to observe potential changes in strategy use over time.

<Figure 8>

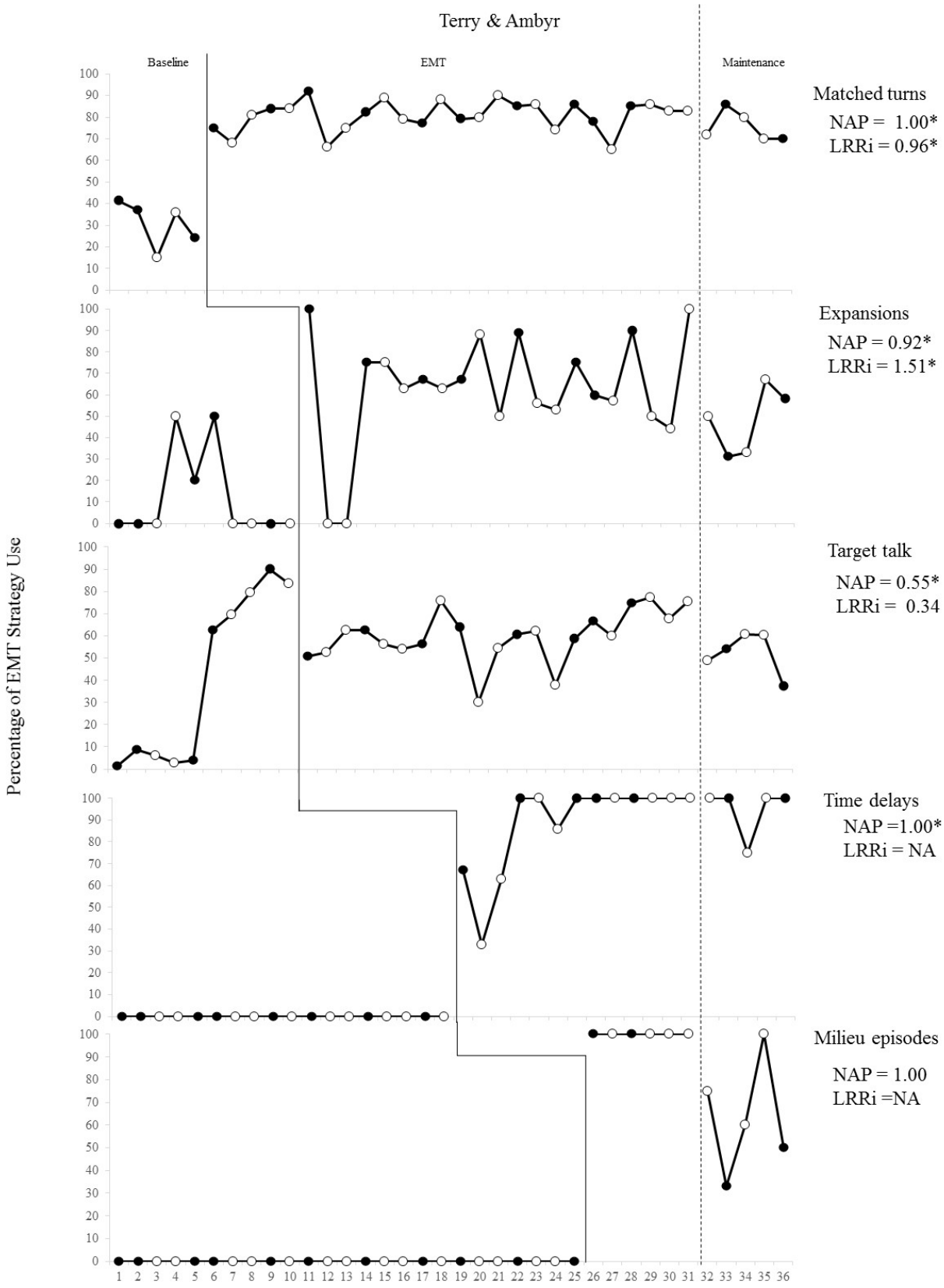


Figure 8. Terry's percentage of EMT strategy use. Sessions provided in person are indicated by filled circles. Sessions delivered via telepractice are indicated by open circles.

During the intervention condition, Terry showed a large and abrupt increase in level for four EMT strategies: matched turns, expansions, time delays, and milieu teaching episodes. For matched turns, she showed a large, immediate increase in level, followed by a gradual, accelerating (therapeutic) trend (range = 68% – 92%). This trend stabilized to zero-celerating shortly after she met the learning criterion. Her performance maintained at or above the learning criterion for 73% (16 / 26) of the intervention sessions. For expansions, Terry demonstrated an immediate increase in level followed by a variable, zero-celerating trend (range = 0 – 100). She had two outlier data points (session 12, 13) that overlapped with her performance during baseline. Her strategy use maintained at levels at or above the learning criterion during 90% of the intervention sessions (19/21). For time delays, Terry showed an abrupt increase in level followed by a steep, accelerating (therapeutic) trend which stabilized at or near the strategy ceiling (86% – 100%). Her performance was at or above the learning criterion for 71% of intervention sessions. For milieu-teaching episodes, she showed an abrupt increase in level followed by performance at the strategy ceiling (100%) during all of the intervention sessions. In contrast, for target talk, Terry showed an immediate decrease in level (range = 51% – 62%) followed by a variable trend. The decrease in target talk use represented a positive change because ideal target talk involves 50% of adult utterances at the child's target MLU and 50% of utterances above the child's target MLU. Terry's target talk use overlapped with her performance during the baseline condition. She met the learning criterion for four EMT strategies taught during the intervention condition. A functional relation between the EMT Telepractice Program and increases in caregiver strategy use was established, because, Terry's behavior changed at four different points in time across all four tiers.

NAP and LRR estimates were calculated to complement the results of structured visual analysis. NAP estimates quantified the degree of overlap for all five EMT strategies. All NAP estimates were significant. According to Peterson-Brown et al. (2012), NAP estimates were large for matched turns (NAP = 1.00, SE = 0.00, 95% CI = 1.00 – 1.00) time delays, (NAP = 1.00, SE = 0.00, 95% CI = 1.00 – 1.00), and milieu-teaching episodes (NAP = 1.00, SE = 0.00, 95% CI = 1.00 – 1.00). They were small for expansions (NAP = 0.92, SE = 0.05, 95% CI =0.72 – 0.97) and target talk, (NAP = 0.55, SE = 0.15, 95 % CI = 0.34 – 0.74). LRR quantified the magnitude of changes between conditions for three EMT strategies: matched turns (LRR = 0.96, SE = 0.16, 95% CI = 0.65 – 1.27), expansions (LRR = 1.51, SE = 0.56, 95% CI = 0.41– 2.60), and target talk (LRR= 0.34, SE = 0.30, 95 % CI = -0.25 – 0.93). LRR estimates were not possible to calculate for time delays and milieu teaching episodes since the percentage of strategy use was at zero during the baseline condition.

Figure 9 depicts the graphed data for the secondary dependent variable, the number of EMT strategies used. Overall, visual analysis of Terry's number of EMT strategies showed response patterns consistent with her percentage data. During the baseline condition, Terry exhibited stable responding for four EMT strategies: matched turns, expansions, time delays, and milieu teaching episodes.. For matched turns, Terry's strategy use was stable at a moderate level with a zero-celerating trend (range = 23 – 40). For time delays, expansions, and milieu teaching episodes her performance was low and stable at or near zero. For target talk, Terry's strategy use began at a low level (range = 1– 9) and was stable. After the interventionist delivered the intervention in Tier 1 (session 6),Terry showed an immediate increase in level and an accelerating (therapeutic) trend for target talk (range = 37 – 51).

<Figure 9>

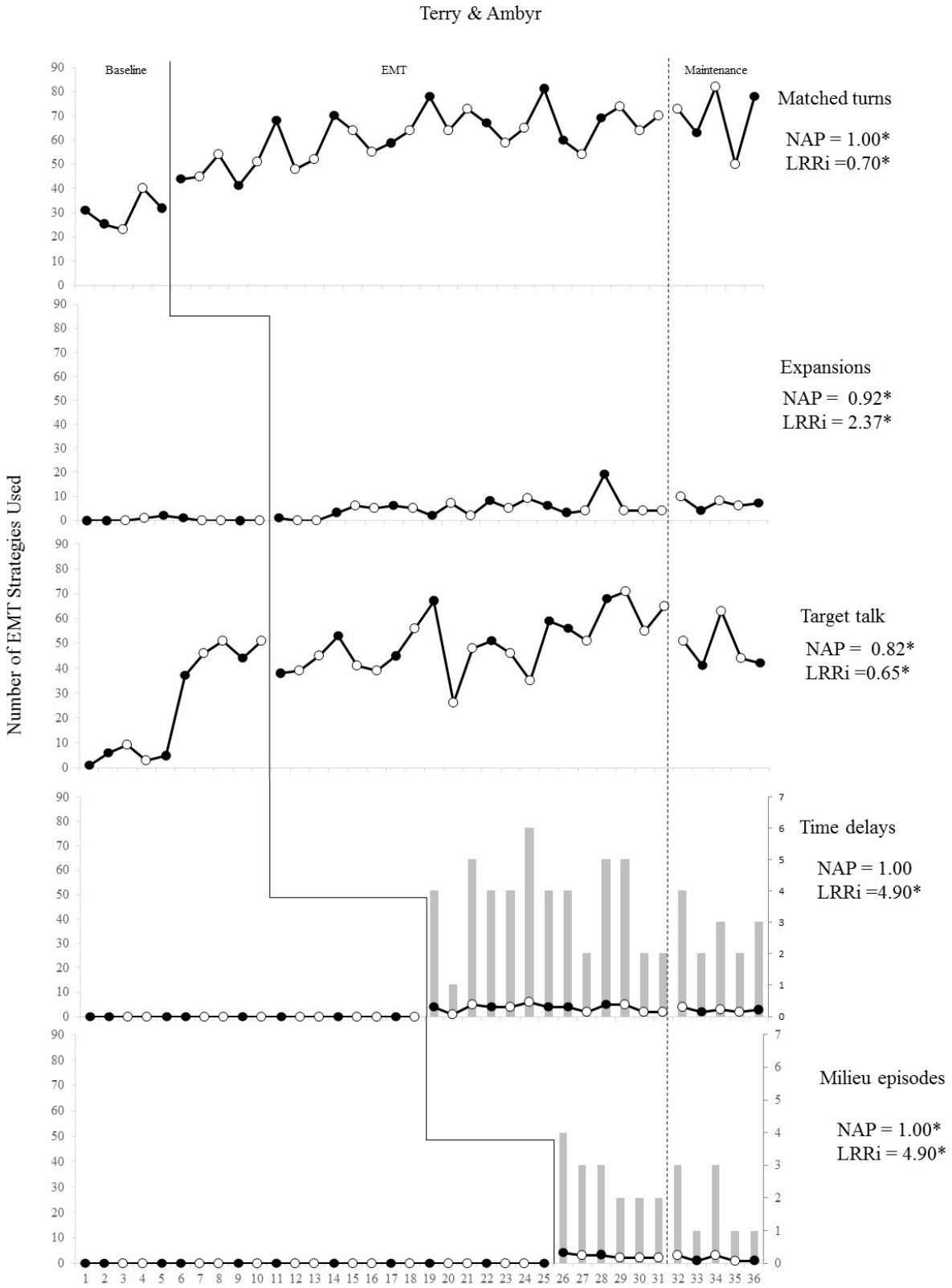


Figure 9. Terry's number of EMT strategies used. Sessions provided in person are indicated by filled circles. Sessions delivered via telepractice are indicated by open circles.

During the intervention condition, Terry demonstrated an immediate increase in strategy use after the intervention was applied for four EMT strategies: matched turns, expansions, time delays, and milieu teaching episodes. For matched turns, she showed a modest increase in level and a gradual, accelerating (therapeutic) trend with some variability (range = 51 – 81). For expansions, time delays, and milieu-teaching episodes, Terry showed an abrupt increase in level and a stable, zero-celerating trend (expansions range = 0 – 19; time delays range = 1 – 6; milieu-teaching episodes range = 2 – 4). For target talk, there was no clear increase in level. The accelerating trend, which began during the baseline sessions continued into the intervention condition (range = 36 – 67).

All NAP and LLR estimates for number of EMT strategies used were significant. According to Peterson-Brown et al. (2012) NAP estimates were large for matched turns (NAP = 1.00, SE = 0, 95 % CI = 1.00 – 1.00), time delays (NAP = 1.00, SE = 0, 95% CI = 1.00 – 1.00), and milieu- teaching episodes (NAP = 1.00, SE = 0, 95% CI = 1.00 – 1.00). They were small for expansions (NAP = 0.92, SE = 0.05, 95% CI = 0.73 – 0.98) and target talk (NAP = 0.82, SE = 0. 08, 95 % CI = 0.60 – 0.92). LRR estimates were calculated for all five EMT strategies: matched turns (LRR = 0.70, SE = 0.10, 95% CI = 0.50 – 0.91), expansions (LRR = 2.37, SE = 0.58, 95 % CI =1.23 – 3.51), target talk (LRR = 0.65 , SE =0.28, 95% CI =0.09 – 1.20), time delays (LRR = 4.89 , SE = 0.11 , 95% CI = 4.68 – 5.12), and milieu teaching episodes (LRR= 4.90, SE = 0.13, 95% CI = 4.66 – 5.15)

Research Question 2

Do Caregivers Continue To Use EMT Strategies During Caregiver-Child Interactions At Levels Consistent With The Learning Criterion During The Intervention Condition (≥ 10% Below The Learning Criterion) For Each Strategy Several Weeks (E.G., 2 – 6) After Completing The Intervention? Levels were consistent with the learning criterion if they were: at or above 70% for matched turns, 30% for expansions, 40% for target talk, and 70% for time delays and milieu teaching episodes. During the maintenance condition, all three caregivers continued to use all five EMT strategies at or above the learning criterion for the majority (> 50%) of maintenance sessions. Jessica's strategy use was at or above the learning criterion during 6/7 sessions for matched turns (range = 69% – 100%), 5/7 sessions for time delays (range = 0 – 100%), and 4/7 sessions for milieu teaching episodes (range = 0 – 100%). She performed at or above criterion during all seven sessions for target talk (range = 53% – 72%) and expansions (range = 53% – 72%). Elena's performance was consistent with the learning criterion during all five maintenance sessions for matched turns (range = 85% – 96%), expansions (range = 53% – 85%), target talk (range = 45% – 81%), and time delays (range = 78% – 100%). Her performance was at or above the learning criterion during 4/5 sessions for milieu teaching episodes (range = 67% –100%). Terry's responding was consistent with the learning criterion during all five maintenance sessions for matched turns (range = 70% – 86%), expansions (range = 31% – 61%) and time delays (range = 75% – 100%). She had performance at or above the criterion during 4/5 sessions for target talk (range = 37% – 61%) and 2/5 sessions for milieu teaching episodes (range = 33 – 100%).

Research Question 3

Is Caregiver Use Of EMT Strategies During Telepractice Instruction Associated With Increases In The Number Of Child Communication Acts During Caregiver-Child Interactions? Caregiver strategy use was judged to be associated with increases in the number of child communication acts if the child's data showed a latent increase in level and/or an accelerating, therapeutic trend within a month of the caregiver meeting the learning criterion for matched turns. Performance on two different metrics were visually analyzed: number of spontaneous communication acts and weighted count of communication acts. Child performance was consistent across metrics. Caregiver use of EMT strategies was associated with increases in number of child communication acts during caregiver-child interactions for one dyad, Elena and Ira. Performance for all three dyads on number of communication acts and weighted count of communication acts is summarized below.

Number Of Communication Acts. As shown in Figure 10, during the baseline condition, Jameson's communication acts were at a moderate level with a decelerating (contra-therapeutic) trend (range = 10 – 33). During the intervention condition, his communication acts increased to a moderate level with a highly variable, zero-celerating trend (range = 5- 50). His performance during the intervention condition had a high degree of overlap with his performance during the baseline condition. He had one outlier data point (session 22). During the maintenance condition, his communication acts were at a moderate level with a highly variable, zero-celerating trend (range = 15 – 42). For number of communication acts, Jameson did not demonstrate a latent increase in level or accelerating trend within a month of Jessica meeting the learning criterion for matched turns (i.e., prior to session 19).

< Figure 10 >

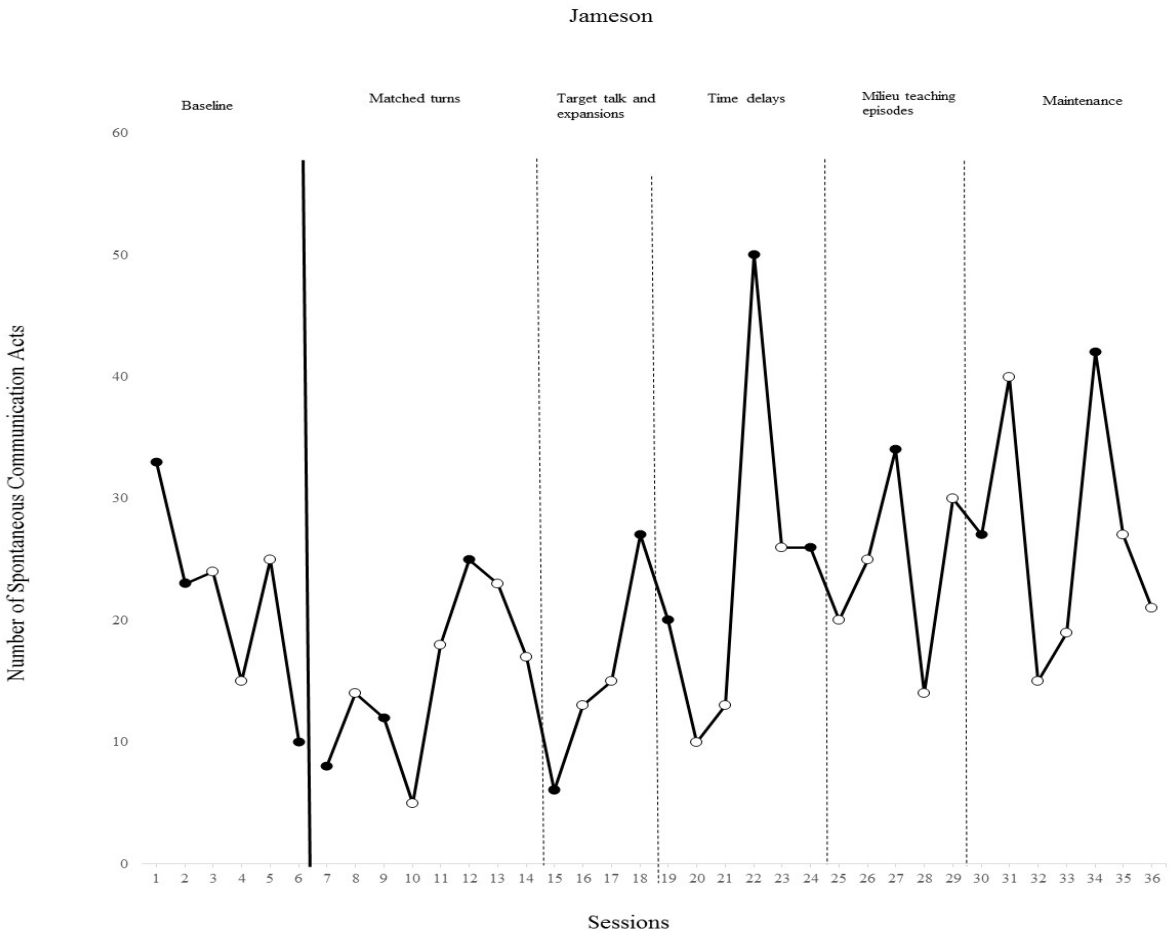


Figure 10. Jameson's number of spontaneous communication acts. Sessions provided in person are indicated by filled circles. Sessions delivered via telepractice are indicated by open circles.

As shown in Figure 11, during the baseline condition, Ira's communication acts were at a low level with a stable, zero-celerating trend (range = 11 – 18). During the intervention condition, his number of communication acts showed a latent increase in level and a gradual, accelerating, (therapeutic) trend with high variability (range = 7 – 52). His performance during the intervention sessions had a moderate degree of overlap with his performance during the baseline sessions. During the maintenance condition, his communication acts were at a moderate level with high variability (range = 22 – 80). For number of communication acts, Ira had a latent increase in level, and an accelerating (therapeutic) trend within a month of Elena meeting the learning criterion for matched turns (i.e., prior to session 23).

< Figure 11 >

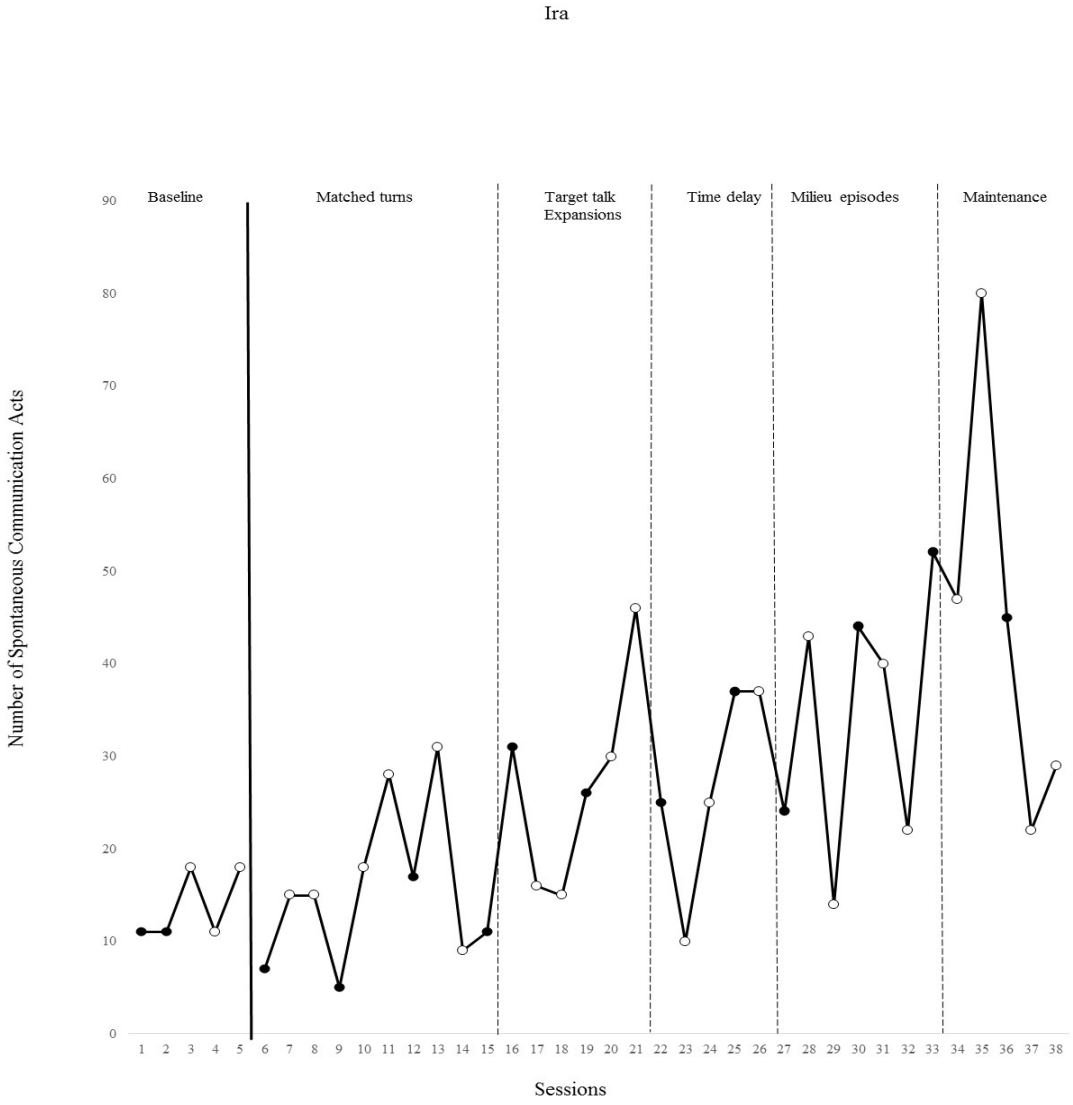


Figure 11. Ira's number of spontaneous communication acts. Sessions provided in person are indicated by filled circles. Sessions delivered via telepractice are indicated by open circles.

As shown in Figure 12, during the baseline condition, Ambyr's communication acts were at a low level for the first three baseline sessions (range = 2 – 7). Her performance increased in level and showed an accelerating (therapeutic) trend during the last two baseline sessions (range = 13 – 19). During the intervention condition, Ambyr showed an early decrease in communication acts followed by a gradual accelerating (therapeutic) trend while Terry was learning expansions (sessions 11 – 18). During sessions 19 and 21– 24 Ambyr showed an increase in level (range = 22 – 34), followed by a zero-celerating trend with some variability (range = 18 – 26). Her performance during the intervention sessions had a moderate degree of overlap with her performance during the baseline sessions. During the maintenance condition, her communication acts had high variability (range = 5- 41). For number of communication acts, Ambyr did not show a latent increase in level, and accelerating trend within a month of Terry meeting the learning criterion for matched turns (i.e., prior to session 17). Although, she did show a latent increase in level and accelerating trend after session 19.

< Figure 12 >

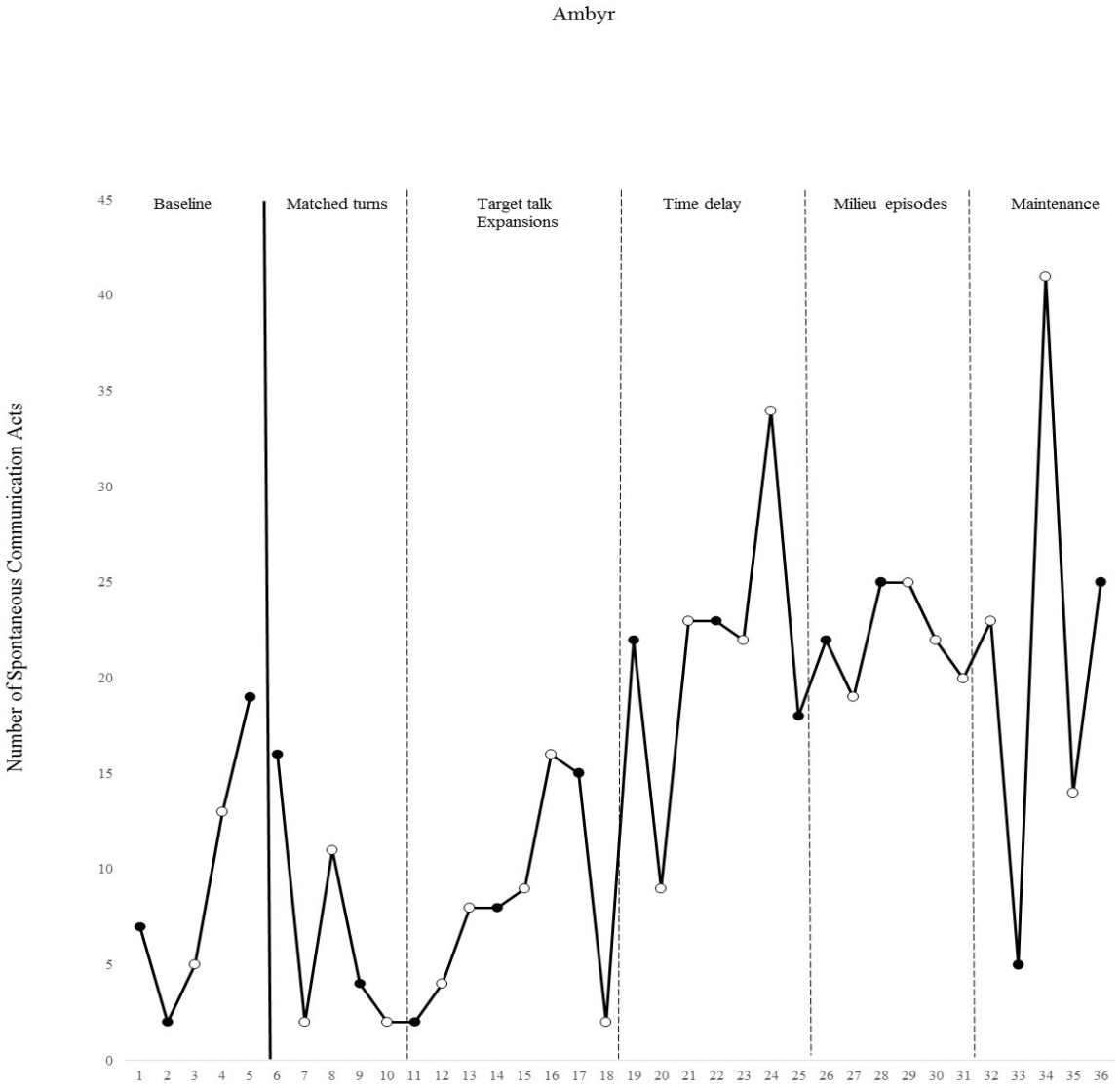


Figure 12. Ambyr's number of spontaneous communication acts. Sessions provided in person are indicated by filled circles. Sessions delivered via telepractice are indicated by open circles.

Weighted Count Of Communication Acts. As shown in Figure 13, during the baseline condition, Jameson had a moderate level (range = 31 – 105), highly variable, decelerating (contra-therapeutic) trend. He had one outlier data point (session 5). During the intervention condition, Jameson performed at a moderate level, with a highly variable, zero-celerating trend (range = 26- 120). He had two large, positive outliers during sessions 22 and 27. His performance during the intervention condition had a high degree of overlap with his performance during the baseline condition. During the maintenance phase, Jameson's performance remained at a moderate level with high variability (range = 32 – 112). For number of weighted communication acts, Jameson did not demonstrate a gradual, accelerating trend within a month of Jessica reaching the learning criterion for matched turns (e.g., prior to session 19).

< Figure 13 >

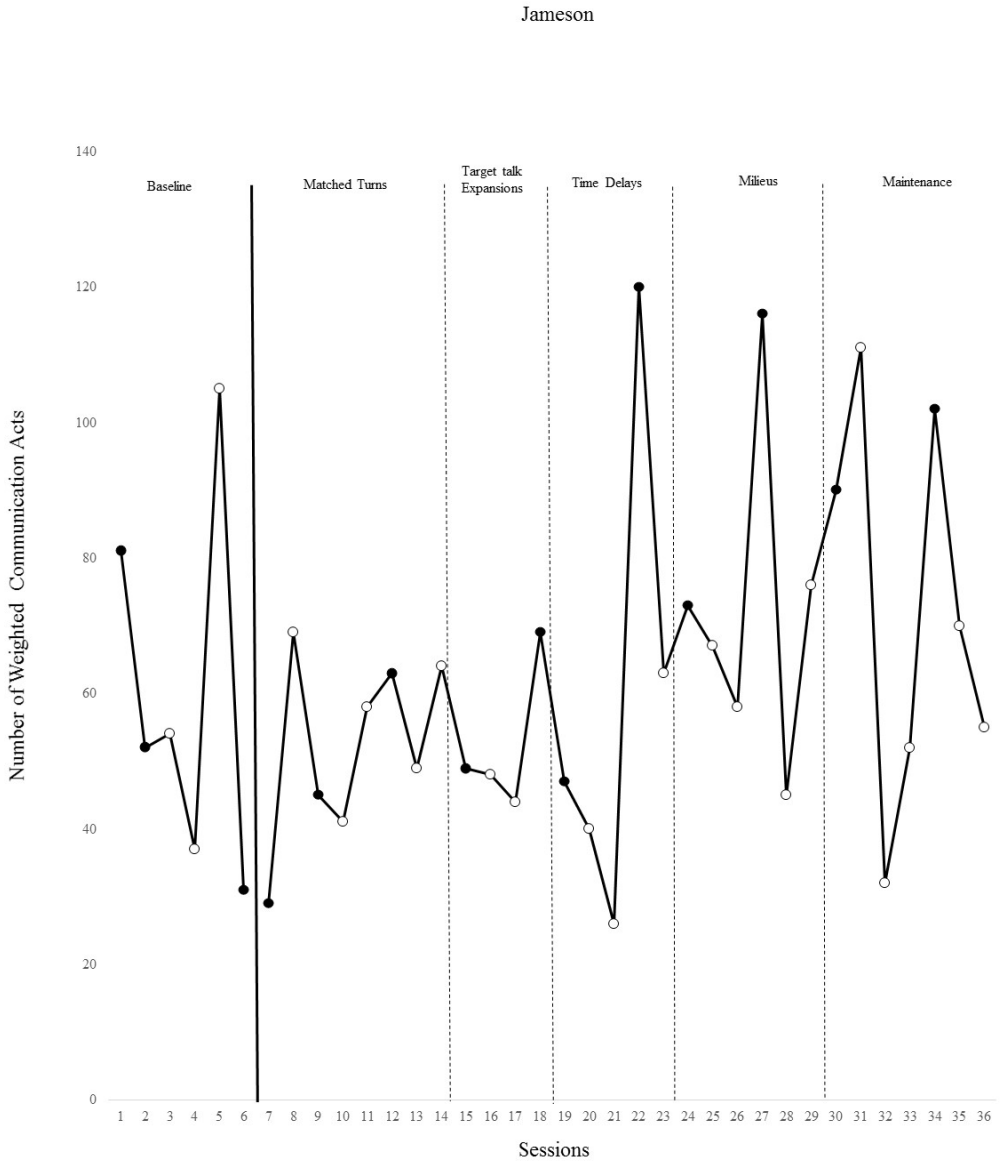


Figure 13. Jameson's weighted count of communication acts. Sessions provided in person are indicated by filled circles. Sessions delivered via telepractice are indicated by open circles.

As shown in Figure 14, during the baseline condition, Ira had a low level, stable, zero-celerating trend (range = 32 – 46). During the intervention condition, Ira showed a latent increase in level during session 11. His increase in level maintained at a moderate level (range = 57 – 78) while Elena learned matched turns (sessions 11- 15). Ira's increase in level was followed by a gradual but highly variable, accelerating (therapeutic) trend (range = 40 – 125). His performance during the intervention condition, had a moderate degree of overlap with his performance during the baseline condition. During the maintenance condition, Ira performed at a high level with some variability (range = 61- 177). His performance during the intervention condition, had a moderate degree of overlap with his performance during the baseline condition. For number of weighted communication acts, Ira demonstrated a latent increase in level and a gradual, accelerating trend within a month of Elena meeting the learning criterion for matched turns (i.e., prior to session 23).

< Figure 14>

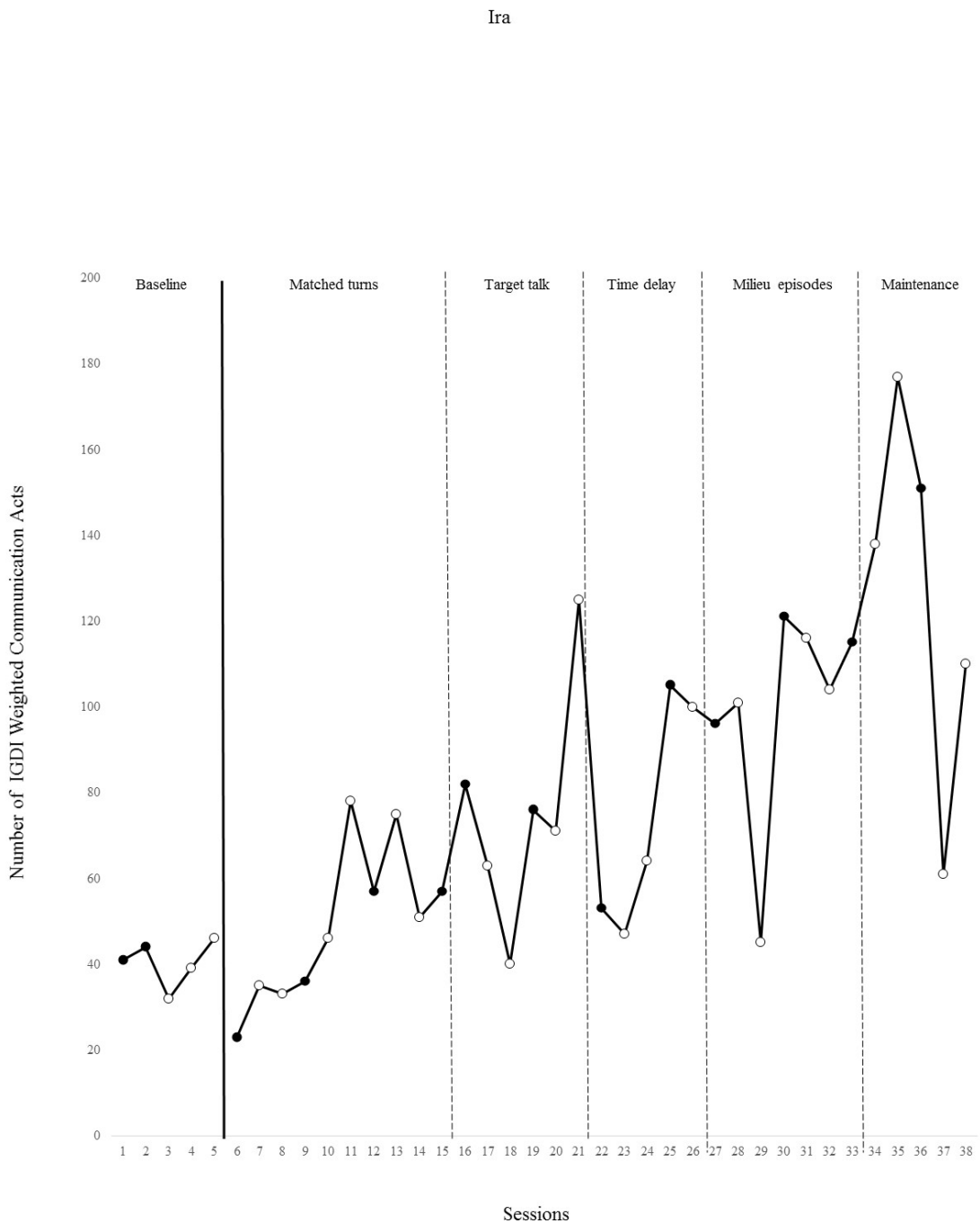


Figure 14. Ira's weighted count for communication acts. Sessions provided in person are indicated by filled circles. Sessions delivered via telepractice are indicated by open circles.

As shown in Figure 15, during the baseline condition, Ambyr performed at a low level initially with a slight decelerating (contra-therapeutic) trend before showing an increase in level which stabilized during sessions 4 and 5. During the intervention condition, Ambyr had a gradual, decelerating (contra-therapeutic) trend (range = 44 – 26) while Terry was taught matched turns (sessions 6 – 10). She showed a highly variable, accelerating trend during sessions 11 – 16 (range = 19 – 66). After session 16, Ambyr's performance stabilized and she performed at a moderate level which was at or slightly above her baseline responding (range = 42 – 96). Her performance during the intervention condition had a moderate degree of overlap with her performance during the baseline condition. For number of weighted communication acts, Ambyr did not show a clear increase in level within a month of Terry meeting the learning criterion for matched turns (prior to session 17). There were two data points slightly above baseline responding (range = 60 – 66) during sessions 16 and 17.

< Figure 15 >

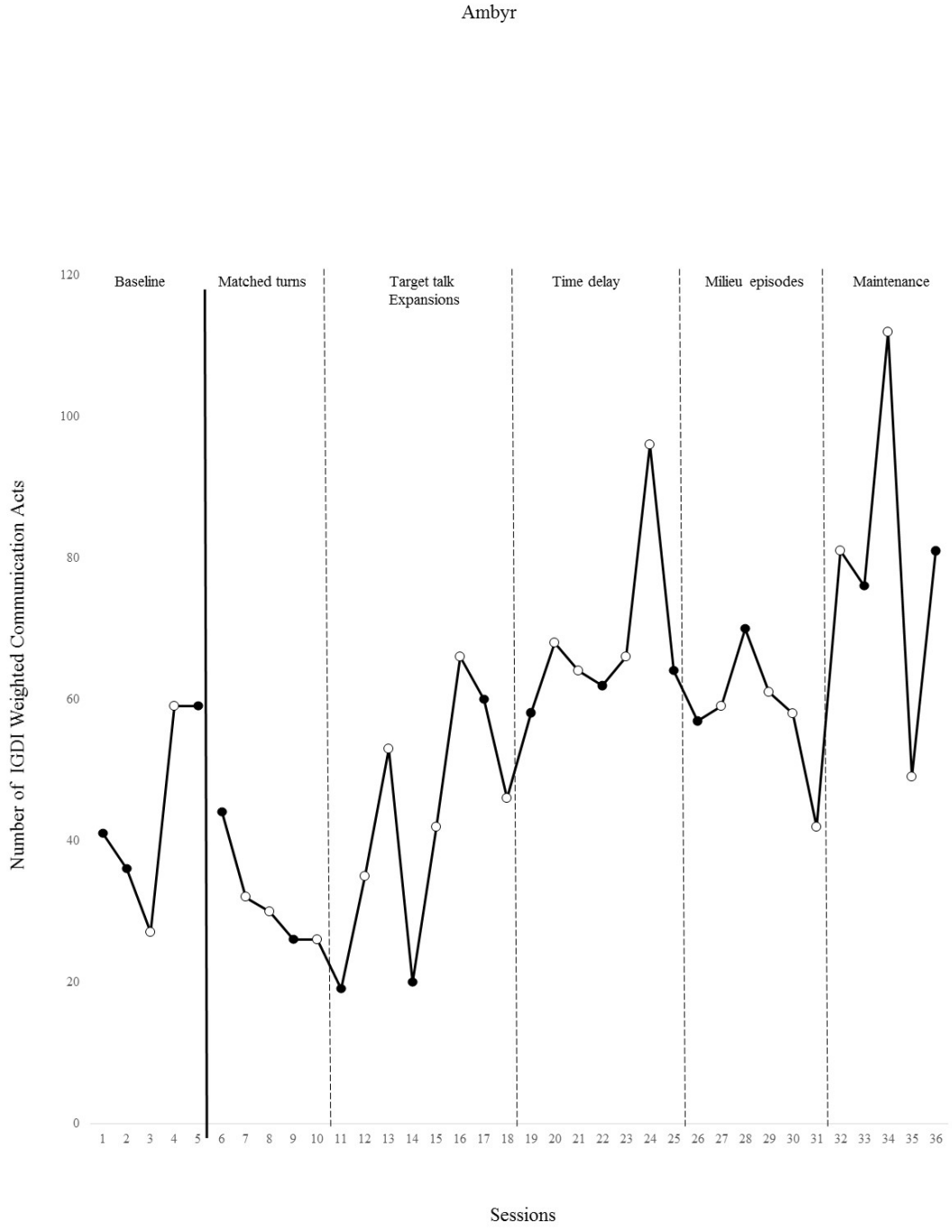


Figure 15. Ambyr's weighted count for communication acts. Sessions provided in person are indicated by filled circles. Sessions delivered via telepractice are indicated by open circles.

Research Questions 4

Is Caregiver Use Of EMT Strategies During Telepractice Instruction Associated With Increases In The Child's Lexical Diversity (Number Of Different Words) During Caregiver-Child Interactions? Caregiver strategy use was judged to be associated with increases in the child's number of different words if the child's data showed a latent increase in level and/or an accelerating, therapeutic trend within a month of the caregiver meeting the learning criterion for matched turns. Caregiver use of EMT strategies was associated with increases in the number of different words expressed during caregiver-child interactions for two dyads: Elena and Ira and Terry and Ambyr. Performance for all three dyads on number of different words expressed is summarized below.

As shown in Figure 16, during the baseline condition, Jackson performed at a moderate level with some variability (range = 4 – 10). During the intervention condition, Jameson performed at a moderate level with a highly variable, zero-celerating trend (range = 1 – 17). His performance during the intervention condition had a high degree of overlap with his performance during the baseline condition. During the maintenance phase, Jameson's performance showed some increases in level but with high variability (range = 6 – 25). For number of different words, Jameson did not demonstrate a latent increase in level or a gradual, accelerating trend within a month of Jessica reaching the learning criterion for matched turns (prior to session 19).

< Figure 16 >

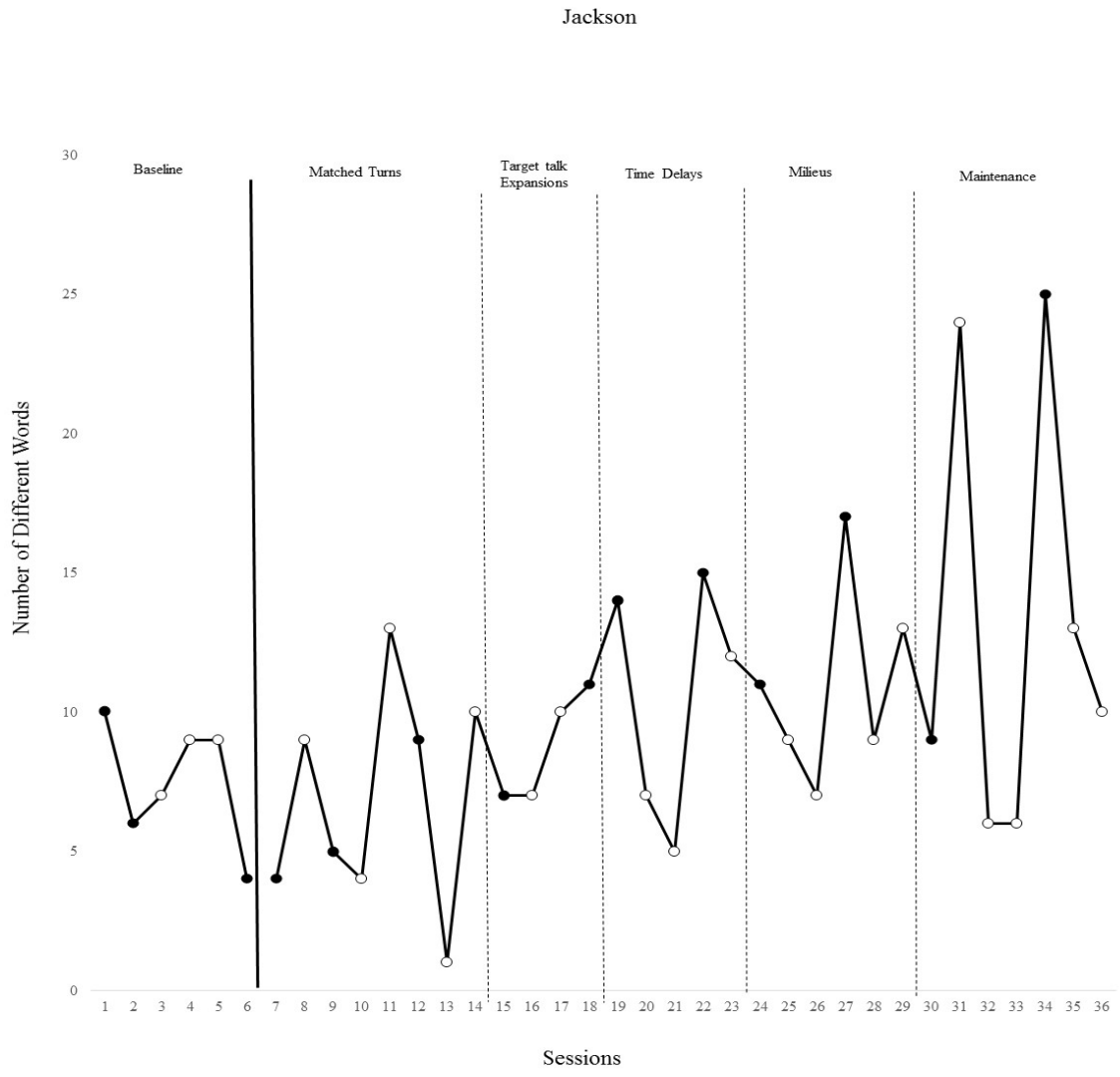


Figure 16. Jackson's number of different words. Sessions provided in person are indicated by filled circles. Sessions delivered via telepractice are indicated by open circles.

As shown in Figure 17, during the baseline condition, Ira performed at a low level, with a stable, zero-celerating trend (range = 0 – 1). During the intervention condition, Ira showed a latent increase in level with some variability (range 0 – 3) while Elena learned matched turns (sessions 11 – 14). This increase in level and gradual accelerating trend continued during the remainder of the intervention sessions while Elena learned the remaining EMT strategies (range = 3 – 12). His performance during the intervention condition, had a small amount of overlap with his performance during the baseline condition. During the maintenance condition, Ira performed primarily at a high level (range = 11 - 13) outside of one outlier (session 37). For number of different words, Ira demonstrated a latent increase in level and a gradual, accelerating trend within a month of Elena meeting the learning criterion for matched turns (prior to session 23).

< Figure 17 >

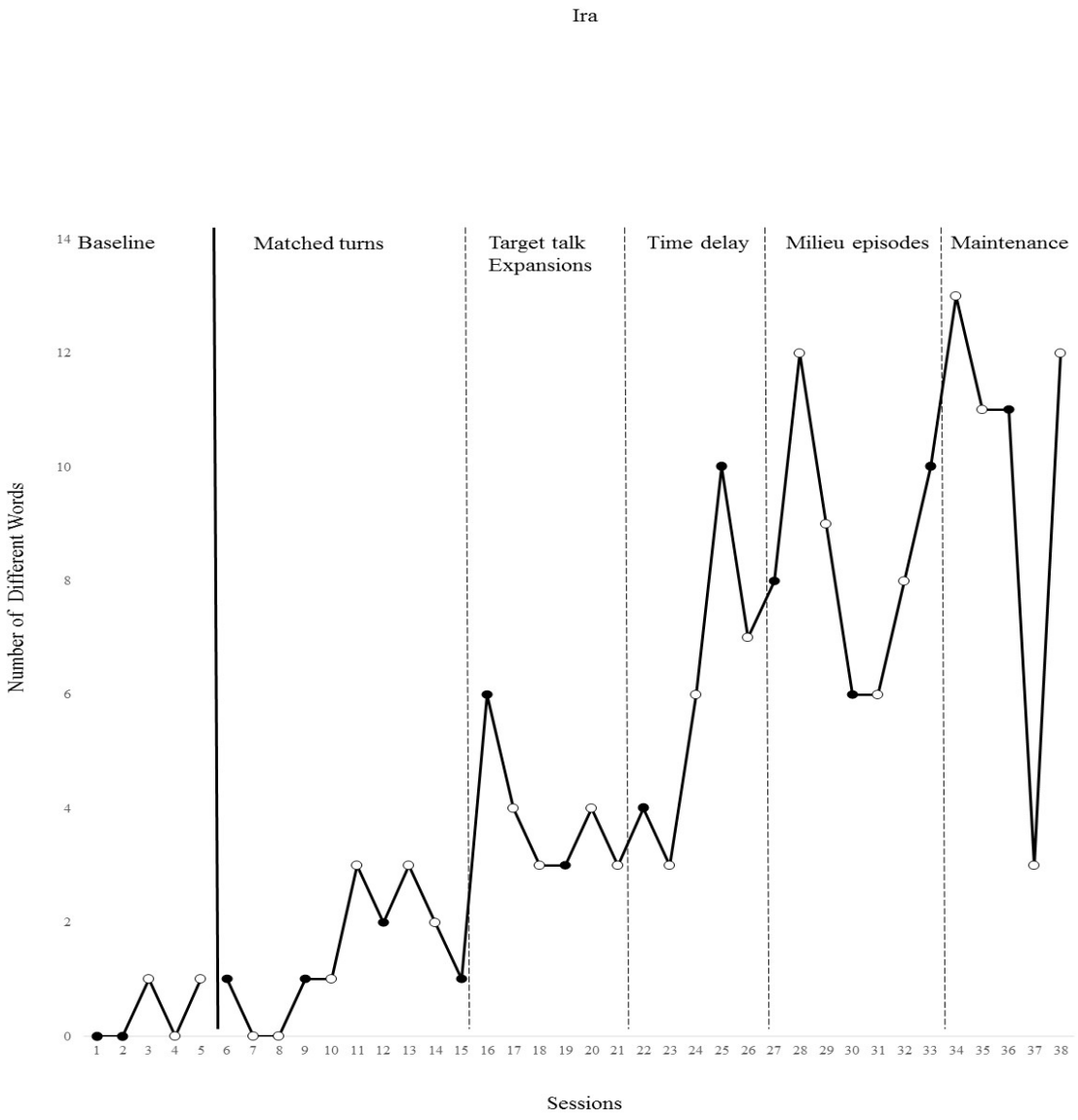


Figure 17. Ira's number of different words. Sessions provided in person are indicated by filled circles. Sessions delivered via telepractice are indicated by open circles.

As shown in Figure 18, during the baseline condition, Ambyr showed a gradual, accelerating (therapeutic) trend (range = 0 – 3). During the intervention condition, Ambyr had an increase in level and an accelerating (therapeutic) trend during session 12. This accelerating trend continued through session 17, when her performance stabilized, and maintained at levels above her baseline performance for the remainder of the study (range = 7 – 10). Her performance during the intervention condition, had some overlap with her performance during the baseline condition. During the maintenance condition, Ambyr responded at a moderate level with high variability (range = 42 – 112). For number of weighted communication acts, Ambyr demonstrated a latent increase in level and gradual, accelerating trend within a month of Terry meeting the learning criterion for matched turns (prior to session 17).

<Figure 18>

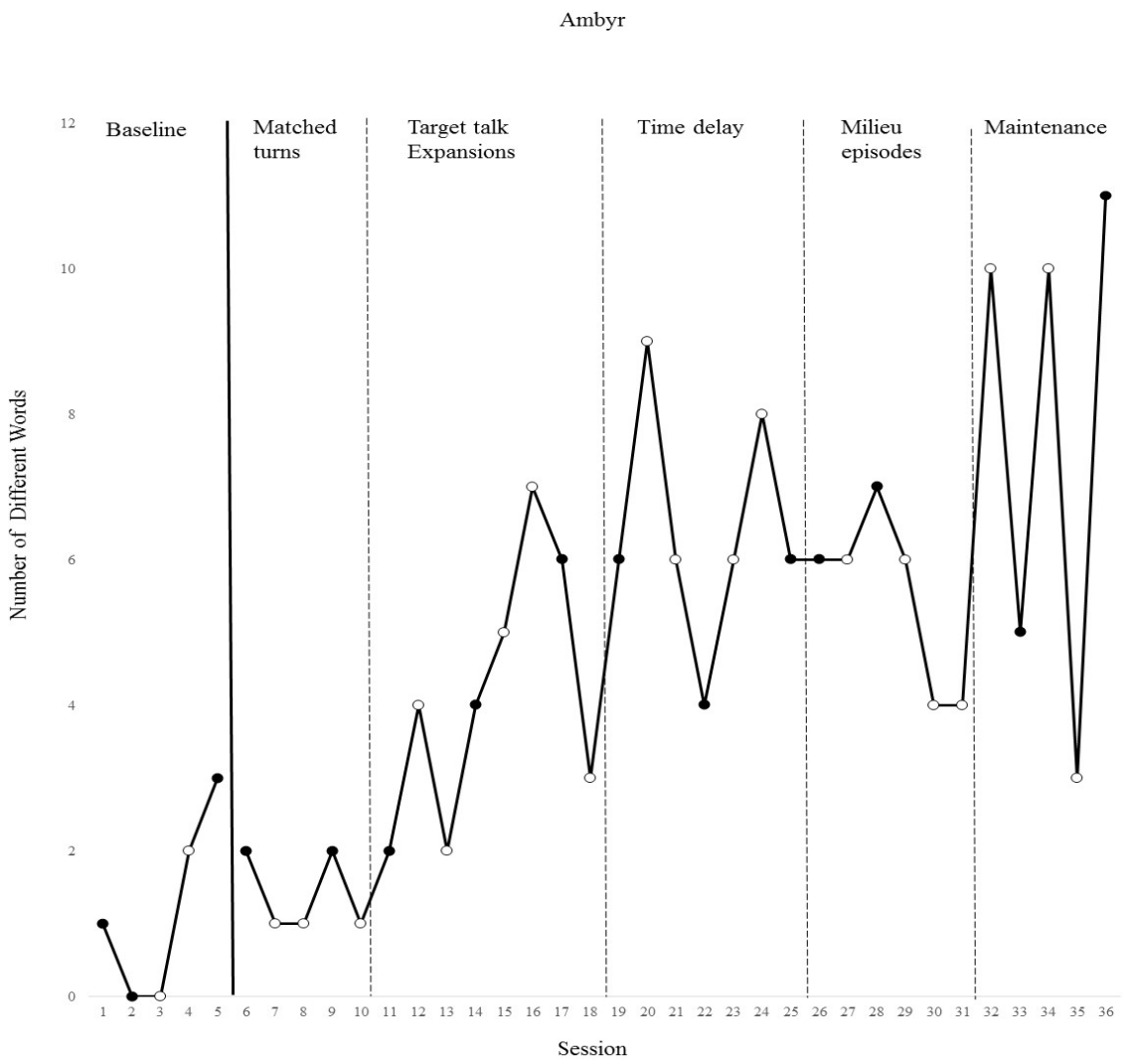


Figure 18. Ambyr's number of different words. Sessions provided in person are indicated by filled circles. Sessions delivered via telepractice are indicated by open circles.

Research Question 5

What Are The Costs Of Delivering EMT Via A Blended Telepractice Model? Table 17 outlines the expenses associated with the EMT Telepractice Program. Assessment materials including PLS- 5, MSEL, MCDI, CBCL, language sample toy materials, and SPA materials had a total cost of $ 2137.00. Telepractice equipment including three iPads, three Kubi, one Professional Zoom account subscription, one blue-tooth headset had a total cost of $2,939.00. Altogether assessment materials and telepractice equipment had a total cost of $5,076.00. Table 18 outlines the costs for delivering the telepractice program for each caregiver-child dyad. Costs for delivering the EMT Telepractice for each dyad were as follows: $3,091.92 for Jessica and Jameson, $2561.04 for Elena and Ira, and $5,703.70 for Terry and Ambyr. The combined cost of assessment materials, telepractice equipment, and the cost of delivering the EMT Telepractice Program to all three dyads was $ 6,432.66.

< Table 17 and 18>

Table 17.

Assessment and Materials Cost

Budget Expenses	EMT Telepractice Program	EMT (in-person)
Assessment Materials		
PLS-5	$ 395.00	$ 395.00
MSEL	$ 956.80	$ 956.80
MCDI	$ 26.00	$ 26.00
CBCL	$ 160.00	$ 160.00
Language sample toy materials	$ 300.00	$ 300.00
SPA toy materials	$ 300.00	$ 300.00
Assessment Materials Subtotal	$ 2137.00	$ 2137.00
Telepractice Equipment		
3 iPads	$ 987.00	NA
3 Kubi	$ 1800.00	NA
1 Professional Zoom account subscription	$ 120.00	NA
1 Blue tooth headset	$ 32.00	NA
Telepractice Materials Subtotal	$ 2939.00	$ 0.00
Materials Total	**$ 5076.00**	**$ 2137.00**

Table 18.

Costs per caregiver-child dyad

	Budget Expenses	EMT Telepractice Program	EMT (in-person)
Jameson and Jessica	Eligibility Assessment		
	2 hours personnel clinical services	$ 72.00	$ 72.00
	3.6 hours personnel driving time	$ 129.60	$ 129.60
	Mileage (2 Round Trips @ 64 miles)	$ 67.84	$ 67.84
	EMT Sessions (36)		
	Personnel clinical services	$1296.00	$ 1296.00
	Personnel driving time	$ 842.40	$ 2332.80
	Mileage	$ 432.64	$ 1221.12
	Post intervention Assessment		
	1.5 hours personnel clinical services	$ 54.00	$ 54.00
	3.6 hours personnel driving time	$ 129.60	$ 129.60
	Mileage (2 Round Trips @ 64 miles)	$ 67.84	$ 67.84
	Subtotal	$ 3091. 92	$ 5370.80
Ira and Elena	Eligibility Assessment		
	2 hours personnel clinical services	$ 72.00	$ 72.00
	2.6 hours personnel driving time	$ 93.60	$ 93.60
	Mileage (2 Round Trips @ 24 miles)	$ 24.96	$24.96
	EMT Sessions (38)		
	Personnel clinical services	$ 1368.00	$ 1368.00
	Personnel driving time	$ 655.20	$ 1778.40
	Mileage	$ 174.72	$ 483.36
	Post intervention Assessment		
	1.5 hours personnel clinical services	$ 54.00	$ 54.00
	2.6 hours personnel driving time	$ 93.60	$ 93.60
	Mileage (2 Round Trips @ 24 miles)	$ 24.96	$24.96
	Subtotal	$ 2561.04	$ 3992.88
Ambyr and Terry	Eligibility Assessment		
	1.5 hours personnel clinical services	$ 54.00	$ 54.00
	7.3 hours personnel driving time	$ 262.80	$ 262.80
	Mileage (2 Round Trips @178 miles)	$ 188.68	$ 188.68
	EMT Sessions (36)		
	Personnel clinical services	$1296.00	$1296.00
	Personnel driving time	$ 1981.80	$ 4665.60
	Mileage	$ 1415.10	$ 3396.24
	Post intervention Assessment		
	1.5 hours personnel clinical services	$ 54.00	$ 54.00
	7.3 hours personnel driving time	$ 262.80	$ 262.80
	Mileage (2 Round Trips @178 miles)	$ 188.68	$ 188.68
	Subtotal	$ 5,703.70	$10,368.72

Note= Hourly rate for the speech-language pathologist was calculated as $36 an hour.

Research Question 6

Are The Costs Of Delivering EMT Through An In-Person Service Delivery Model Greater Than The Costs Of Delivering EMT Though A Blended Service Delivery Model? Figure 19 compares the costs of providing the EMT Telepractice Program through a blended service delivery model with the costs of providing EMT in- person. Compared to delivering EMT in person, delivering EMT through a blended service delivery model saved an average of $ 2,791.91 per participant. Specifically providing EMT through a blended model saved $2278.88 dollars for Jessica and Jameson, $1431.84 dollars for Elena and Ira and $4665.02. for Terry and Ambyr. When telepractice equipment costs are included in the cost estimates, providing EMT through a blended model saved an average of 1812.24 per participant, and saved $1299.21 for Jessica and Jameson, $452.17 for Elena and Ira, and $3685.35 for Terry and Ambyr.

<Figure 19>

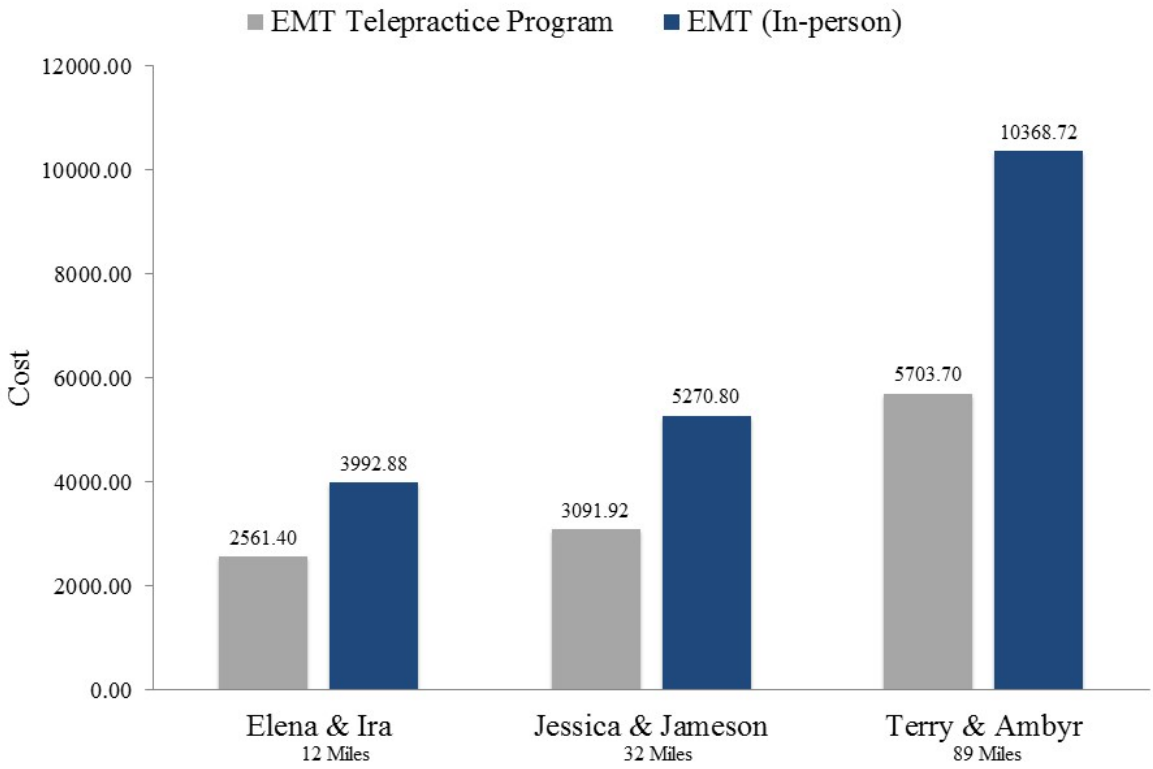


Figure 19. Comparison of the EMT Telepractice Program blended service delivery model and in person service delivery model.

Post Intervention Assessment

After the intervention and maintenance conditions were completed, the interventionists completed the following assessments to describe the children's language, communication, and play skills: PLS- 5, MCDI, SPA, and a Language Sample. Table 19 shows the outcomes for each assessment for each child. Relative to their performance at study entry, all children showed higher developmental play skills, expressive vocabulary,and expressive communication and language skills as measured by the SPA, MCDI, and LS. Two children had higher standard scores on the PLS-5: Ira and Terry. Jackson's standard score on the PLS-5 decreased relative to his performance at study entry. Results of the post intervention assessment must be interpreted with caution since there is no comparison group.

<Table 19>

Table 19.

Post-Intervention Assessment Results

	Jameson		Ira		Ambyr	
Measures	Pre-Intervention	Post Intervention	Pre-Intervention	Post Intervention	Pre-Intervention	Post Intervention
PLS-5						
Auditory Comprehension[SS]	67	57	81	115	66	82
Expressive Communication[SS]	74	75	72	94	76	88
Total Score[SS]	69	64	74	105	69	84
MacArthur Bates CDI Words and Gestures Vocabulary Checklist						
Total Words Understood	58	186	86	355	213	255
Total Words Produced	22	52	8	51	39	105
Total Verbs Understood	10	34	9	54	38	42
Total Verbs Produced	0	2	0	1	4	18
Structured Language Sample						
Rate (Communication Acts/Min)	0.97	1.75	1.10	3.04	0.46	2.67
NDW	7	25	0	27	0	17
Structured Play Assessment						
Most Frequent Play Level	Indiscriminate actions	Takes apart combinations	General combinations	General combinations	Discriminate Actions	General combinations
Highest Play Level	Take part combinations	General combinations	Specific combinations/ conventional attributes	Single scheme sequences	Take apart combinations	Single scheme Sequences

Note. SS= Standard Score with a mean of 100 and standard deviation of 15. T= T score, for the Mullen T Scores have a mean of 50 and a standard deviation of 10. For the CBCL, T scores of less than 60 are considered typical and are within age expectations

Social Validity Assessment

To examine the social validity of the intervention the three caregivers completed a survey of the intervention goals, procedures and effects. Table 20 includes a summary of each caregiver's responses to the social validity questionnaire. All caregivers strongly agreed that the intervention goals made sense for their children, were important for their children's development, and were meaningful to their family. Regarding the intervention procedures, all caregivers agreed or strongly agreed that the coach's suggestions were easy to follow, they were able to use the EMT strategies during typical activities and routines, and the duration of the sessions was acceptable for the family. All three caregivers strongly agreed that the EMT sessions were effective in helping support their child's language learning, effective in improving their child's language and communication skills. Each caregiver expressed they would strongly recommend the program to other parents. All caregivers indicated that they felt the in-person sessions were necessary to the success of the program. None of the caregivers felt the program would be as effective if implemented entirely at a distance via telepractice.

<Table 20>

Table 20.

Social Validity

Intervention Goals	Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5
The language and communication goals addressed during sessions make sense for my child.					3/3 100%
The language and communication goals addressed during sessions are important for my child's development and meaningful to me and my family.					3/3 100%
Intervention Procedures					
My coach's suggestions are easy to follow.				1/3 66%	2/3 66%
I am able to use program strategies during typical activities and routines.				1/3 66%	2/3 66%
The duration of our sessions is acceptable for my family.					3/3 100%
Intervention Effects					
The sessions are effective in helping me learn language support strategies to help my child					3/3 100%
The sessions are effective in improving my child's language and communication skills.					3/3 100%
I would recommend this program to other parents of children with language delays.					3/3 100%

Comparing Caregiver Performance During Telepractice And Distance Sessions

To examine differences in performance across service delivery method, caregivers' percentage of EMT strategy use during the in-person sessions and telepractice sessions are compared in Table 21. Caregivers' strategy use was consistent, their responding was similar across service delivery models. The difference in performance between in-person and telepractice sessions was small and ranged from an average of 4% during the baseline condition, 8% during the intervention condition, and 11% during the maintenance condition.

<Table 21>

Table 21.

Average Percentage of Correct Strategy Use Across Caregives, Strategies, and Contexts

		Jessica & Jameson		Elena & Ira		Terry& Ambyr	
		In Person	Telepractice	In Person	Telepractice	In Person	Telepractice
Baseline	Matched turns	22% (17% – 33%)	29% (17% – 46%)	26% (25%- 26%)	23% (21% - 25%)	34% (24- 41%)	26% (15 – 36%)
	Expansions	0	4% (0 – 20%)	0	0	14% (0 – 50%)	10% (0 – 50%)
	Target talk	28% (4% – 67%)	30% (8 %- 66%)	24% (1% – 60%)_	12% (2% – 41%)	33.4% (1% – 90%)	49% (5%- 84%)
	Time Delays	0	0	0	8% (0 – 100%)	0	0
	Milieu teaching	0	0	0	0	0	0
Intervention	Matched turns	74% (43% – 87%)	77% (56% - 94%)	77% (51- 94%)	82% (44% – 99%)	82% (75% – 92 %)	80% (74%– 90 %)
	Expansions	76% (57% – 89 %)	77% (50 %– 100%)	62% (0 – 100%	72% (71- 100%)	78% (60% – 100%)	53% (0 – 100%)
	Target talk	66% (55%– 75%)	66% (40% – 69%)	57% (24%– 67%)	60% (14%– 75%)	62 % (51%– 75 %)	59% (30% - 76%)
	Time delays	94% (75 – 100 %)	98% (83 %– 100%)	95% (80% – 100%)	90% (67%- 100%)	93.4% (67% – 100%)	85% (33% - 100%)
	Milieu teaching	100	75% (0 – 100%)	95% (86%- 100%)	67% (0 – 100%)	100%	100%
Maintenance	Matched turns	78% (69%– 85%)	85% (71% – 100%)	96%	91% (85 %– 97%)	78% (70% – 86 %)	76% (70% – 80%)
	Expansions	54% (36%– 72 %)	70.2% (50% -89%)	85%	58% (50%– 70 %)	45% (31% – 58%)	50% (33% – 67 %)
	Target talk	55% (53% – 57%)	66% (65% - 72%)	81%	61% (45% – 80%)	46% (37% – 54%)	57% (49% – 61%)
	Time delays	84% (67% – 100%)	82 (0 – 100%)	100%	95% (78% – 100%)	100%	92 % (75%– 100 %)
	Milieu teaching	74% (67% – 80%)	75 % (0 – 100%)	100%	92% (67%– 100%)	41.5% (33% – 50 %)	78% (60% – 100%)

CHAPTER IV

DISCUSSION

The purpose of this study was to examine the efficacy of delivering the EMT Telepractice Program and providing caregiver instruction using the TMCR framework via a blended service delivery model. Results from this study demonstrated that delivering the EMT Telepractice Program and using the TMCR framework increased caregivers' use of four EMT strategies: matched turns, expansions, time delays, and milieu teaching episodes. Visual analysis suggested a functional relation between the introduction of the EMT Telepractice Program and increases in caregiver strategy use for all three caregiver-child dyads. Non-overlap estimates (NAP) and parametric effect size estimates (LRR) indicated that the change from the baseline to the intervention phase was statistically significant for percentage and number of EMT strategy use across tiers (matched turns, expansions, time delays, and milieu teaching episodes) and dyads. Caregivers continued to use EMT strategies with fidelity several weeks (2 – 6) after the intervention was completed. Increases in child communication during caregiver-child interactions were modest and variable across children. Two children (Ira and Ambyr) demonstrated an increase in number of communication acts and number of different words associated with their caregiver's use of EMT strategies. However, the study design did not permit assessment of a functional relation between caregiver training and child outcomes. The cost savings for the EMT Telepractice Program were related to personnel time spent traveling to family homes, and mileage reimbursement for home-visits. The farther families lived from the research center, the greater the costs savings associated with delivering the intervention via

telepractice. Overall, these findings confirmed the hypothesis that delivering EMT and TMCR through a blended service delivery model is a cost efficient method to improve caregiver use of EMT strategies during caregiver-child interactions.

Findings from the current study replicate and expand previous investigations of caregiver-implemented EMT that utilized the TMCR instructional framework (c.f., Peredo, et al, 2018; Roberts et al., 2014; Roberts & Kaiser; 2015; Wright & Kaiser, 2016) in several key ways. First, this study adapted the EMT and TMCR in-person service delivery model to a telepractice service delivery model. Utilizing a blended service delivery model within a multiple-baseline design, provided an initial demonstration of the effects of delivering EMT via telepractice. Even though the current study does not provide sufficient experimental control to answer questions about the relative effectiveness of the EMT Telepractice Program, it does provide initial positive evidence for delivering EMT via telepractice. It is clear from the caregivers' data that they were able to learn and maintain the EMT strategies with similar accuracy across in-person and telepractice sessions. It is noteworthy that caregivers received a similar treatment intensity to prior studies and met the learning criterion for each EMT strategy within 5 – 7 sessions, which is consistent with caregivers' performance in other EMT studies. This supports the notion that parents were able to learn efficiently from both in-person and telepractice sessions.

Second, the interventionist leveraged technology including (a) videos of caregivers performing EMT strategies (video self-modeling), (b) power-point vignettes that scripted conversational turns using EMT strategies, and (c) bar graphs depicting mastery of EMT strategies, in order to enhance the TMCR framework. The interventionist used technology to emphasize coaching practices with proven efficacy for teaching adults new instructional practices including modeling, observation, reflection, and performance feedback (Artman-

Meeker & Hemmeter, 2013; Barton, Kinder, Casey, & Artman, 2011; Conroy, Sutherlan, Vo, Carr & Ogston, 2014; Fox, Hemmeter, Snyder, Binder & Clarke, 2011 Friedman & Woods, 2015). Video modeling provided caregivers with more opportunities to observe, reflect, and receive performance feedback from the interventionist. The power-point vignettes provided additional practice role-playing EMT strategy use with scenarios from the previous session. The bar graphs depicted the caregiver's performance for a target EMT strategy with a goal line illustrating the learning criterion. These bar graphs provided a context to discuss caregivers' mastery of EMT strategies. Wright & Kaiser (2016) suggested mastery was one adult learning method, which was not explicitly addressed in prior studies of EMT and TMCR. Mastery involves comparing the adult's individual performance to a standard (Trivette et al., 2009). Thus, the current study addressed this limitation by reviewing bar graphs to discuss mastery and provide performance feedback regarding EMT strategy use. Although, we cannot estimate the value added by the videos, vignettes, and bar graphs, the caregivers' data from the intervention and maintenance conditions suggest that TMCR implemented in the current study was sufficient for caregivers to learn EMT strategies and use them with fidelity several weeks (2- 6) after the intervention was complete.

Findings from the current study are consistent with previous research examining telepractice- based caregiver instruction, which showed positive effects of telepractice interventions on caregiver language strategy use (e.g. McDuffie et al; 2012; 2014; Meaden et al., 2016). Results from this study extended the previous research by using a rigorous experimental design that met several contemporary design standards. The study permitted three demonstrations of basic effect within each caregiver-child dyad (i.e. across EMT strategies taught in the intervention) and replication across two caregiver-child dyads. Second, it examined

the telepractice service delivery of EMT. Although the interventions examined in previous research had empirical support, none of the previous studies used an established naturalistic teaching model comparable to EMT. Third, caregiver training utilized the TMCR instructional framework; whereas, previous studies did not describe a systematic approach or use an empirically supported caregiver instructional framework. Fourth, the current study specified explicit learning criterion (levels of mastery) for caregivers. Several of the previous telepractice studies introduced strategies after a specified number of sessions; they did not make response guided decisions based on caregiver behaviors. Fifth, the current study delivered the telepractice intervention at high dose duration and dose frequency. Most previous studies delivered the intervention once per week and provided an average of 15 intervention sessions and 14 coaching sessions. The current study more than doubled the number of intervention sessions provided to families during a three to four month period relative to the extant research. It is possible that the stronger outcomes observed in the current study were the result of more frequent intervention and coaching sessions and the larger total number of sessions. This is an important contribution since little is known about the treatment intensity required to insure optimal effects of caregiver-implemented interventions (Baker 2012; Warren, Fey, & Yoder, 2007).

Limitations

Although a rigorous multiple-baseline design, which controlled for many threats to internal validity and minimized the risk of bias was implemented in the current study, several constraints of the study design introduced potential for systematic error (Higgins et al. 2011). Potential sources of bias included: (a) detection bias, (b) correlated measurement error, (c)

performance bias, and (d) selection bias (Reichow, Barton & Maggin, 2015; 2018). Each of these sources of bias are described in the paragraphs below.

There is a high risk of detection bias because the investigator was unable to blind outcome assessors (coders) to the study condition. A key component of the EMT intervention was coaching the caregivers on five specific EMT strategies used during parent-child interactions. The presence or absence of coaching was a clear signal to the coder whether the caregiver-child dyad was in the intervention or baseline condition. The type of coaching provided to the caregiver was another possible signal to coder of which EMT behavior was being targeted. Blinding of outcome assessments was not possible since the dependent variables (caregiver EMT strategy use, child communication, child number of different words) were measured while the interventionist delivered the EMT Telepractice Program. Consequently, there is also a high risk of observer-caused correlated measurement error (Yoder, Lloyd, & Simmons, 2018). This type of correlated measurement error occurs when a coder systematically overestimates the true score during the intervention sessions and/or systematically underestimates the true score during baseline sessions. Detection bias and correlated measurement error can lead to an increased likelihood of Type 1 errors when interpreting study results.

Systematic changes in the measurement context (caregiver-child interaction) between the baseline condition and intervention condition introduced a second type of correlated measurement error, contextual measurement error. As a result of instruction and coaching on EMT strategies, the caregiver was expected to adopt a new interaction style that was more responsive to child communication. Adopting a new interaction style during the intervention phase represented a systematic change in caregiver behavior during the caregiver-child

interaction between the baseline and intervention conditions. While this was the desired outcome, using a responsive interaction style during the intervention condition supported the child's communication skills. This may have affected the exploratory dependent variable, making it appear that the child's communication acts and number of different words increased, when the child's skill level had not actually improved, if measured in a different context.

There is a high risk of performance bias since research participants and personnel were not blind to when the intervention was implemented or when phases changed within the intervention. Performance bias is difficult to minimize in single case design because of the frequent and intimate interactions between the investigator, participants, and research staff (Reichow, et al., 2018). The current study did not conduct masked visual analysis to minimize performance bias in visual analysis (Byun, Hitchcock & Ferron, 2017; Ferron, Joo & Levin, 2017).

An overall constraint of the study design led to a high risk of selection bias related to sequence generation. The investigator was unable to use randomization in the selection of tiers within the multiple baseline design because of the prescribed sequence of EMT strategies taught in prior research on caregiver-implemented EMT. To be consistent with prior research, the current study grouped EMT strategies into (mostly) functionally independent tiers that integrated some knowledge from previous tiers. Thus, it was impossible to randomize the implementation of the intervention across tiers to minimize bias (Kratochwill & Levin, 2010; Ledford, Lane & Tate, 2018).

Aside from potential forms of bias, there were a few additional constraints of the study design which should be considered alongside the study findings. First, the EMT strategies were not functionally independent, as evidenced by the behavioral covariation between matched turns

(Tier 1) and target talk (Tier 2). As part of the EMT Telepractice program, the interventionist modeled all five EMT strategies during in-person sessions for 10 minutes while the caregiver observed. Each of the child participants had a one-word target MLU which often makes the interventionist's use of target talk more pronounced, because the interventionist constrains some of her utterances to one word. It is not surprising for caregivers to match the interventionist's model, if they observed target talk increasing child engagement and communication. Second, the current design is insufficient to determine a functional relation between the intervention and the child outcomes. There are clear limitations to interpreting the child dependent variables measured during the caregiver-child interactions and the post-intervention assessments, because there is neither experimental control in the single-case design, nor a comparison control group, and there is a potential for systematic bias. Despite these limitations, the increases in the exploratory dependent variables, and post-intervention assessment results depict a pattern of responding which can provide a rational for future research.

Future Research

There are three critical avenues for future research. First, the results of the current study must be replicated with a larger and representative sample of children receiving Part C services. It is critical that future replication studies use experimental designs that allow for examining the intervention effects on child communication skills. A randomized control trial, or rigorous between-group experimental design that controls for systematic bias can answer questions about the intervention efficacy for child communication outcomes. Future research involving single case design methodology must address the dependent relationship between matched turns and target talk, systematic bias, and select a design, or series of designs which allow for experimental

control for child dependent variables. Future replication studies should partner with additional community agencies to attempt to recruit a wider population of families receiving Part C services including (a) caregivers employed outside the home, (b) families receiving Part C services in community based settings, (c) families from under represented racial and/or ethnic groups, and (d) families experiencing poverty. All caregivers in the current study stayed at home with their child (or children) and were not employed outside of the home. Data from the Oregon Census regarding labor force participation indicate that more than one in five mothers in Oregon (21% of 25-54 year old women with children) are staying home to take care of family members. Findings from the current study may not generalize to the 79% of mothers in Oregon who are participating in the labor force. Importantly, telepractice offers benefits for working families including (a) flexible schedules for sessions, (b) minimizing travel to receive services, and (c) less disruption of family activities by home visitors. Future research may explore which procedures in the current study require adaptations for families with primary caregivers employed outside of the home and for children enrolled in center-based care. Nationally, 88.1% of infants and toddlers received Part C services in their homes, 7.6% of infants and toddlers received services in community based settings and 4.4% receive services in other settings (U.S. Department of Education, 2016). Last, the population in the current study did not represent families with cultural or linguistic diversity, families from under-represented racial and/or ethnic groups, or families experiencing poverty. Peredo et al. (2017) developed EMT en Espanol, and found there were many intervention adaptations which were needed for Spanish speaking families of toddlers with language impairments. A recent meta-analysis of predictors of outcomes among late talkers found that socioeconomic status significantly predicted expressive language outcomes (Fisher, et al., 2017). Future studies should include families from varied resource backgrounds to determine

if telepractice interventions can be effective across the range of SES and can specifically address the needs of children and families experiencing poverty or living in low resource communities.

Second, there is a compelling need to examine how telepractice interventions can optimize existing evidence based language interventions. For example, telepractice has the potential to provide "booster" sessions, monitor procedural fidelity, and provide individualized coaching in a consultative model. Telepractice holds promise for increasing the intensity of interventions and maximizing the timing of interventions based on the child and family developmental skills. While some caregiver implemented language interventions, were conducted entirely via telepractice (Meaden et al. 2016), feedback from caregivers in the current study suggested they preferred a blended model. Thus the goal of telepractice may not be to replace in-person intervention, instead, the focus of research may be on leveraging technology to achieve outcomes, or maintain outcomes that would be difficult or impossible otherwise.

Third, few studies have explored the characteristics of triadic (caregiver + EI provider + child) coaching interventions associated with child language and communication growth (Artman-Meeker et al., 2015; Oborn & Johnson, 2015). Understanding what constitutes best practice in triadic coaching (caregiver + EI provider + child) is tantamount to the development future caregiver- implemented interventions delivered via telepractice. Additional research is needed to help EI providers learn which aspects of their coaching practices need to change for telepractice service delivery and how to change those practices to best facilitate child language growth (Artman-Meeker, Fettig, Barton & Zeng, 2015; Friedman & Woods, 2012; Kemp & Turnbull, 2014). Closely examining the results from the current study and comparing these results to extant literature can inform future research comparing different coaching frameworks for telepractice language interventions.

Clinical Implications

Findings from this research have the potential to inform local, regional, and national EI programs that may be considering adoption of telepractice service delivery models. The results demonstrated the potential efficacy and feasibility of using video-teleconferencing to provide naturalistic language interventions such as EMT. Knowledge gained from this study has the potential to translate to broader telepractice advances in early intervention and early childhood education across domains (e.g., cognitive, adaptive, gross motor).

Conclusion

In this study, three caregivers learned EMT strategies and implemented them at home during play and family routines with their young children with language impairments. The effects of the intervention maintained for up to six weeks after the intervention was completed. The intervention was delivered using a blended in-person and telepractice model. The blended-service delivery model was cost effective. Results demonstrate the efficacy and feasibility of using video-teleconferencing to teach caregivers language support strategies. Findings from the current research have the potential to help early intervention providers maximize resources and expand access to services to children and families who are significantly underserved (Rosenberg, Zhang & Robinson, 2008).

REFERENCES

Achenbach, T.M., & Rescorla, L.A. (2000). *Manual for the ASEBA School-Age Forms & Profiles.* Burlington, VT: University of Vermont, Research Center for Children, Youth, & Families.

Adamson, L. B., Kaiser, A. P., Tamis-LaMonda, K. S., Owen, M. T., & Dimitrova, N. (2018). The developmental landscape of language acquisition and intervention. Submitted to *Early Childhood Research Quarterly*

Aldred, C., Green, J., & Adams, C. (2004). A new social communication intervention for children with autism: pilot randomised controlled treatment study suggesting effectiveness. *Journal of Child Psychology and Psychiatry*, *45*(8), 1420–1430. doi:10.1111/j.1469-7610.2004.00338.x

American Speech-Language Hearing Association. (2016).Telepractice (Practice Portal). Retrieved from www.asha.org/Practice-Portal/Professional-Issues/Telepractice.

American Speech-Language-Hearing Association. (2008). *Roles and responsibilities of speech-language pathologists in early intervention: Technical report*. Available from www.asha.org/policy.

Askvig, B. A., Liccini, H., & Bossert, B. S. W. (2015). *Tele-intervention in an early intervention home visitation program: A Pilot Study.* Retrieved from http://ndcpd.org/assets/teleintervention-ei---2015.pdf.

Baggett, K. M., Davis, B., Feil, E. G., Sheeber, L. L., Landry, S. H., Carta, J. J., & Leve, C. (2010). Technologies for expanding the reach of evidence-based interventions: Preliminary results for promoting social-emotional development in early childhood. *Topics in Early Childhood Special Education*, *29*, 226 – 238.

Baharav, E., & Reiser, C. (2010). Using Telepractice in Parent Training in Early Autism. *Telemedicine and E-Health*, *16*(6), 727–731.doi:10.1089/tmj.2010.0029

Black, L.I. Vaharatian, A., Hoffman, H.J., (2015). Communication disorders and use of intervention among children aged 3-17 years: United States, 2012. National Center for Health Statistics data brief, No. 205. Hyattsville, MD: National Center for Health Statistics.

Blaiser, K. M., Behl, D., Callow-Heusser, C., & White, K. R. (2013). Measuring Costs and Outcomes of Tele-Intervention When Serving Families of Children who are Deaf/Hard-of-Hearing. *International Journal of Telerehabilitation*, *5*(2), 3–10. doi:10.5195ijt.2013.6129

Bosivert, M., Lang, R., Andrianopoulos, M., & Boscardin, M. L. (2010). Telepractice in the assessment and treatment of individuals with autism spectrum disorders: A systematic review. *Developmental Neurorehabilitation*, *13*, 423–432.

Brady, N. (2015). Communication Complexity Scale. Lawrence, Kansas: University of Kansas.

Briggs-Gowan, M.J. & Carter, A.S. (1998) Preliminary acceptability and psychometrics of the Infant-Toddler Social Emotional Assessment (ITSEA): a new adult report questionnaire. *Infant Mental Health Journal*, 19(4) 422-445.

Bruner, J.S. (1975). From communication to language: A psychological perspective. Cognition, 3, 255-287.

Byun, T., Hitchcock, E. R., Ferron, J. (2017). Masked visual analysis: Minimizing type I error in visually guided single case design for communication disorders. *Journal of Speech Language Hearing Research,* 60(6), 1455-1466.

Carter, A. S., Messinger, D. S., Stone, W. L., Celimli, S., Nahmias, A. S., & Yoder, P. (2011). A randomized controlled trial of hanen's "more than words" in toddlers with early autism symptoms. Journal of Child Psychology and Psychiatry, 52(7), 741–752.

Carta, J.J. , Greenwood, C.R. , Walker, D. , & Buzhardt, J. (2010). Using IGDIs: Monitoring progress and improving intervention results for infants and young children. Baltimore, MD: Brookes.

Cason, J., Behl, D., & Ringwalt, S. (2012). Overview of states' use of telehealth for the delivery of early intervention (IDEA Part C) services. *International Journal of Telerehabilitation*, *4*(2), 39–46. doi:10.5195/IJT.2012.6105

Council for Exceptional Children (2014). Council for exceptional children standards for evidence-based practices in special education. Available at: www.cec.sped.org. Arlington, VA: Author.

Division for Early Childhood. (2014). DEC recommended practices in early intervention/early childhood special education 2014. Retrieved from http://www.decsped.org/reccomendedpractices.

Dunst, C. J., & Trivette, C. M. (2009). Using research evidence to inform and evaluate early childhood intervention practices. *Topics in Early Childhood Special Education, 29*, 40-52.

Fenson, L., Marchman, V., Thal, D., Dale, P., Reznick, J., & Bates, E. (2007). *The MacArthur-dates communicative development inventories words and gestures.* Baltimore, MD: Paul Brookes.

Ferron, J. M., Joo, S.-H., & Levin, J. R. (2017). A Monte Carlo evaluation of masked visual analysis in response-guided versus fixed-criteria multiple-baseline designs. *Journal of Applied Behavior Analysis*, *50*(4), 701–716. doi:10.1002/jaba.410

Fey, M. E., Warren, S. F., Brady, N., Finestack, L. H., Bredin-Oja, S. L., Fairchild, M., … Yoder, P. J. (2006). Early effects of responsivity education/prelinguistic milieu teaching for children with developmental delays and their parents. *Journal of Speech, Language, and Hearing Research : JSLHR*, *49*(3), 526–547. doi: 10.1044/1092-4388(2006/039)

Fisher, E. L. (2017). A Systematic Review and Meta-Analysis of Predictors of Expressive-Language Outcomes Among Late Talkers. *Journal of Speech, Language, and Hearing Research*. doi:10.1044/2017_jslhr-l-16-0310

Greenwood, C. R. Walker, D. & Buzhardt, J. (2010). The Early communication indicator for infants and toddlers: Early head start growth norms from two states. *Journal of Early Intervention, 32, 5, 310-334.*

Haebig, E., McDuffie, A., & Weismer, S. E. (2013). Brief Report: Parent verbal responsiveness and language development in toddlers on the autism spectrum. *Journal of Autism and Developmental Disorders*, *43*(9), 2218–2227. doi:10.1007/s10803-013-1763-5

Hadley, P.A., & Rispoli, M. (2015). Toy talk strategies: An instructional resource. Retrieved from https://www.ideals.illinois.edu/

Hadley, P. A., & Walsh, K. M. (2014). Toy talk: simple strategies to create richer grammatical input. *Language, Speech, and Hearing Services in Schools*, *45*(3), 159–172. doi:10.1044/2014_LSHSS-13-0055

Hall, C. M., & Bierman, K. L. (2015). Technology-assisted interventions for parents of young children: Emerging practices, current research, and future directions. *Early Childhood Research Quarterly*, *33*, 21–32. doi:10.1016/j.ecresq.2015.05.003

Hall, C. M., Culler, E. D., & Frank-Webb, A. (2016). Online dissemination of resources and services for parents of children with autism spectrum disorders (asds): A systematic review of evidence. *Review Journal of Autism and Developmental Disorders*, *3*(4), 273–285. doi:10.1007/s40489-016-0083-z

Hampton, L. H., & Kaiser, A. P. (2016). Intervention effects on spoken-language outcomes for children with autism: a systematic review and meta-analysis. *Journal of Intellectual Disability Research*, *60*(5), 444–463. doi.org;10.1111/jir.12283

Harris, P., Taylor, R., Thielke, R., Payne, J., Gonzalez, N., & Conde, J. (2009). Research electronic data capture (REDCap)—A metadata-driven methodology and workflow process for providing translational research informatics support. *Journal of Biomedical Informatics, 42*, 377–381.

Hart. B. & Risely, R.R. (1995). *Meaningful differences in the everyday experiences of young American children.* Baltimore, MD: Paul H. Brookes.

Hebbeler, K., Spiker, D., & Kahn, L. (2012). Individuals with disabilities education act's early childhood programs: Powerful vision and pesky details. *Topics in Early Childhood Special Education*, *31*(4), 199–207.doi:10.1177/0271121411429077

Hedges, L. V., Pustejovsky, J. E., & Shadish, W. R. (2012). A standardized mean difference effect size for single case designs. *Research Synthesis Methods*, *3*, 224-239.

Heidlage, J., Cunningham, J., Kaiser, A. P., Trivette, C., Barton, E., Frey, J., & Roberts, M. The effects of parent-implemented language interventions of child linguistic outcomes: A meta analysis. *Submitted to Early Childhood Research Quarterly.*

Higgins, J.., Altman, D., Gotzsche, P., Juni, P., Moher, D., & Oxman, A. et al. (2011). The Cochrane Collaboration's tool for assessing risk of bias in randomised trials. *British Medical Journal, 343*, d5928–d5928. doi:10.1136/bmj.d5928

Hirsh-Pasek, K., Adamson, L. B., Bakeman, R., Owen, M. T., Golinkoff, R. M., Pace, A., … Suma, K. (2015). The Contribution of Early Communication Quality to Low-Income Children's Language Success. *Psychological Science*, *26*(7), 1071–1083. doi:10.1177/0956797615581493

Hoff, E, (2006). How social contexts support and shape language development. *Developmental Review, 26,* 55-88.

Hoff, E. (2013). Interpreting the early language trajectories of children from low-ses and language minority homes: Implications for closing achievement gaps. *Developmental Review, 26, 55-88.*

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

Individuals with Disabilities Education Act, 20 U.S.C. § 1400 (2004)

Justice, L. M., Bowles, R. P., Pence Turnbull, K. L., & Skibbe, L. E. (2009). School readiness among children with varying histories of language difficulties. *Developmental Psychology*, *45*, 460–476.

Landry, S., Smith, K.E., & Swank (2006). Responsive parenting: Establishing early foundations for social communication, and independent problem-solving skills*, Developmental Psychology*, 42:627–642

Ledford, J. R., Barton, E. E., Severini, K. S., & Zimmerman, K. N. (2017). A primer on single case designs: Contemporary use, analysis, and synthesis. *Manuscript under review.*

Ledford, J.R., & Gast, D.L. (Eds). (2018). Single case research methodology: Applications in special education and behavioral sciences. New York, NY: Routledge.

Ledford, J. R., Lane, J. D., & Severini, K. E. (2018). Systematic use of visual analysis for assessing outcomes in single case design studies. *Brain Impairment*, *19*(1), 4–17. doi:10.1017/BrImp.2017.16

Kaiser, A. P. (1993). Parent-implemented language intervention: An environmental system perspective., 63–84.

Kaiser, A. P., & Roberts, M. Y. (2013). Parent-implemented enhanced milieu teaching with preschool children who have intellectual disabilities. *Journal of Speech, Language, and Hearing Research*, *56*(1), 295–309

Kaiser, A. P. & Hampton, L. H. (2016). Enhanced Milieu Teaching. In R. McCauley, M. Fey & R. Gilliam (Eds.) *Treatment of Language Disorders in Children (2nd Edition),* (pp. 87-120). Baltimore: Brookes.

Kashinath, S., Woods, J., & Goldstein, H. (2006). Enhancing generalized teaching strategy use in daily routines by parents of children with autism. *Journal of Speech, Language, and Hearing Research*, *49*(3), 466 – 485.

Kelso, G., Fiechtl, B., Olsen, S., & Rule, S. (2009). The feasibility of virtual home visits to provide early intervention: a pilot study. *Infants and Young Children*, 22, 332-340.

Kemp, P., & Turnbull, A. P. (2014). Coaching with parents in early intervention: an interdisciplinary research synthesis. *Infants & Young Children*, *27*(4), 305. doi:10.1097IYC.0000000000000018

Knutsen, J., Wolfe, A., Burke, B. L., Hepburn, S., Lindgren, S., & Coury, D. (2016). A systematic review of telemedicine in autism spectrum disorders. *Review Journal of Autism and Developmental Disorders*, *3*(4), 330–344. doi:10.1007/s40489-016-0086-9.

Kratochwill, T.R., Levin, J. (2014). Single-case intervention research: Methodological and statistical advances. Washington, D. C.: American Psychological Associations.

Machalicek, W., Lequia, J., Pinkelman, S., Knowles, C., Raulston, T., Davis, T., & Alresheed, F. (2016). Behavioral Telehealth Consultation with Families of Children with Autism Spectrum Disorder. *Behavioral Interventions*, *31*(3), 223–250. doi:10.1002/bin.1450.

McDuffie, A., Oakes, A., Machalicek, W., Ma, M., Bullard, L., Nelson, S., & Abbeduto, L. (2016). Early language intervention using distance video-teleconferencing: A pilot study of young males with Fragile X syndrome and their mothers. *American Journal of Speech-Language Pathology, 25,* 46-66.

McDuffie, A., Machalicek, W., Oakes, A., Haebig, E., Weismer, S. E., & Abbeduto, L. (2013). Distance video-teleconferencing in early intervention: Pilot study of a naturalistic parent-implemented language intervention. *Topics in Early Childhood Special Education*, 172-185. doi:10.1177/0271121413476348.

McManus, B. M., Magnusson, D., & Rosenberg, S. (2014). Restricting state Part C eligibility policy is associated with lower early intervention utilization. *Maternal and Child Heath Journal, 4,* 1031-1037.

Meadan, H., & Daczewitz, M. (2015). Internet-based intervention training for parents of young children with disabilities: A promising service-delivery model. *Early Child Development and care, 185,* 155-169.

Meadan, H., Meyer, L. E. ., Snodgrass, M. R. ., & Halle, J. W. (2013). Coaching parents of young children with autism in rural areas using internet-technologies: A pilot program. *Rural Special Education Quarterly*, *32*(3), 3–10.

Meadan, H., Snodgrass, M. R., Meyer, L. E., Fisher, K. W., Chung, M. Y., & Halle, J. W. (2016). Internet-Based parent-implemented intervention for young children with autism: A Pilot Study. *Journal of Early Intervention*, *38*(1), 3–23. doi:10.1177/1053815116630327

Miller, J. & Iglesias, A. (2012). Systematic Analysis of Language Transcripts (SALT), Research Version 2012 [Computer Software]. Middleton, WI: SALT Software, LLC.

Molini-Avejonas, D. R., Rondon-Melo, S., Amato, C. A. de L. H., & Samelli, A. G. (2015). A systematic review of the use of telehealth in speech, language and hearing sciences. *Journal of Telemedicine and Telecare,* 21(7), 367–376. doi:10.1177/1357633X15583215

Mullen, E. (1995). *Mullen Scales of Early Learning: AGS Edition*. Circle Pines, MN: AGS.

Oregon Office of Rural Health (2018). Oregon rural health service areas. Retrieved from https://www.ohsu.edu/xd/outreach/oregon-rural-health/about-rural-frontier/service-areas.cfm.

Parker, R. I., & Vannest, K. (2009). An improved effect size for single-case research: Non-overlap of all pairs. *Behavior Therapy*, *40*, 357-367.

Petersen-Brown, S., Karich, A. C., & Symons, F. J. (2012). Examining estimates of effect using non-overlap of all pairs in multiple baseline studies of academic intervention. *Journal of Behavioral Education*, *21*, 203-216.

Peredo, T. N., Zelaya, M. I., & Kaiser, A. P. (2018). Teaching Low-Income Spanish-Speaking Caregivers to Implement EMT en Español With Their Young Children With Language Impairment: A Pilot Study. *American Journal of Speech-Language Pathology*, *27*(1), 136–153. doi:10.1044/2017_AJSLP-16-0228

Pustejovsky, J. E. (2015). *Operational sensitivities of non-overlap effect sizes for single case designs.* Paper presented at the annual meeting of the American Educational Research Association, Chicago, IL. New Version available at: https://osf.io/pxn24/

Pustejovsky, J. E. (2016). SCD-effect-sizes: A web application for calculating effect size indices for single-case designs (Version 0.1) [Web application]. Retrieved from: https://jepusto.shinyapps.io/SCD-effect-sizes

Pustejovsky, J. E., & Ferron, J. M. (2017). Research synthesis and meta-analysis of single-case designs. In J. M. Kaufmann, D. P. Hallahan, & P. C. Pullen (Eds.), *Handbook of Special Education, 2nd Edition*. New York, NY: Routledge.

Pustejovsky, J. E. & Swan, D. M. (2018). Single-case effect size calculator (Version 0.4) Web application. Retrieved from https://jepusto.shinyapps.io/SCD-effect-sizes/

Quinn, E., Heidladge, J. Cunningham, J., & Kaiser A., (in preparation). Using telesupervision and telepractice to implement language and social communication interventions: A meta-analysis. *American Journal of Speech-Language Pathology.*

Reichow, B., Barton E.E., & Maggin D. (2015). *Risk of bias assessment for single case designs.*

Unpublished manuscript, Anita Zucker Center for Excellence for Excellence in Early Childhood Studies, University of Florida, Gainesville, FL.

Reichow, B., Barton E.E., & Maggin, D. M. (2018). Development and applications of the single-case design risk of bias tool for evaluating single case design research study reports. *Research in Developmental Disabilities. 79, 53- 64.*

Roberts, M.Y., Kaiser, A.P., 2011. The effectiveness of parent-implemented language interventions: a meta-analysis. *American Journal of Speech and Language Pathology*, 20, 180–199. doi: 10.1044/1058-0360(2011/10-0055)

Roberts, M., & Kaiser, A. (2012). Assessing the effects of a parent-implemented language intervention for children with language impairments using empirical benchmarks: A pilot study. *Journal of Speech, Language, and Hearing Research*, *55*(6), 1655- 1670.

Roberts, M. Y., & Kaiser, A. P. (2015). Early intervention for toddlers with language delays: a randomized controlled trial. *Pediatrics*, 2014-2134. doi:10.1542/peds.2014-2134

Roberts, M. Y., Kaiser, A. P., Wolfe, C. E., Bryant, J. D., & Spidalieri, A. M. (2014). Effects of the teach- model-coach-review instructional approach on caregiver use of language support strategies and children's expressive language skills. *Journal of Speech, Language, and Hearing Research, 57,* 1851- 1869.

Robins D.L., Fein D, Barton M., (2009) *The Modified Checklist for Autism in Toddlers, Revised with Follow-Up (M-CHAT-R/F)*. Self-published.

Romski, M., Sevcik, R. A., Adamson, L. B., Cheslock, M., Smith, A., Barker, R. M., & Bakeman, R. (2010). Randomized comparison of augmented and non-augmented language interventions for toddlers with developmental delays and their parents. *Journal of Speech, Language, and Hearing Research*, *53*(2), 350–364.

Rosenberg, S. A., Robinson, C. C., Shaw, E. F., & Ellison, M. C. (2013). Part c early intervention for infants and toddlers: percentage eligible versus served. *Pediatrics, 131,* 38-46.

Rosenberg, S. A., Zhang, D., & Robinson, C.C. (2008). Prevalence of developmental delays and participation in early intervention services for young children. *Pediatrics*, *121*(6), 1503–1509.

Rowe, M. L. (2012). A longitudinal investigation of the role of quantity and quality of child-directed speech in vocabulary development. *Child Development*, *83*(5), 1762–1774. doi:10.1111/j.1467-8624.2012.01805.x

Salisbury, C., Woods, J., Snyder, P., Moddelmog, K., Mawdsley, H., Romano, M., & Windsor, K. (2018). Caregiver and Provider Experiences With Coaching and Embedded Intervention. *Topics in Early Childhood Special Education*, *38*(1), 17–29. doi:10.1177/0271121417708036

Sameroff, A. J. & Chandler, M. J. (1975). Reproductive risk and the continuum of caretaker casualty. In F. D. Horowitz (Ed.), Review of child development research (Vol. 4). Chicago: University of Chicago Press

Sameroff, A. J. (Ed.) (2009). The transactional model of development: How children and contexts shape each other. Washington, DC: American Psychological Association.

Shadish, W. R., Hedges, L. V., Horner, R. H., & Odom, S. L. (2015). *The role of between-case effect size in conducting, interpreting, and summarizing single-case research.* Washington, DC: National Center for Education Research, Institute of Education Sciences, U. S. Department of Education. Retrieved from: http://files.eric.ed.gov/fulltext/ED562991.pdf

Shadish, W. R., Hedges, L. V., & Pustejovsky, J. E. (2014). Analysis and meta-analysis of single-case designs with a standardized mean difference statistic: A primer and applications. *Journal of School Psychology*, *52*, 123-147.

Snyder-McLean, L. K., & McLean, J. E. (1978). Verbal information gathering strategies: the child's use of language to acquire language. *The Journal of Speech and Hearing Disorders*, *43*(3), 306–325.

Tate, R. L., Perdices, M., Rosenkoetter, U., Wakim, D., Godbee, K., Togher, L., & McDonald, S. (2013). Revision of method quality rating scale for a single case experimental designs and n-of-1 trials: The 15-item Risk of Bias in N-of-1 Trials (ROBINT) scale. *Neuropsychological Rehabilitation, 23,* 619-638.

Theodoros, D. (2011). Telepractice in speech-language pathology: the evidence, the challenges, and the future. *Perspectives on Telepractice, 1,* 10-21.

Tomblin, J. B., Zhang, X., Buckwalter, P., & O'Brien, M. (2003). The stability of primary language disorder: four years after kindergarten diagnosis. *Journal of Speech, Language, and Hearing Research: JSLHR*, *46*, 1283 – 1296.

Trivette, C. M., Dunst, C. J., & Hamby, D. W. (2010). Influences of family-systems intervention practices on parent-child interactions and child development. *Topics in Early Childhood Special Education*, *30*(1), 3–19. doi:10.1177/0271121410364250

U.S. Census Bureau. (2018). U.S. Census Bureau Data, *Poverty thresholds by size of family and number of children.* Retreived from https://www.census.gov/data/tables/time-series/demo/income-poverty/historical-poverty-thresholds.html

U.S. Department of Education (2015). U.S. Department of Education, Office of Special Education Programs, Individuals with Disabilities Education Act (IDEA) database,

retrieved from http://www2.ed.gov/programs/osepidea/618-data/state-level-data-files/index.html#bcc.

U.S. Department of Education (2016). *Department of Education 2016 Congressional Action – IDEA, Part C Grants for Infants and Families.* Retrieved from http://www2.ed.gov/about/overview/budget/budget16/16action.pdf

Ungerer, J.A. & Sigman M. (1981). Symbolic play and language in autistic children. *Journal of the American Academy of Child Psychiatry, 20,* 318 - 337.

Vismara, L. A., McCormick, C. E. B., Wagner, A. L., Monlux, K., Nadhan, A., & Young, G. S. (2016). Telehealth parent training in the early start Denver model results from a randomized controlled study. *Focus on Autism and Other Developmental Disabilities*, 1-13.

Vismara, L. A., McCormick, C., Young, G. S., Nadhan, A., & Monlux, K. (2013). Preliminary findings of a telehealth approach to parent training in autism. *Journal of Autism and Developmental Disorders*, *43*(12), 2953–2969. doi:10.1007/s10803-013-1841-8

Vismara, L. A., Young, G. S., & Rogers, S. J. (2012). Telehealth for expanding the reach of early autism training to parents. *Autism Research and Treatment*, 1-12. doi:10.1155/2012/121878.

Wainer, A. L., & Ingersoll, B. R. (2013). Disseminating asd interventions: A pilot study of a distance learning program for parents and professionals. *Journal of Autism and Developmental Disorders*, *43*, 11–24.

Wainer, A. L., & Ingersoll, B. R. (2015). Increasing access to an asd imitation intervention via a telehealth parent training program. *Journal of Autism and Developmental Disorders*, *45*, 3877–3890.

What Works Clearinghouse (2014). Single Case Design Standards. Version 3.0. Retrieved from https://ies.ed.gov/ncee/wwc/Document/229

Woods, J. J., Wilcox, M. J., Friedman, M., & Murch, T. (2011). Collaborative consultation in natural environments: Strategies to enhance family-centered supports and services. *Language Speech and Hearing Services in Schools*, *42*(3), 379. doi:10.1044/0161-1461(2011/10-0016).

Wright, C. A., Kaiser, A. P., Reikowsky, D. I., & Roberts, M. Y. (2013). Effects of a naturalistic sign intervention on expressive language of toddlers with Down syndrome. *Journal of Speech, Language and Hearing Research (Online)*, *56*(3), 994–1008.

Yoder, P. J., Bottema-Beutel, K., Woynaroski, T., Chandrasekhar, R., & Sandbank, M. (2013). Social communication intervention effects vary by dependent variable type in preschoolers with autism spectrum disorders. *Evidence-Based Communication Assessment and Intervention*, *7*(4), 150–174. Doi:10.1080/17489539.2014.917780.

Yoder, P., Lloyd, B., Symmons, F. J. (2018). *Observational Measurement of Behavior: Second Edition.* Baltimore, MD: Paul Brookes Publishing.

Yoder, P., Stone, W. L., Walden, T., & Malesa, E. (2009). Predicting social impairment and ASD diagnosis in younger siblings of children with autism spectrum disorder. *Journal of Autism and Developmental Disorders*, *39*(10), 1381–1391. doi:10.1007/s10803-009-0753-0

Zimmerman, I.L., Steiner, V. & Evatt Pont, R. (2011). *Preschool Language Scale- 5*. San Antonio, TX: The Psychological Corporation

Appendix A: Implementation Supports

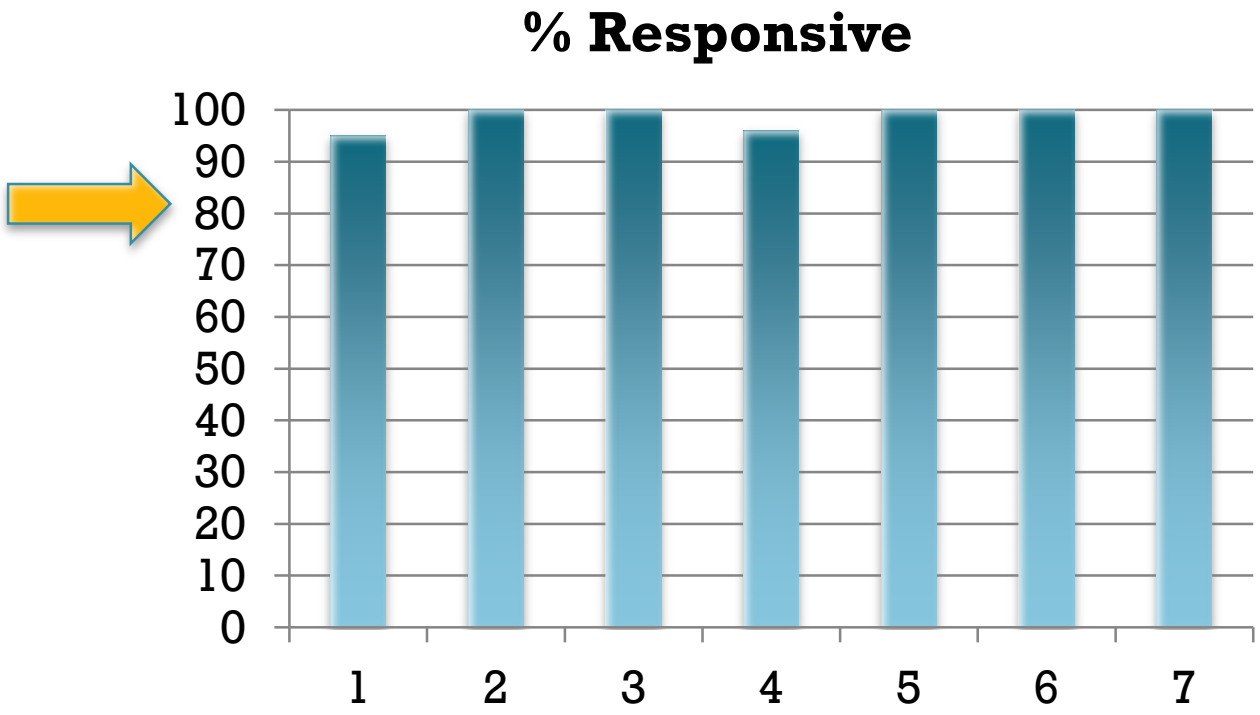
Setting the Foundation for Communication

Last Week's focus

- Minimize questions
- Balanced Turn Taking
- Mirror and Map

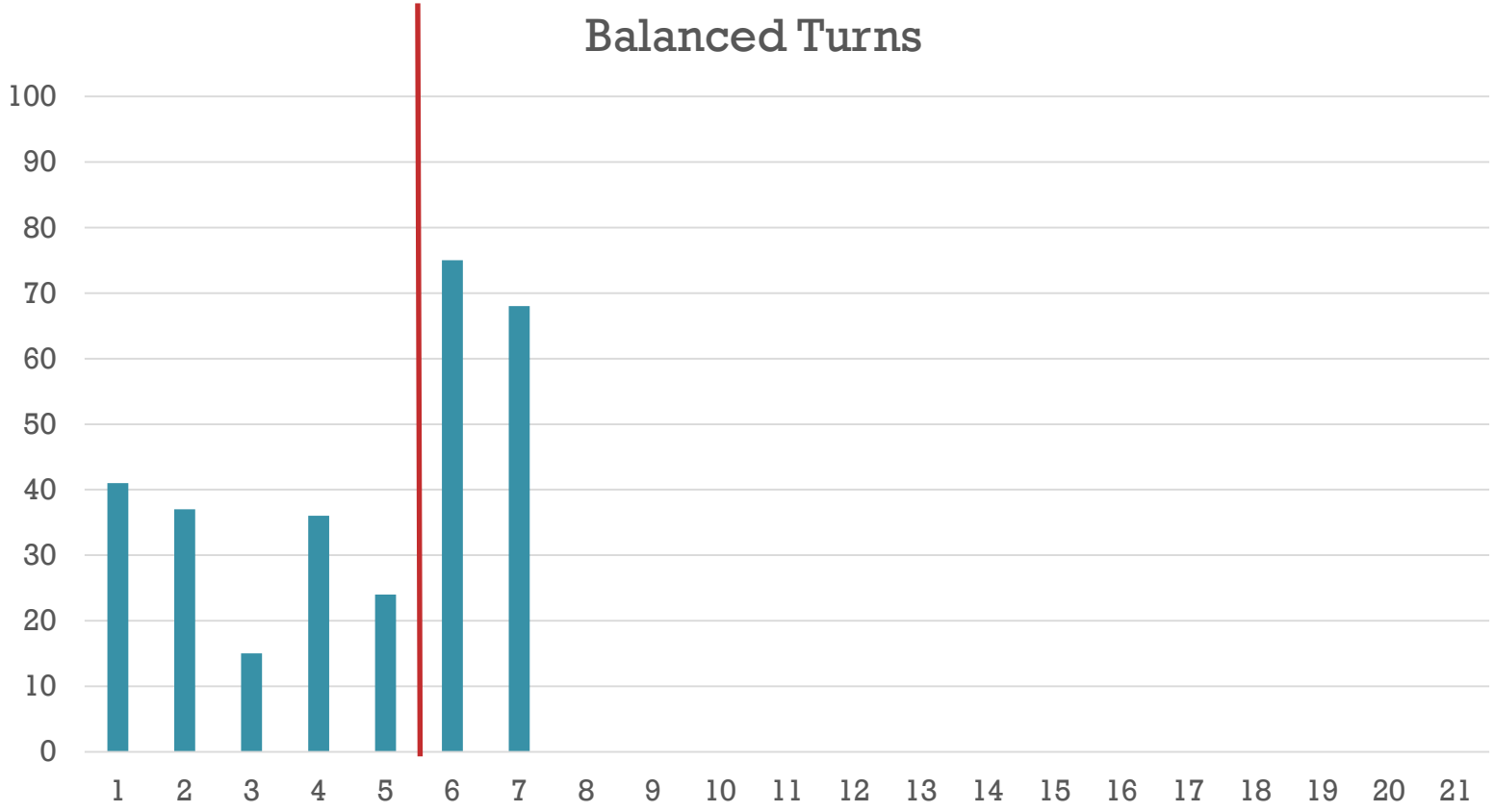
How is your responding?

- Goal is to respond to 90% or more of your child's communication.



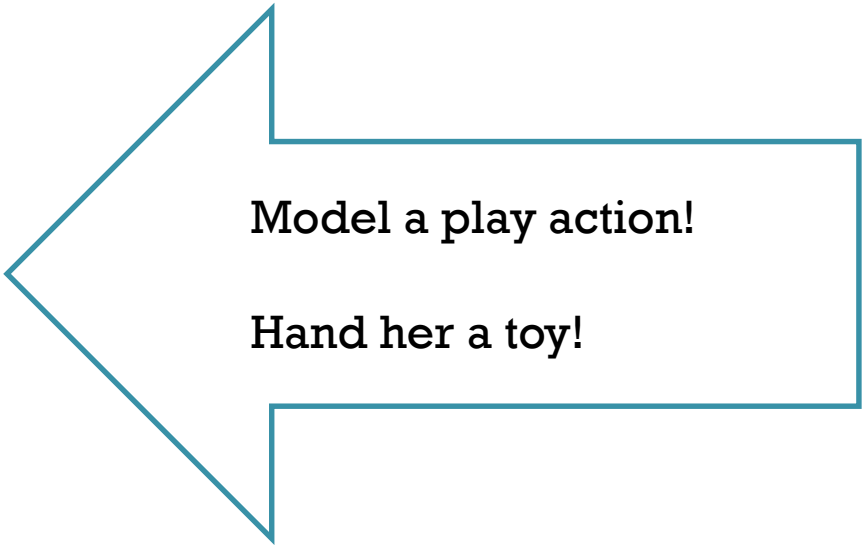
How are balanced are your turns?

Goal: 80%
45% increase !!!!



Ideas to improve for today: Engage with fewer questions.

- T: What's the matter ?
- T: hmm ?
- T: what are you doing ?
- T: Are you being silly ?



Ideas for Today: Give to get Started

- Give A a toy!
- A takes the toy!
- Label the toy!

- T: (gives ball)
- A:(takes ball)
- T: Ball.

Engaging without questions

Replace questions with statements we want our child to say!

Question	Statements
Where does the circle go?	Circle In!
You want to build?	Build a tower!
Is that a blue block?	I see three blue blocks!
Should we throw it?	Throw!

Appendix B: EMT Treatment Manual Examples

Setting the Foundation for Communication

What is Enhanced Milieu Teaching?

- EMT is an effective early language intervention with over 20 years of research support.
- EMT is a naturalistic, conversation-based intervention that uses child interests and initiations as opportunities to model and prompt language in everyday contexts.

EMT Strategies

- 4 Early EMT Strategies
  - Play and Engage
  - Notice and Respond
  - Balance spoken turns
  - Mirror and Map

Play and Engage

- Goal: Set up opportunities for both the adult and child to take turns.
- Communication develops from shared joint attention and engagement
  - Social games
  - Play
  - Everyday routines

Why Play and Engage?

- Children learn best when they are engaged with a communication partner.
- Children are more likely to learn language while doing activities they enjoy.
- When an adult joins a child in play, the adult optimizes the opportunity for learning

How to Play and Engage?

- Be at your child's level.
- Do whatever your child is doing.
- Follow your child's lead.

Lets Watch Together!

- Are you are your child's level? .
- Are you doing what your child is doing?
- Are you following your child's lead?

Play and Engage

Replace questions with statements we want our child to say!

Question	Statements
What does the doggie say?	My doggie says woof woof!
Are you making a tower?	Build the tower!
Is that a blue block?	I see three blue blocks!

Let's Watch Together

- Avoid directions and let your child lead the play.
- Avoid questions and let your child initiate the communication.

How to Play and Engage ?

- Avoid directions and let your child lead the play.
  - Put this block here!
- Avoid questions and let your child initiate the communication.
  - What is that?
  - Is that a turtle?

How to play and Engage

- Choose toys that are interesting and engaging.
- Put away toys that aren't being used.
- Substitute undesired activities with desired activities.

Let's Watch Together!

- Are the toys interesting and engaging?
- How are the toys impacting engagement?
- Is there a need to substitute toys?

Interesting Toys

On Target	Stretch Goals
Blocks	Cars + Ramps
Shapes and Shape Sorters	Little People + Cars
Small, Medium and Large Containers and tubes	Dolls/ Action Heros + Food
Activity boards	Cups, Brush, Spoon, Blankets
Cars	

When to Play and Engage?

- Whenever possible
- At least once a day for at least 15 minutes of adult-child time

Review strategy 1: Play and Engage

- Be at your child's level.
- Do whatever your child is doing.
- Follow your child's lead.

Strategy 2: Notice and Respond to all Communication

<u>Pre-linguistic</u>

- Point
- Show
- Give
- Vocalizations
- Reach
- Lifts arms up
- Shakes head

<u>Linguistic</u>

- Signs
- Pictures
- Symbols
- Words

Requesting

Commenting

How is Your Child Communicating?

Watch the video and look for:

1. How is _____ communicating now?
2. Why is _____ communicating now?

Why Notice and Respond?

- Noticing and responding to all communication teaches your child that their communication is important to you.
- By acknowledging all communication you reward your child for communicating.
- The more your child communicates, the more practice they receive and the easier communication becomes.

Notice and Respond to Communication

- Notice and respond every time your child communicates.
- Respond by talking about what your child is doing.
- Language is most meaningful when it's related to what your child is doing OR in response to what your child is communicating.

When to notice and respond?

- As much as possible
- In all contexts throughout the day
  - Play
  - Meals
  - Routines (bath, car, dressing)

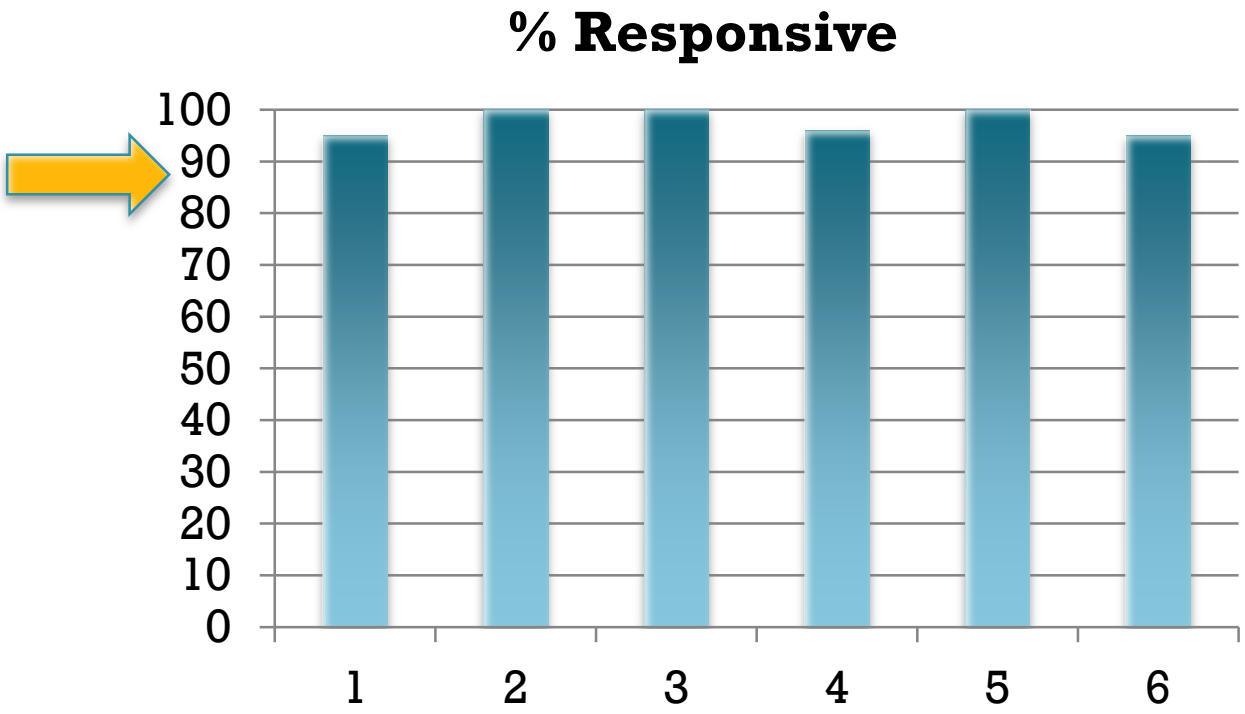
How are you responding?

- Responding to communication

- Talking about what __ is doing

Goal 1: Responding to Communication

- Responsiveness: you should respond to 90% or more of your child's communication.



Strategy 3: Take Turns

- Take turns communicating with J.
- Allow time for J to communicate.
- Play a game of "communication catch"
  - J communicates
  - You respond (and waits)
  - J communicates
  - You respond (and waits)
- Only say something after J communicates
  - Gesture, Vocalization, Word

Why Take Turns?

- It allows your child more opportunities to communicate.
  - More opportunities = more practice = growth in communication skills.
- It teaches your child how to have a conversation.
  - Child communicates
  - Parent communicates and WAITS, which signals to the child that it is his or her turn to communicate

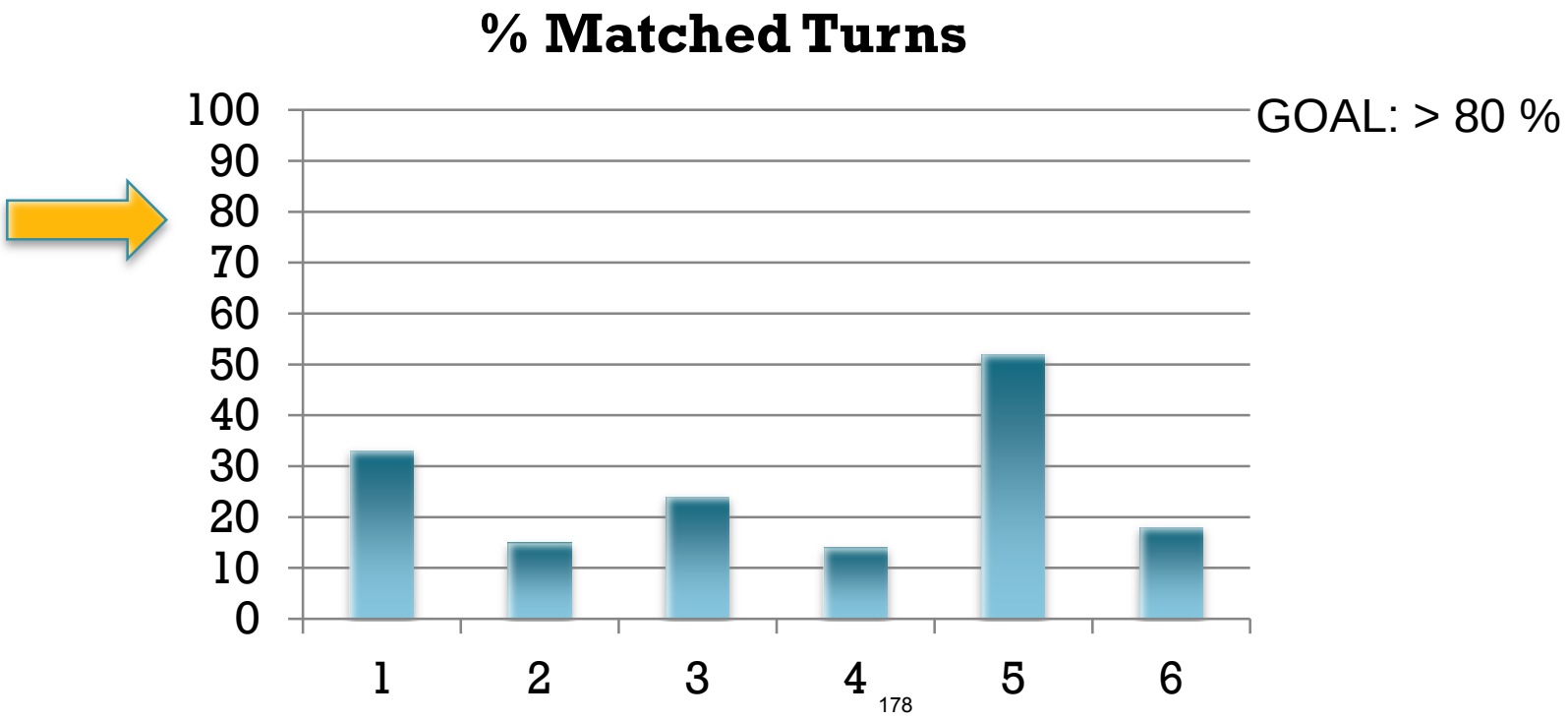
How's your turn taking?

- Taking turns

- Waiting for communication

Goal: Matched Turns

- Matched turns > 80% of what you say should be "matched" or in response to your child's communication).



Strategy 4: Mirror and Map

- Mirroring: adult imitates the child's nonverbal behaviors.
- Mapping: adult "maps" language onto these actions, by describing these actions.
  - Child: (Stacks Blocks)
  - Adult: (Stacks blocks) Build the tower!

Why use mirroring and mapping?

- Mirroring allows the adult to join in the interaction with the child.
- Mapping provides the child with a language rich description of the activity.
- Mirroring and mapping allows the adult to have balanced turns when the child is not communicating.
- What the adult says is more meaningful since the adult and child are doing the same action and language is "mapped" right on top of what the child is doing.

How and When to Mirror and Map?

- Use mirroring and mapping when J is not communicating.
- Mapping must come after mirroring.
- First imitate the action and then label the action with words.
  - J: {feeds baby}
  - Mom: {feeds baby} eat.

How and When to Mirror and Map?

- Mirror (imitate) close to ___'s actions to make language more obvious.
- Avoid mirroring behaviors that are unacceptable (e.g., throwing toys, hitting).
- Balance mapping and playing (e.g., don't over map).

Let's Review

- Do what ___ does, following his lead.
- Make statements (no questions, no directions).
- Respond when ___ communicates.
- Talk about what ___ is doing.
- Wait for communication.
- Only talk after ___ talks.
- Mirror and map when __ is not communicating.

Now

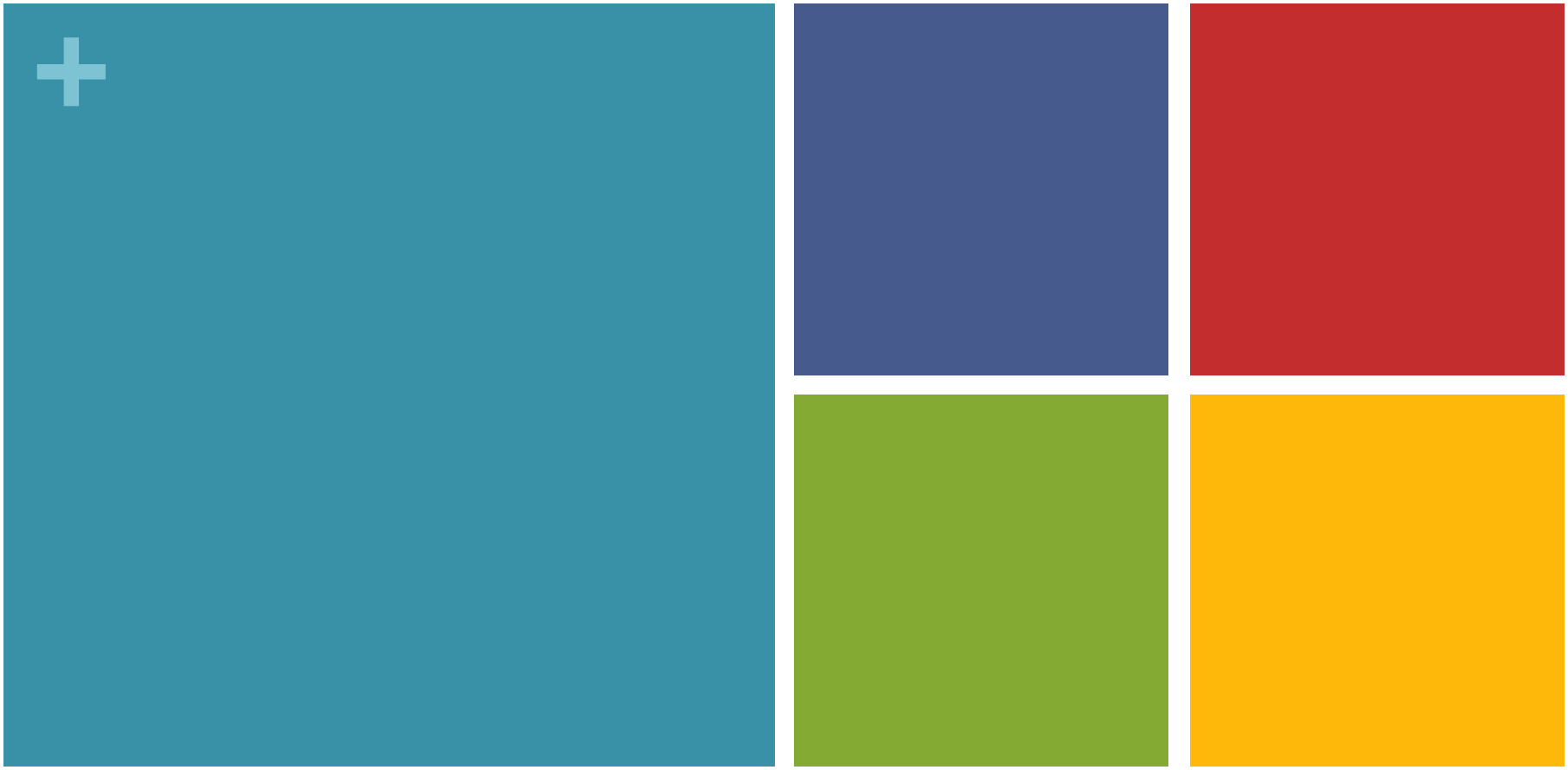
1. Review target strategy and role play
2. Pick toys and talk about how you will play and engage, notice and respond, and take turns with the toys.
3. Watch your child play and look for how he/ she responds, plays, engages, and arranges the environment.
4. Practice with your child for 15 minutes.

Coaching

- Coaching gives you immediate feedback.
- Coaching should not disrupt the interaction between you and your child.
- Coaching styles?
- How do you want feedback?

Questions?

- Next session is on _____
- Any questions?
- Home visit plan/schedule
- Intervention calendar



Modeling Play and Communication

Next Strategies

- Model language using Target Talk
- Expand communication
- Model new play actions

Why model language using target talk ?

- Children learn language through modeling.
- Contingent modeling that is in response to a child' s communication is the most powerful form of modeling.
- Simplifying language to match J's language targets helps J learn language more quickly.
  - Easier to imitate
  - Easier to understand

Target Talk

- Teach using one word phrases
- Say single word phrases focusing on nouns, verbs, and requesting words
  - Nouns: car, block, baby, road
  - Verbs: push, go, wash, eat, drive
  - Early Prepositions/ Adverbs: in, out, on off, up, down,
  - Requests- want, more, help mine

Targets: Single Words

- 50% of what you say should be single words
  - Nouns (e.g., cow, cat)
  - Action verbs (e.g., push, eat)
  - Function verbs (e.g., in, out)
  - Requesting verbs (e.g., want, help, more)
- 50% of what you say should be short phrases
  - 2-5 words long
  - Phrases should include multiple target words
    - Nouns, Verbs, Modifiers/ Adjectives
  - Grammatically correct

When to model targets?

- After J communicates.
  - Child: {reaches for cow}
  - Adult: {gives cow} Cow.
- When you are mirroring and mapping
  - Child: {drives car}.
  - Adult: {drives car} drive.

How are you using targets?

Goal for target talk: Adult uses single words 50% of the time.

Now, we will brainstorm ideas for targets

Targets	Blocks
Nouns	blocks, people, Tower, house, castle
Verbs	stack, build, crash, dump, wobble,
Early Prepositions	In, on, up, down

Expanding Communication

- An expansion is imitating what your child communicated and then adding more words.
- The most powerful expansion includes one of your child's communication targets.

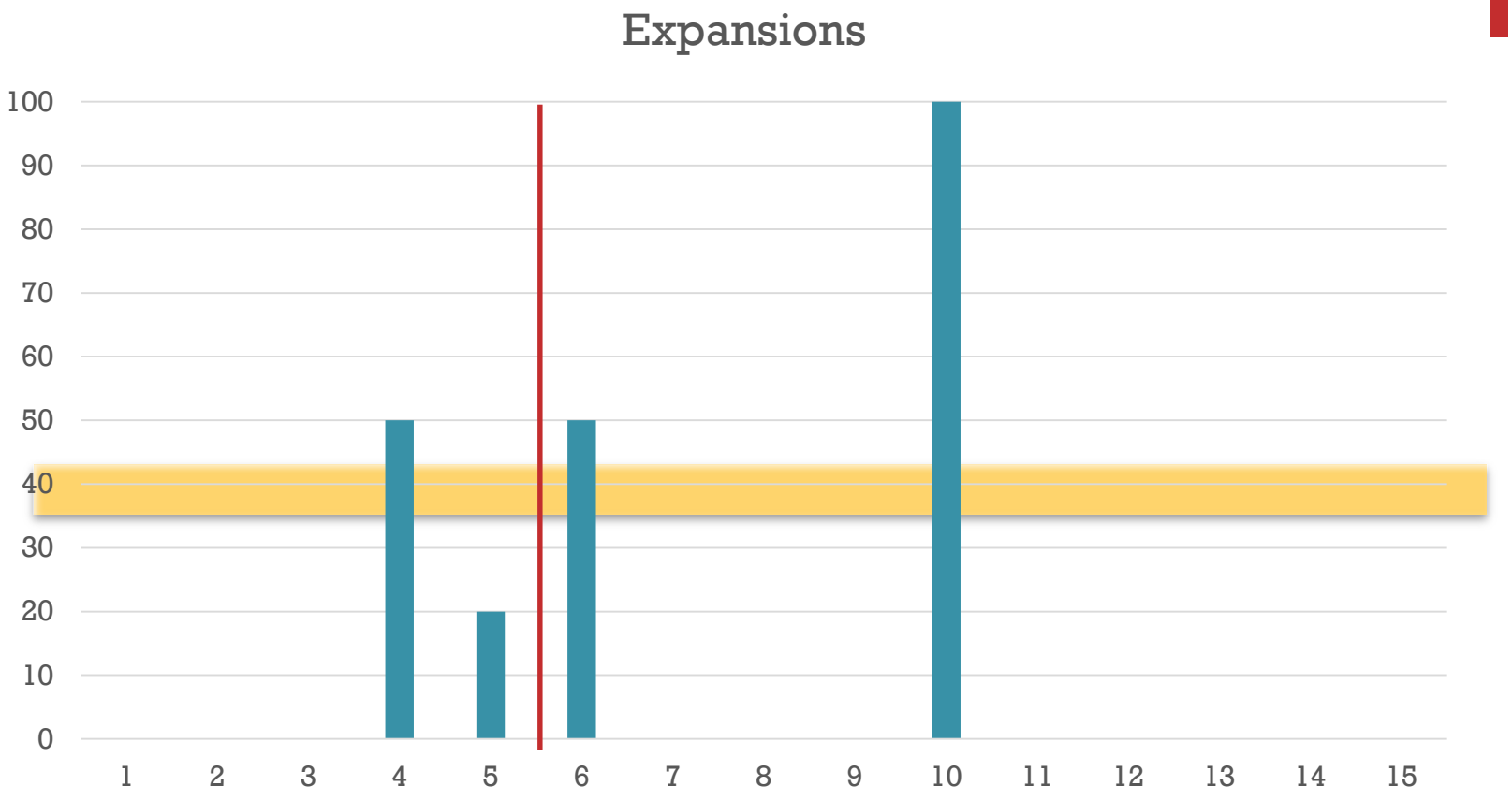
How to expand communication?

- When J says a word imitate his/her communication and add target words.
  - Child: ball.
  - Adult: roll the ball!

Why expand communication?

- Expansions immediately connect the child's communication to additional new communication.
- The more your child hears and practices language that is more complex, the better his/her language skills become.
- Expansions help your child learn new vocabulary and talk in more complex sentences.

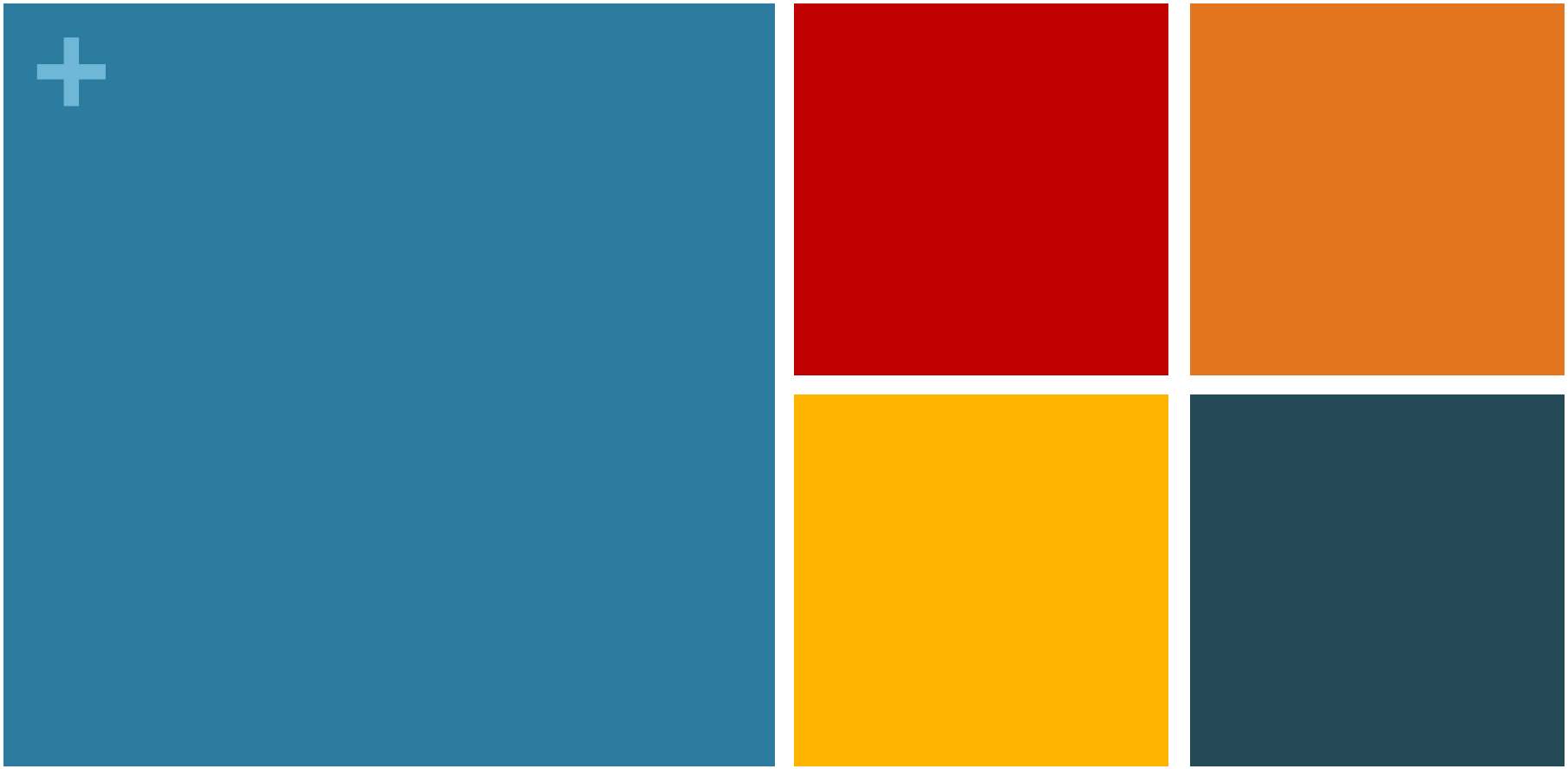
How are you expanding?



Goal for expansions: Adult expands child communication 50% of the time.

How to Expand Play

- Set out a new toy.
- Model a new action.
- Hand the child a toy.



Using Time Delays

Recap and Review: EMT Strategies

- Interactive play between parent and child
- Notice and Respond
- Balance spoken turns
- Mirroring and Mapping
- Modeling and expanding play
- Modeling and expanding Communication

New Strategy

- Using Time Delays

What is a Time Delay ?

- Strategy used to encourage your child to communicate with you.

- A pause with an expectant look that indicates to the child that a response is required.

5 Time Delays

- Pause in Routine
- Visual Choice
- Assistance
- Inadequate Portions

Pause in Routine

- After 2 or three predictable repetitions in a routine, pause with an expectant look until the child uses any form of communication or 5 second elapses
- Example:
  - Building with blocks, pause holding blocks at the top of the tower.

Pause in Routine

Pause in Routine

Visual Choice

- Hold up two items that the child might want and wait with an expectant look until the child uses any form of communication or 5 seconds elapses
- Example: Building a Tower
  - Left Hand : Building Block
  - Right Hand: Toy Pig
- Example: Playing with Play dough
  - Left Hand: Stamp
  - Right Hand: Roller

Visual Choice

Assistance

- Provide the child with an activity that they need assistance to gain access to or operate (e.g. wind up toy) and wait until the child uses any form of communication or 5 seconds elapses.

Assistance

Inadequate Portions

- Provide the child with less than what might be needed or desired for an activity (e.g. small ball of playdough, only a few blocks, a small portion of snack) and wait until the child uses any form or communication or 5 seconds elapses

Inadequate Portions

Create a Plan for Time Delays

- Go into the time delay with an idea of how your child might respond
- Know what you expect from your child.
  - Communicate with a vocalization
  - Communicate with a gesture (point, show, give)
  - Communicate with a word

Ending the Time Delay

- If the child communicates the adult should immediately stop and respond to the communication or expand the spoken utterance.
- If at any point during the Time Delay the child looses interest in the object or action, the adult should stop and should NOT give the child the desired object or action.

Why set up Time Delays?

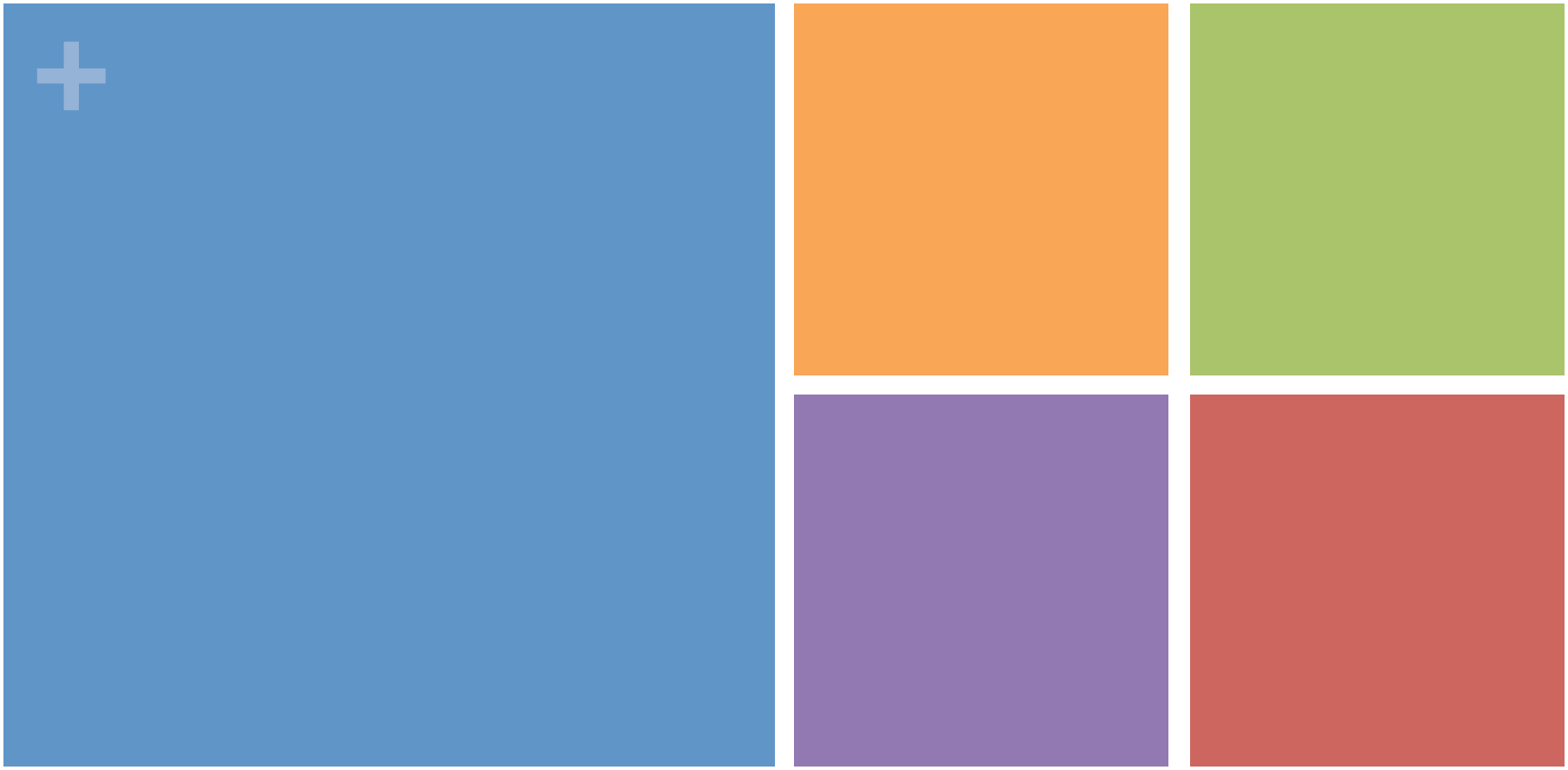
- Provide your child with more opportunities to practice communicating
  - Increases your child's rate of communication
- Provide you with more opportunities to reinforce and teach language by
  - Responding
  - Expanding your child's communication
- Decreased dependence on a prompt to communicate

When to use Time Delays

- When your child is not communicating frequently
- Some strategies work better than others
  - Use ones that work best for your child
  - Avoid strategies that frustrate your child

Let's Review

- Use TD strategies to set up an opportunity for (child's name) to communicate when (he/she) is not communicating at a high rate.
  - Inadequate portions
  - Waiting with routine
  - Waiting with cue
  - Assistance
  - Choice making
- Expand this communication to include a target.



Prompting

Review: Time Delay

- Expectant look and waits for J to communicate
  - **Assistance**
  - **Waiting with routine**
  - **Choices**
- Time delay offers the least language support
- Time delays provide opportunity to

What is a language prompt?

- A signal to the child to do or say something.
- We will add 2 types of prompts to our time delays
  - Choice prompt : " Bubbles or Puzzle"
  - SAY prompt: "Say open!"

What to Prompt?

- J 's language targets:
  - Target 1: noun (e.g., cat)
  - Target 2: verb (e.g., eat, in)
  - Target 4: request (e.g., help, again)

How to Prompt Language

- Wait for the child to request
- Use one type of time delay to elicit a request
  - **Assistance**
  - **Pause/ Wait in routine**
  - **Choice making**

Choice Prompt

- The adult asks a choice prompt that has no single correct answer.
- Choice prompts offer even more support by including the answer in the question.
- Example: "*bus or blocks?*"

SAY Prompt

- The adult tells the child exactly what to say.
- The SAY prompt offers the most adult support because it tells the child exactly what to say.
- Example: "*Say 'car.'*"
- Video Example

How to Prompt Language

- Wait for J to request.
- Use a time delay strategy to elicit a request.
  - Inadequate proportions
  - Assistance
  - Waiting as part of a routine
  - Choice making

Why Prompt Language

- Gives J an opportunity to practice communication targets during a highly motivating context.
- Gives J functional practice and reinforcement for communication.

When to Prompt Language?

- Only when J is requesting and not using a target.
- Not more than 3 times per 10 minute session
  - Too many demands may cause J to become frustrated.
- Discontinue prompting if J loses interest.

Ideas for Prompting :Add a Say Prompt to a Pause

Building Blocks:

1. Mom: Blocks on! J: (Stacks Blocks)
2. Mom: Blocks on! J: (Stacks Blocks)
3. Mom: Blocks on! J: (Stacks Blocks)
4. Mom: Pause with blocks. J (Pushes's Mom's Hands)
5. Mom: Say ON! J: On!
6. Mom: On the Tower!

Ideas for Prompting: Choice

- Mom: Holds up Bus and Truck
- J: (Reaches for Bus)
- Mom: Say Bus
- J: Bus
- Mom: Play with bus!

Let's Review

- Prompt J when he is requesting a ball and using a gesture.
  - When he uses a gesture (reach, point)
    - "Say ball."
- Prompt J when he is requesting the bus and uses the wrong word.
  - When he starts counting.
    - Say "Bus".
- Use prompting sparingly (about 2-3x per 10 minutes) so J does not become frustrated
- Discontinue prompting if J loses interest

Appendix C: Demographic & Medical History Form

1. Demographic & Medical History Form

ID: _____ Date: _____ Person completing form: _____

The information in this survey will be used to help us learn more about factors affecting the development of your child. For each question, please provide an answer for all questions, even if it represents your "best guess".

Information about Your Family:

Answers to the following questions will help us know that children from a variety of backgrounds are represented in the study. We appreciate you sharing this information with us.

1. The person filling out this form is the child's:

   ____ Mother
   ____ Father
   ____ Stepmother
   ____ Stepfather
   ____ Foster Mother
   ____ Foster Father
   ____ Grandmother
   ____ Grandfather
   ____ Other (please describe_____)

2. How many people live in your house? _____
   Number of adults over 21 yrs.: _____
   Number of children less than 21 yrs.: _____

3. What is your child's date of birth: ____/_____/_____

4. What is your child's **ethnic** background?

   ____ Hispanic or Latino ____ Not Hispanic or Latino

5. What is your child's **racial** background (select one or more)?

____ American Indian or Alaska Native
____ Asian
____ Native Hawaiian/ Pacific Islander
____ African American
____ White
____ Other: _____

6. What language does your child hear most at home?

____English ____French

____Spanish ____Other (please specify) _____

____Korean

7. Does your child hear any other language at home? ____No ____Yes
   a. If yes, specify the language(s): _____

8. Mother's date of birth: ____/_____/_____

9. What is your child's mother's **ethnic** background?

   ____ Hispanic or Latino ____ Not Hispanic or Latino

10. What is your child's mother's **racial** background (select one or more)?

____ American Indian or Alaska Native ____ African American

____ Asian ____ White

____ Native Hawaiian/ Pacific Islander ____ Other: _____

11. Mother's education (circle one):

Less than 7th grade Some College

Junior High Special Training After High School

Some High School College Graduate

High School Graduate Graduate/Professional Training

12. Mother's occupation: _____

13. Mother's current employment status: (circle one)

Not employed Self-employed part-time

Employed part-time 2. Self-employed full-time

Employed full-time 3. Employed full-time and second job

14. Does the mother work outside the home?

____No ____Part-time ____Full-time

15. Father's date of birth: _____/_____/_____

16. What is your child's father's **ethnic** background?

____ Hispanic or Latino ____ Not Hispanic or Latino

17. What is your child's father's **racial** background (select one or more)?

____ American Indian or Alaska Native
____ Asian
____ Native Hawaiian/ Pacific Islander
____ African American
____ White
____ Other: _____

18. Father's education:

Less than 7th grade
Junior High
Some High School
High School Graduate
Some College
Special Training After High School
College Graduate
Graduate/Professional Training

19. Father's occupation: _____

20. Father's current employment status: (circle one)

Not employed
Employed part-time
Employed full-time
Self-employed part-time
Self-employed full-time
Employed full-time and second job

21. Does the father work outside the home?

____No ____Part-time ____Full-time

22. What is the family income per year?

____ less than $10,000
____$10,000-$20,000
____$20,000-$30,000
____$30,000-$40,000
____$40,000-$50,000
____$50,000-$60,000
____$60,000-$80,000
____$80,000-$100,000
____above $100,000

23. Does the family receive any of the following assistance? (check all that apply)

____Medicaid
____Food stamps
____SSI (Supplemental Security Income)
____Commodities/food pantry
____TANF
____Unemployment
____WIC
____Housing assistance
____Other: _____
_____

24. During the past year, has your family moved?

____ No ____Yes If yes, how many moves? _____

25. During the past year, has there been a change in your child's primary caregiver?

____No ____Yes If yes, briefly explain: _____

26. During the past year, has there been a change in the parent's marital status?

____No ____Yes

i. _____Newly married
ii. _____Separated
iii. _____Divorced

27. During the past year, has there been a change in child custody?

____No ____Yes If yes, briefly explain: _____

Fill in the information requested or select the relevant response:

Yes, No, NK=Not Known or Not Available

Prenatal/Early Postnatal History

1. Complications during pregnancy? __Yes __No __NK

   If yes, describe_____

2. Birth weight _____lbs._____ oz. __NK
3. Birth length _____(inches) __NK
4. Full term? __Yes __No __NK

   If No, how many weeks gestation? _____
5. Number of days in hospital after birth _____
6. Number of days, if any, spent in NICU after birth_____

Developmental History

1. Age at walking 10 steps (in months) _____
2. Age at first words (in months) _____
3. Current speech/language:

   Verbal? __Yes __No __NK

   If yes, how many words? (check one below)

   __Uses fewer than 10 Single words __Uses 10 or more single words

   __Speaks in 2 word combinations __Speaks in 3 or more word combinations

Current Medications

1. Prescription medications for behavioral concerns __Yes __No __NK
2. Prescription medications for physical health concerns __Yes __No __NK
3. Over-the-counter medications __Yes __No __NK
4. Dietary supplements __Yes __No __NK
5. Special diet (e.g., celiacs, gluten free, etc.) __Yes __No __NK

   Notes for any checked yes above:_____

_____

Review of Systems

1. Has your child had a formal eye exam in the past 12 months? __Yes __No __NK

   Results: _____

2. Has your child had a formal hearing exam in the past 12 months? __Yes __No __NK

   Results: _____

3. How many ear infections has your child had?_____

   How many in the last year?_____

   Age of onset:_____Most recent:_____

4. Has your child had PE (ear) Tubes surgically placed? __Yes __No __NK

   How many sets of tubes has your child had placed?_____

   Does your child currently have them? __Yes __No __NK

5. Does your child have any dental abnormalities? __Yes __No __NK
6. Does your child have or has he/she ever had any heart abnormalities? __Yes __No __NK

   If yes, list here:_____

7. Has your child had surgery or procedures to correct these heart abnormalities? __Yes __No _NK

   If yes, list dates and procedures here: _____

   _____

8. Does your child have any feeding or diet concerns? __Yes __No __NK

   If yes, list here:_____

9. Does your child have any other medical concerns not previously addressed? __Yes __No __NK

   If yes, please list here: _____

   _____

   _____

   _____

   _____

   _____

10. Please list any other hospitalizations your child has experienced:

Dates	Reason for hospitalization

Services Received

1. When did your child first start receiving therapies?

Early intervention:_____

Occupational Therapy:_____

Physical Therapy:_____

Speech/Language:_____

Preschool:_____

Behavioral:_____

Feeding:_____

Other:_____

Have any of these services been discontinued? List dates and service below:

_____

2. Has your child ever been diagnosed with a motor speech disorder such as apraxia or dysarthria?

   __Yes __No __NK

3. Has your child ever been taught to use any augmentative modes of communication (sign language, speech output devices, PECS, etc.)?

   __Yes __No __NK

   If yes, list here_____

4. Have you ever received any parent training in speech, language, or behavioral techniques?

   __Yes __No __NK

   If yes, list here_____

Please list all the services your child is receiving currently on the next page.

Type of Intervention	Name/ Organization	Number of hours received /wk	Intervention done as a group or individually	Where is the intervention delivered?
Early intervention provider			☐ Ind. ☐ Group	☐ Home ☐ School ☐ Clinic
			☐ Ind. ☐ Group	☐ Home ☐ School ☐ Clinic
Occupational Therapy			☐ Ind. ☐ Group	☐ Home ☐ School ☐ Clinic
			☐ Ind. ☐ Group	☐ Home ☐ School ☐ Clinic
Physical Therapy			☐ Ind. ☐ Group	☐ Home ☐ School ☐ Clinic
			☐ Ind. ☐ Group	☐ Home ☐ School ☐ Clinic
Speech and Language Therapy			☐ Ind. ☐ Group	☐ Home ☐ School ☐ Clinic
			☐ Ind. ☐ Group	☐ Home ☐ School ☐ Clinic
Preschool			☐ Ind. ☐ Group	☐ Home ☐ School ☐ Clinic
			☐ Ind. ☐ Group	☐ Home ☐ School ☐ Clinic
Behavioral Therapy			☐ Ind. ☐ Group	☐ Home ☐ School ☐ Clinic
			☐ Ind. ☐ Group	☐ Home ☐ School ☐ Clinic
Feeding Therapy			☐ Ind. ☐ Group	☐ Home ☐ School ☐ Clinic
			☐ Ind. ☐ Group	☐ Home ☐ School ☐ Clinic
Other:			☐ Ind. ☐ Group	☐ Home ☐ School ☐ Clinic

Appendix D: Assessment Protocols

Language Sample Protocol

A language sample is a naturalistic adult-child interaction with a specific set of toys to evaluate a child's spontaneous expressive language ability.

Purpose:

1. A language sample accurately captures a child's initiated, unprompted language using a 20-minute language sample.
2. A language sample avoids language-rich verbs and labels that may not occur in the child's natural environment but provides a fun, responsive and engaging environment.

Materials:

There are 5 toys sets that comprise the language sample: babies, cars, barn, Play-Doh, book

Procedures:

1. Set the timer for 21 minutes.
2. Be at the child's eye level in close proximity to the child.
3. Use a warm, positive tone of voice and engage with the child.
4. Respond to all child communication (gesture, vocalization, words) by imitating their words or by making a sound (e.g., "mhm," "yeah," "uh-huh")
5. Present all 4 toy sets and wordless picture book during the 20 minute session. Toys may be combined. Remove toys that aren't being used by the child/tester.
6. The tester introduces each toy set by saying:
    a. Book: Here's my dog book, tell me what you see.
    b. Babies: here are some babies, what should we do?
    c. Barn: here are some animals, what should they do?
    d. Play-Doh: here's some Play-Doh, what should we make?
    e. Cars + blocks: here are some cars, where should they go?
7. For the book, point to at least 4 different pictures.
8. Play with the child during each of the 4 play sets.
9. For each of the play sets:
    a. Model at least 2 novel play actions
    b. Use at least 2 environmental arrangement strategies:
        i. Inadequate Portions: providing small or inadequate portions of preferred materials (e.g., giving only a little Play-Doh).
        ii. Assistance: creating situations in which the child needs the adult's help (e.g., giving Play-Doh with top on)
        iii. Waiting Expectantly: setting up a routine in which the child expects certain actions and then waiting before during the expected action again (e.g., crashing car into blocks and then waiting before crashing again).
        iv. Choice Making: holding up two objects and waiting for the child to communicate about which item he/she wants (e.g., holding up two different items).
10. Discontinue playing with a given set if the child loses interest and after you have modeled 2 play actions and used 2 environmental prompts (if possible).
11. If the child has not initiated vocalizations or verbal language within a two-minute interval, make a comment about the toy set or book.
12. Be sure to label the video with the correct name on the video log.

Structured Play Assessment (SPA)

Purpose:

1. To determine a child's diversity and complexity of play actions.
2. To accurately capture the child's spontaneous play and highest level of imitated play.

Basal: Spontaneous play during each of the 5 play sets.

Ceiling: Failure to imitate 2 of the same adult models of play, which is 1-2 levels higher than the child's highest play level (spontaneous or supported).

Procedure:

1. Be sure that the camera (and videographer – preferred) and the toys are set up in advance of the testing session.
    a. **Schedule another person to video record this assessment if possible.
2. Ensure that you have the child's attention before presenting each toy set.
3. Introduce the assessment (and all subsequent new toy sets) by saying, "It's time to play with some new toys."
4. Place each toy set in an organized way (see pictures below) on the table in the arrangement depicted in the pictures above.
    a. All toys in a given toy set should be accessible to the child
    b. All other toys should be out of the child's sight (e.g., under a blanket)
5. Part 1: Spontaneous play (first 2-3 minutes with the toy set)
    a. Allow the child to play independently for at least 2-3 minutes with the toy set.
    b. The child may play up to 5 minutes if he/she is doing diverse play actions (e.g., not doing the same action with the same object).
    c. If the child expressed disinterest (e.g., says "no", screams, throws toys), the tester should end the spontaneous play section and start the supported play section.
    d. The tester may comment on the child's play but less talking is preferred. Be natural.
    e. Record the child's play actions according to the play levels on the SPA protocol.
        i. Place a check (√) in the box corresponding to the correct play level for each set under the "observe column"
        ii. You do not need to record every play action, but enough actions to get a basal and a ceiling for each toy set.
6. Part 2: Supported play (following 2-3 or 5 minutes depending on the child)
    a. *Environmental Prompt (EA)*: If the child has not played with all of the materials in the toy set, give the child an object with which he/she has not played (or place object in front of child).
        i. Record any play actions following an environmental prompt as in response to an EA prompt. Place a check (√) in the box corresponding the correct play level for each set under the "EA prompt" column.
        ii. You do not need to record every play action, but enough actions to get a basal and a ceiling for each toy set.
    b. *Model Prompt*: Regardless of how the child responds to the environmental prompt, model 1 to 2 play level higher than the highest level observed (including those in response to the EA prompt).
        i. Examples of each play level are provided on the SPA protocol.

ii. If the child imitates the model, continue modeling 1-2 play levels higher (up to multi-scheme sequence) until the child fails to imitate the model.
iii. When the child fails to imitate the model, give the same model again. Only give 2 models for each toy set.
iv. Record any play actions following an adult model as in response to a model prompt. Place a check (√) in the box corresponding the correct play level for each set under the "model" column.
v. You must record every play action in response to an adult model.
vi. Record failures to imitate adult play actions as ∅ in the box corresponding to the play action the adult modeled under the "model" column.
vii. You must record every play action the child failed to imitate following an adult model.

7. A ceiling is reached for each toy set when the child has failed to imitate 2 adult models of the same play action, which is 1 to 2 play levels higher than the highest observed child play level (spontaneous or supported).
8. Check scoring to be sure you have achieved a ceiling for each toy set.
9. Allow the child to help clean up the toys in each set if they desire, but do not insist they clean up the toys.
10. Continue the above procedure for all 5 toy sets.
11. Be sure to label the video with the correct name on the video log.

Scoring the SPA

1. Complete the following information on the test protocol: (a) Child ID, (b) Time point, (c) Tester Name, (d) Date
2. Record play actions you observe with a check (√) in the appropriate column:
   a. Observed – play action that is spontaneously observed
   b. EA prompt – play action that is in response the adult handing the child a toy or placing the object in front of the child.
   c. Model – play action that is in response to the adult modeling the play action.
3. Record child failures to imitate an adult model of a play action with a ∅ in the box corresponding to the play action the adult modeled under the "model" column.

Materials:

1. A watch to keep track of the spontaneous play sessions.
2. Video camera, tripod and videographer (preferred).
3. SPA test protocol and pencil.
4. Toy Sets (see below).

Set 1: Shape sorter/puzzle	***Set 2: Tea set***	***Set 3: Grooming***	***Set 4: Furniture***	***Set 4: Farm***
1. Animal Puzzle 2. Shape Sorter 3. Stacking Cups	1. Two dolls 2. Teapot with lid 3. Bowl 4. Cup & saucer 5. Spoon 6. Bottle 7. Sponge	1. Two dolls 2. Hairbrush 3. Telephone 4. Mirror	1. Bed 2. Pillow 3. Chairs 4. Tables 5. Dog figures	1. Dump truck 2. Barn 3. Blocks 4. Doll figure 5. Farm animals

S.P.A.

Level	*Toy set 1*			*Toy set 2*			*Toy set 3*			*Toy set 4*			*Toy set 5*		
Indiscriminate actions															
Discriminate actions on single objects															
Takes apart combinations															
Presentation combinations – recreates combinations of objects															
General combinations – non specific combinations															
Pretend self – relates objects to self															
Specific combinations/ physical attributes – constructs with secondary indicator															
Child as agent – extends familiar actions to doll figures, with child as agent of the activity															
Specific combinations/ conventional attributes – combines one object with another associated object															
Single scheme sequences – extends same action to two or more figures															
Substitutions – uses one object to stand in place of another object															
Substitutions without object – pretends to use something that is not there															
Doll as agent – figure does the action															
Multischeme sequences – 3 actions to same figure, story-like															
Sociodramatic play															
Adopts roles of fantasy characteristics															

Appendix E: EMT Coding Manual

TELEPRACTICE EMT Code Updated 1-16-18

General coding rules:

1. All codes come before the period.
   Example: `a cook food [mt].`
2. There must be a space in between the last word and the first [.
3. All adult and child lines should contain one code for every category or a single code.
4. All child lines should be followed by an adult utterance or an inserted adult line with an [n] for no response (+ expansion code, [nx] or [ix]) or an [o] for no opportunity.
5. You do not need to capitalize the coded letters; [mt] OR [MT] is acceptable.
6. In addition, code prompting and time delay episodes as they occur throughout the session (see **Prompting Strategies**).
7. Transcripts should never end with a child line. If the child takes the last turn before the timer beeps, insert the adult's responding utterance. If the adult stops when the timer beeps, insert an adult line with a [o] for no opportunity.
8. Transcripts should never begin with an adult matched turn and/or expansion without the preceding child turn. If the transcript begins with an adult matched turn [mt], include the previous child utterance.

Child Codes:

Single Codes	***Independence***	***Form***
[n] – no response	[u] – unprompted	[z] – ASL sign
[o] – no opportunity	[e] – elicited	[g] – gesture
[t]- action	[i] – imitated	[w] – words
[pcv] – potentially communicative vocalization	[p] – prompted	
[s] – scripted		

Coding Instructions:

At the end of each line, you will either insert one Single Code or insert a code from each category (Independence, Form).

Examples:
c xxx [pcv].
c ball [u][w].

Child Single Codes:

1. **No Response [N]** = the child does not respond to an adult prompt within **3** seconds (if right on the line of 3 seconds, code [n]). Only use this code WITHIN a milieu episode. This includes any type of milieu prompt, including open questions (What do you want?), choice prompts (red ball or green ball?) or model (say) prompts (say dog).

   Example:
   a what do you want?
   c [n].

   Example:
   a can you put the pig in the barn?
   a i put the pig in the barn.

   The first utterance is functioning like a command. The adult wants the child to put the pig in the barn. Because the adult expects an action rather than a verbal response, do NOT insert a line and code [n].

   Example:
   a what is your name?
   a your name is bob.

   Because the adult asks a test questions, not a real open question, do no insert a child line for no response [n].

2. **No Opportunity [O]** = the child has no opportunity to respond to the adult's prompt. Only use this code WITHIN a milieu episode. Insert a child line with this code when there are less than 3 seconds between adult prompts (if on the line of 3 seconds, code [n]).

   Example:
   a red ball or green ball?
   =2 seconds pass
   c [o].
   a say red ball.

3. **Child Action [T]:** Child does a play action that the adult immediately imitates to Mirror and Map. Gestures are not actions.

   Example:
   c {child pours beans} [t].
   a {adult pours beans} pour bean/s**.**

   [t] is only used as the single code for a given utterance. If the child does an action AND says something, code the communication.

   Example:
   c {in} xx [pcv].
   a {in} in the bucket.

4. **Potentially Communicative Vocalization [PCV]:** Vocalizations are non-word or unintelligible utterances voiced by the child to a partner. Utterances that are coded as

vocalizations are those that cannot be understood as single or multiple words. When vocalizations co-occur in utterances in which single or multiple words are understood, the vocalization(s) should not be recorded. Vocalizations are only recorded when they occur in an utterance consisting only of vocalizations or gestures and vocalizations that occur together. An utterance ends when there has been a breadth or a clear break of at least one second without vocalizations. The best way to determine this is to count to yourself "one thousand one." Vocalizations are coded when the child does the following"

- **Laughs out loud during the play session.**
- Makes animal sounds (Moo) when looking at a toy, transportation, motor sounds, (e.g. vroom) when pushing a tractor, or other vowel-vowel or vowel consonant combinations or babbling and coding sounds or fillers such as "mm" or "huh".

The following are not coded as vocalizations:

- Crying/ screaming/ whining
- Involuntary noises such as hiccups
- An utterance that includes a recognizable word or word combination.

Child is completely unintelligible [PCV]; the child is saying a word and NOT vocalizing, that one cannot understand. This code is only used if the entire utterance is unintelligible**.** If the utterance is partially unintelligible, code based on what is intelligible.

Example**:**

c x [pcv].

c x playdoh [w][u].

Note: This code is only used if you are sure the child is intentionally trying to communicate (i.e., not vocalizing or stemming) but the words are not clear enough to be understood.

This code can be used along with the independence code (see Independence) only ***IF*** the child also gestures in the utterance.

Example:
c {grabs} xxx [pcv][u][g].

1. **Scripted Self Talk [S]:** the child is using rote speech that is not functionally communicative. An instance of non-contextual or non-functional speech, including babbling, humming, singing, repetitive noises, or phrases from movies/tv/songs that are unrelated to the present situation. Scripted episodes usually last more than 2 seconds and are often accompanied by stereotypy (peering, flapping, jumping, etc). The child is usually saying the script to himself/herself (not social, not communicative). Scripts are repetitive (chain, succession, same time or with same materials during "play" or routine), often have a pattern of sound or noise (ahAHah ahAHah ahAHah), and can be difficult to interrupt or unaffected by adult speech or actions. Pronoun reversal and incorrect labeling are also common.

   Examples:
   c bobthebuilder [s].
   – child is speaking rotely and out of context

   c (you're ok you're ok) you're ok [s].
   – child is meaning that he/she is ok and saying it for the purpose of self-soothing

c {grabs} happybirthday [s].
– the child means “I want this” and is using “happy birthday” inappropriately

Example:
c bobthebuilder [s].

Independence: The level of support the child needs to communicate.

1. **Unprompted [U]:** The child takes a spontaneous turn – not prompted, imitated, or elicited by the adult. If the child is responding to a question, it is not spontaneous. If they are following an adult statement with their own statement, it is spontaneous. If the child imitates part or all of the adult’s previous communication, but changes the mode of communication, (adult says “More” child uses the manual sign for “More”) it is considered unprompted [u]. If the child stays in the same communicative mode, but adds language to the adult’s previous communication then it is considered unprompted [u].

   If the child repeats what the adult says but it happens more than 3 seconds after the adult speaks, it is considered spontaneous/unprompted [u].

   Example:
   a hammer.
   c nail [u].

   Example:
   a dog.
   c big dog [u]. ←here the child added new language

   Example:
   a ball.
   c {signs ball}[u] [z]. ←here the child changed the mode of communication to signing

   Example:
   a drive the truck.
   c {five seconds after} drive [u]. ←here more than 3 seconds have passed which moves the child’s communication into unprompted

   Example:
   a roll the ball.
   c {signs ball ‘ball’ on aac} [u][z]. ←here the child changed the mode of communication from verbal to ASL signs

2. **Prompted [P]:** The child takes a turn in response to an adult prompt. These will typically be Milieu “say” or choice prompts, where the response options are included in the adult’s turn. Child utterances in response to a time delay or other questions do **not** count as prompted, unless the child repeats the words spoken in the question when responding. This is because in that instance, the child is both being elicited to communicate AND imitating the word(s) the adult is saying, so it is the least independent.

   Example*:*

a say dog.
c dog [p].

Example:
a red truck or blue truck?
c red truck [p].

a do you want to play with the puzzle?
c puzzle [p].

When a parent is providing hand over hand assistance, gestures can be coded as [g][p]. If the child is using the parent's hand as a tool, it may also be coded as prompted.

a {hand over hand} a turtle [ut][ix][at][ja].
C {hand over hand point} [g][p].

3. **Imitated [I]:** The child imitates all or part of the preceding adult communicative act (words, ASL sign, gesture) but does not add anything to it. If the child adds words or changes the mode then it is [u]. The child must imitate the utterance within 3 seconds to be considered [i]. If the child repeats any or all of the previous adult utterance but it occurs *after* 3 seconds, it is considered [u]. If on the line of 3 seconds, code [i].

   Example:
   a dog.
   c dog [i].

   Example:
   a {signs dog}.
   c {signs dog} [i].

   Example:
   a we have red and blue playdoh.
   c have red playdoh [i]. ←here the child repeats *part* of the adult's utterance but does not add anything new or change the mode of communication.

   Example:
   a dog.
   c big dog [u]. ←here the child adds new words

   Example:
   a dog.
   c {signs dog} [u]. ←here the child changes the mode of communication

4. **Elicited [E]:** The child is using spontaneous language in response to an adult communication open prompt, question, or cue. Child utterances in response to any of the following will receive this code:
   a. Open Question (Milieu Prompt – "what do you want?")
   b. Yes/No Question ("do you want the ball?")
   c. Clarifying question ("huh?")
   d. Test Question ("what is this?")

e. Time Delay

Examples:
a {holds up two objects}. ← this is a Time Delay
c {grabs} [e].

a tell me what you want.
c playdoh [e].

a {holds up two objects}.
c red truck [e].

a what is this?
c ball [e].

Time Delay: A time delay is a nonverbal way of prompting the child to request an object, action or assistance. A Time Delay occurs when an adult uses an expectant look while holding a toy out of reach, waiting to perform an action the child wants (i.e., not opening a box or not winding a toy while looking expectantly at child), or sabotaging a child's routine (i.e. stopping cars from going down the track, putting hand over ball chute, looking at child expectantly or oriented toward the child and waiting for a child to respond).

- A time delay should be overt
- A time delay must begin with the adult having the child's attention

The following are considered time delay strategies:

a. Assistance: creating a situation in which the child needs the adult's help
   Examples: Bottles, bags, jars, etc. that the child cannot open; toys the child cannot assemble alone; wind-up toys the child cannot operate
b. Inadequate portions: providing a small amount of a desired material
   Examples: Pouring a small amount of water into a tub; putting only a small ball of playdoh on the table; squirting only a tiny amount of paint in the dish
c. Choice Making: the adult holds up two options and waits from the child to communicate (this should be done without any words).
d. Waiting with routine: the adult sets up a routine while modeling the language target, and then waits in the middle of the routine to see if the child will produce the target.
   Example: The adult and child pour beans together and the adult says "pour" after each time they pour the beans. The 3rd time, the adult holds the beans up and but does not pour the beans and looks at the child expectantly until he communicates.
e. Waiting with cue: the adult sets up the environment so that the objects cue the child.
   Example: The adult holds the shoe up to the baby's foot and looks at the child expectantly until he communicates.

Form: How the child is communicating.

1. **Gesture [G]:** The child makes a gesture alone (a signal that does not refer to a specific action or object). If the child uses words and gestures, code as words [w]. Gestures include reaches, grabs, shaking of the head, head nodding, points, shows, and gives.

   Examples:
   c {child reaches} [g].
   c {child points to apple} [g].

   Note: While playing with books or puzzles, pay extra close attention for pointing. If the child's hands are already on the toy, code conservatively. One way to help make a determination is to ask, " Would I count this as pointing if the child was playing with a different toy (e.g., blocks, babies, balls).

   Note: Hand as tool (always paired with prompted code [p] code, and joint attention adult code [ja].

   Example
   c {hand as tool} [g] [p].
   a {hand as tool} turtle [mt][gx][at][ja].

2. **Words [W]:** The child says a word. A word does not have to be clearly articulated, just intelligible enough to decipher. If the child uses the same sounds for the same object consistently, it is considered a word

   Examples:
   c ball [w].
   c {child says ba for "ball"} ball [w].

3. **ASL SIGN [z]:** The child uses a clearly defined manual sign. that is made in the same way each time during the session. If the child used the ASL sign and then speaks, code as ASL.

   Examples:
   c {signs 'sing'} sing [z].
   c {signs'sing' and then says sing} sing [z].
   c {says 'sing' first and then signs 'sing'} sing [w].

   Note: ASL communication should be transcribed outside of brackets; the code will denote whether the words were spoken or produced using an ASL sign

   Example:
   c {signs 'ball'} ball [z].

Adult Codes:

Single Codes	***Matched Turn***	***Expansion***	***Target***	***JA***
[n] – no response	[mt] – matched turn	[lx] – spoken "linguistic" expansion	[at] – at target level	[ja] – adult uses JA
[o] – no opportunity	[ut] – unmatched turn	[gx]- expansion of a gesture	[ht] – target with others	[nj] – no adult JA used
[ax] – adult unintelligible	[et] – extra turn	[nx] – no expansion	[xt] – expansion target	
[ar] – adult omitted article		[ix] – impossible to expand	[pt] – proximal target	
			NEW [ab] collapses previous codes for [qt] – question target [ge] – grammatical error [ab] – above target level [ct] – command target [be] – below target level [th] – a linguistic other	

Coding Instructions

At the end of each line, you will either insert one Single Code or insert a code from each category (Matched Turn, Expansion, Target, and JA).

Examples:
a {pours water} pour [mt][ix][at][nj].
a come over here [ut][ix][ab][na][nj].

When inserting a code from each category, ALWAYS put the codes in the following order: Matched Turn, Expansion, Target, JA.

Example:
a {points} throw the ball [mt][nx][at][ja].

*An inserted adult line with the Single Code [n] should always be accompanied by either [nx] or [ix], depending on the adult's ability to expand the child's previous utterance (see **Expansions**).

Adult Single Codes:

1. **No Response [N]:** The adult does not respond to the child's communication within 3 seconds (if on the line of 3 seconds, code [o]). An adult line with this code should be inserted whenever the adult fails to respond to a child utterance within 3 seconds between two child turns. On the inserted line, this code should be accompanied by either [ix] or [nx], depending on the adult's ability to expand the child's previous utterance (see **Expansions**).

   Example:
   c car.
   a **[n][nx].**
   c boat.

   If the adult speaks next after failing to respond to a child turn within 3 seconds, insert an adult line after the child line. It is acceptable to have two adult lines in a row if the adult fails to respond to the child's communication before his/her next turn.

   Example:
   c xx.
   a **[n][ix].**
   a where does this car go [ut][ix][ab]?

2. **No Opportunity [O]:** No opportunity to respond to the child's communication. If the child says multiple utterances in a row without a break of at least 3 seconds, insert adult lines with the code [o] between the child's utterances. If you are unsure about whether or not the adult had an opportunity to respond, code [o].

   Example:
   c mine.
   a [o].
   c i want.

   If another adult in the room interjects between child turns or between the child turn and the next adult turn, and the interjection makes it impossible for the adult to respond to the child within 3 seconds, insert an adult line with the code [o] (regardless of whether the child or the adult speaks next).

   Example:
   c {vocalizes}.
   =therapist talks to parent during parent session
   a [o].
   a wash.

3. **Adult unintelligible [AX]:** Adult is unintelligible. The adult says something that is completely unintelligible.

   Example:
   a xxx [ax].

If the utterance contains both unintelligible and intelligible words, code **based on the intelligible language.**

Examples:
a xxx [ax].

a xx car [mt][ix][at][na][nj].

4. **Adult Omitted Article [AR]:** Adult leaves out an article in an utterance where an article is necessary for the utterance to be grammatically correct. Such utterances include those with 2 or more words where there is either a verb or a preposition followed by a noun. It is not necessary to use an article at the beginning of an utterance starting with a noun, only between a verb and a noun or between a preposition and a noun.
   Examples:
   a drive car [ar].

   a in house [ar].

   Note: this code is inserted at the END of a coded line (after all other adult codes) and not used alone.

   Example:
   c {grabs}.
   a {gives} want the ball [mt][gx][at][ja]**[ar]**.

Matched Turn: Whether or not the adult's utterance was related and/or contingent to the child's previous utterance.

1. **Unmatched turn [UT]:** Adult turns that are not matched to the child's behavior, communication or content focus.
   a. Consecutive adult turns that are not preceded by child lines.
      Example:
      a want to play with this puzzle?
      a oh look there are car/s in here [ut].

   b. Adult turns that are in response to a child utterance but are not related or contingent.
      Note: this ***must*** be overt.
      Example:
      c i want the ball.
      a are you ready to wash your hand/s [ut]?

   c. Adult turns that are not within 5 seconds of a previous child utterance.
      *These should be preceded by an inserted adult line with the codes [n][ix] or [n][nx], depending on the adult's ability to expand the child's previous utterance. If the adult is trying to find toys to mirror/map, setting up the environment, or trying to discern what language the child used, but then expands or matches the child's previous turn, code [mt].
      Example:
      c look!
      = 5 seconds pass
      a [n][nx].
      a what are you doing over there [ut]?

2. **Matched turns [MT]:** Adult turns that follow a child turn that are contingent and related. The adult utterance can contain questions and/or commands if they are contingent and related in content.

   There are two types of child turns that the adult can respond to and get a Matched Turn. One is a child communicative act. Verbal turns, AAC activation, and gestures are considered communicative, as well as vocalizations where the child is making eye contact.
   Example:
   c {gives}.
   a need help [mt].

   The other child turn that the adult can verbally respond to for a matched turn is a child play act. This is only considered a matched turn when the adult is "mirroring and mapping." Mirroring and Mapping is an EMT strategy where the adult mimics a child play act while adding - or "mapping" - language onto it. This turn must occur directly following the child's play act. The adult can also do the action with the child with his/her hand over the child's hand.
   Example:
   c {child pours beans} [t].

a {adult pours beans} pour bean/s [mt].

3. **Extra turns [ET]:** Adult turns taken after an interval of at least **5** seconds in which the child did not take either a play turn or a communicative turn. These are "perfect" turns that include both a language target and a visual referent taken for the purpose of teaching or re-engaging the child in play. Extra turns count neither as matched or unmatched. The child MUST be paying attention for it to count as an extra turn.

   To count as an Extra Turn [et], the adult must:
   a) Be doing a Choice Time Delay
      OR
   b) Use a Target or Proximal Target (see **Adult Targets**) and be talking about something related to current play
      AND
   c) Include one of the following strategies:
      a. Modeling a corresponding play action (saying "drive" while driving a car)
      b. Joint Attention pairing the word with an object (point, show, give)

   Example:
   a pour.

   =5 seconds pass
   a {points} wow [ut][th]! ← the joint attention did not refer to the word and the word is not a language target

   Example:
   c {in} [t].
   a {in} in.
   =7 seconds pass
   a {points} car [et]. ← the adult used a language target and a JA strategy

Adult Targets: The level of language in the adult's utterance in relation to the child's target level of speech.

A "target level" is the appropriate amount of content-words that the child should be using to communicate. Target levels are set by the therapist and vary from 1-3 words, depending on the child and his/her current level of communication. During the intervention the therapist may choose to advance the child to a higher target level, and so the child's target level may change between sessions.

Within each target level there are specific "targets," which are particular types of words or combinations of words that are considered ideal for that level of speech. If the adult/child's utterance is "at target level" it means that he/she is using the right amount of content words. Below is a list of the specific targets for each target level.

Target Level	Targets [at]	[pt]	[ab]	
1-word	[1] Noun (excluding pronouns, such as *he, she, you,* etc.) [2] Verb (help, want) [3] Protoverb [4]Requesting word (more, alldone, allgone)	Adult says 2-3 words (excluding articles; at least 2 content words)	Adult says 4+ words (excluding articles)	Gestures, Vocalizations, Modifiers or other single content words Numbers, letters, colors
2-words	2 specific* content words in a 2-word phrase. There cannot be any linguistic others or non-specific content words between them. Articles don't count.	Adult says 3-4 words (excluding articles; at least 3 content words)	Adult says 5+ words (excluding articles)	Single words, Gestures, 2-word combinations including an other or a non-specific content word;
3-word	Any 3 specific* content word phrase.	Adult says 4-5 words (excluding articles; at least 4 content words)	Adult says 6+ words (excluding articles)	2 words, Single words, Gestures, Vocalizations; 3-word combinations that

				contain non-specific modifiers .

*Must label a specific action, object, place, feeling, etc. or describe a particular aspect of such.

Examples:
(2-word targets)
a this ball [be]. – *this* is a non-specific modifier (as opposed to *yellow*)
a the barn is red [at]. – both *barn* and *red* label specific things

When the adult is expanding (see **Expansions**) or attempting to expand (by repeating all words/gestures from the previous child utterance), the rules for coding the Adult Targets change. The following definitions explain and give examples of how each code should be used depending on the situation. The first definition of each code describes the basic use of the code, and is applicable to most adult utterances. Any following definitions deal with how that code is used in conjunction with the expansion codes [lx] and [nx] (see **Expansions**).

1. **At Target [AT]:** At the child's target level with no extra words (articles don't count towards the number of words in the utterance). The utterance must be grammatically correct. Model prompts (i.e., 'say ball') are considered at target level if the adult is prompting the child's target. See **Notes** below for information about other words that do not count towards the word total.

   Examples:
   (1-word targets)
   a in [**at**].

   (2-word targets)
   a up the tree [**at**].

   a say want ball [**at**].

   OR a correct expansion that contains only the number of words at the child's target level. The utterance must be grammatically correct.

   Examples:
   (1-word targets)
   c {grabs}.
   a {gives} mine [gx][**at**].

   (2-word targets)
   c baby.
   a sleepy baby [lx][**at**].

2. **Target with Others [HT]:** A target with 1-2 linguistic others. Linguistic others are the only words that make the utterance above the child's target level.

Examples:
(1-word targets)
a ok alldone [**ht**]. ← "ok" is a linguistic other, but "alldone" is a target

c {grabs}.
a {gives} wow car/s [gx][**ht**]. ← "wow" is a linguistic other, but "cars" is a target

(2-word targets):
c i do.
a i do it [nx][**ht**]. ← "it" is a linguistic other, but "I do" is a target

*when a child utterance contains a number, and the parent responds with a linguistic other
c one [w][u].
a that/'s a one [mt] [nx][ht][nj].

3. **Expansion Target [XT]:** A correct expansion that is above the child's target level because the child took a target level turn and the adult expanded it. The utterance is 1-2 words above the child's target level because the adult is expanding a target-level child utterance. At least one of the added words must be a content word. The utterance must contain all of the words from the child's previous utterance and maintain the child's communicative intent.

   Examples:
   (1-word targets)
   c balloon/s [at].
   a i love balloon/s [lx][**xt**]. ← the child said 1 word, the adult added 2 words

   (2-word targets)
   c walk dog [at].
   a we walk the dog [lx][**xt**]. ← the child said 2 words, the adult added 2 words

4. **Proximal Target [PT]:** Above the child's target level, but within a proximal range, 1-2 words above the child's target level. At least one of the extra words must be a content word. The utterance must be in the form of a statement unless the adult is matching the intent of the child (e.g. the child asks a question that is 1-2 words above their target level and the adult repeats it). The utterance cannot be more than 2 words above the child's target level.

   Examples:
   (1-word targets)
   a dino roar/3s [**pt**].

   (2-word targets)
   a we play catch [**pt**].

   OR if the adult expanding a child utterance that is below target level, but the adult's utterance is 1-2 words above the child's target level.

   Example:
   (1-word targets)
   c here.
   a here/'s your car [lx][**pt**].

(2-word targets)
c horsey.
a horsey run/3s fast [lx][**pt**].

Note: a Proximal Target turn and an Expansion Target turn will look the same in terms of the number of words. The difference is that the Expansion Target turn happens after a child says a target and is above target level because the adult is expansion, whereas a Proximal Target turn is above target level independently.

The following subcodes are collapsed into an above target code [AB] as of 1-15-18

5. **Question Target [AB]:** At the child's target level **or** the proximal level (1-2 words above the child's target), but in the form of a question. If the utterance weren't a question it would be coded [at] or [pt]. The utterance can include 1-2 linguistic others.

   Examples:
   (1-word targets)
   a alldone [**AB**]? ← at the child's target level

   a are you alldone [**AB**]? ← at the child's proximal level

   (2-word targets)
   a get down [AB]?

   OR an incorrect expansion because the expanded utterance is in the form of a question (would be [at] or [xt] but it's a question).

   Examples:
   (1-word targets)
   c open.
   a open the box [nx][**ab**]?

   (2-word targets)
   c make another.
   a make another snake [nx][**ab]**?

   NOTE: If the child's utterance is in the form of a question and the adult expands or repeats in question form, do not use this code. This is only for cases when the child is saying a statement and the adult responds in question form.

6. **Grammatical Error [ab]:** At the child's target level or proximal target level (1-2 words above the child's target), but the utterance is grammatically or contextually incorrect. The utterance can include 1-2 linguistic others.

   Examples:
   (1-word targets)
   a {shows rhino} hippo [**ab**].

   c drive.
   a car drive [nx][**ab**]. ← should be "drive the car"

(2-word targets):
a we plays [**ab**].

7. **Above Target [AB]:** Above the child's target level by 3 or more words, outside of the proximal target range.

   Example:
   (1-word targets)
   a roll the ball/s down the slide [**ab**].

   OR any question or command that is <u>one or more content words</u> above the child's proximal target level.

   Examples:
   (1-word targets)
   a do you want a ball **[ab]**?

   (2-word targets)
   a you are not allowed to bite the toy/s **[ab]**.

   OR an incorrect expansion because the adult adds 1 or more words above the acceptable amount of words for an expansion and making the utterance outside of the proximal level.
   Examples:
   (1-word targets)
   c bus.
   a wow I didn't know they had a bus [nx][**ab**].

   (2-word targets)
   c ohno.
   a ohno all the people fell off [nx][**ab**].

8. **Command Target [ab]:** At the child's target level or proximal level, but in the form of a command. The utterance can include 1-2 linguistic others.

   Examples:
   (1-word targets)
   a {trying to get the child's attention} look **[ab].**

   a sit down [**ab**]. ← at the proximal level, but still [**ab**]

   (2-word targets)
   a sit down [**ab**].

9. **Below Target [ab]:** Below the child's target level of speech. The utterance contains less content words than the child's target level. Articles and linguistic others do not count as words to make an utterance at target level.

   Examples:
   (1-word targets)
   a {sounds} [**ab**].

   (2-word targets)

a fix it [**ab**].

NOTE: Previous targets for the child are considered below target level [ab] for the adult. For instance, if the child moves from 1 word to 2 word targets and the adult models 1 word, the utterance is considered [ab].

10. **Linguistic Other [ab]:** An utterance that only contains words/phrases that carry little semantic meaning or is ambiguous. The following is a list of commonly occurring adult words/phrases that will be coded as Linguistic Others [ab]. This is not an exhaustive list. Verbs are not coded [ab] except as noted below.

whew	*oops/ uhoh*
here you go	*thereyougo/hereyougo*
lookout	*OK*
here/there	*you know what*
child's name	*wow*
right (when alone)	*yeah*
oh	*yikes*
yes	*no*
hi	*bye*
ouch	*(singing, counting)*
you're welcome	*ohman*
thankyou	*moo, choochoo, woof, etc.*
it's, that's, there's, what's	*what, where*
I don't know	

- Transcribed sounds, such as "moo" and "choochoo," are considered others [th] when used alone. If they are being used as a noun or verb, as in "cow moos," they should not be considered others.
  Examples:
  (1-word targets)
  a what's that?
  c a moo [ab].

  (2-word targets)
  a drive the choochoo [at].
- If "no" is used with a noun or verb to make a two-word request, it is not considered an other.
  Example (2 word targets):
  c no [ab].
  c no ball [at].
- When "yes" and "no" are used to expand a child nodding or shaking their head, they are considered content words.
  Examples (1-word targets):
  a yes **[ab].**

  c {nods} [ab].
  a {nods} yes [gx]**[at].**
- If an "other" is combined with a content word, code the utterance according to the content word.

  Example (2 word targets):
  a uhoh ball [ab].

NOTES:

- Targets [at] must be the exact length of the target <u>if</u> there is not a preceding child <u>verbal</u> utterance.
- When "with" is used in conjunction with a verb, as in "play *with*," it does not count as a word to make an utterance at or above target level. It must DIRECTLY follow the verb, otherwise it counts as a word. "Of" does not count as a word.

  Example:
  (2-word targets)
  a cut with scissors **[at]**.
  a build it with me **[pt]**.
- When "to" is used in conjunction with a verb as in "*to* go" or "talk *to*," it does not count as a word. However, when "to" is used in conjunction with a location, as in "come *to* the house," it does count as a word.

  Examples:
  (2 word targets)
  a go to sleep **[at]**.
  a go to the store **[pt]**.
- Tenses of "to be" – *is, am, are, were, was* – do not count as words to make an utterance at or above target level UNLESS the utterance is ONLY a noun combined with a tense of "to be." Articles don't count.

  Examples:
  (2-word targets)
  a i am happy [at].
  a car is stuck [at].
  a horses are running [at].
  a the dinosaurs are **[ab]**.
- Helping verbs, such as *don't, can't,* and *couldn't,* are considered target words when they are attached to another verb. If they are the only verb in the utterance, they should be considered non-specific content words.

  Examples:
  (2-word targets)
  a I don't **[ab]**.
  a don't touch [at].
- Active pronouns, such as *he, she, they* and *you,* always count as target words for children at the 2-word and 3-word target levels. Passive pronouns, such as *him, her* and *them,* count as target words ONLY when the child/adult is referring to a human/animal or a human/animal toy. Otherwise, they should be considered linguistic others.

  Examples:
  (2-word targets)
  a {points at a dinosaur} want him [at].
  a {pretends to cook} cook them up **[ht]**. – *them* is acting as a linguistic other, because it is being used to describe whatever food it being cooked

Expansion: The adult expands the child's communication by adding words. An expansion must match the intent of the child. In an expansion, the adult adds words to the child's previous utterance without changing the child's function. The adult must EITHER add a word, replace a non-specific word or linguistic other with a content word, OR correct a grammatical or contextual error made by the child. They cannot both add and replace words.

1. **Expansion =** The adult expands the child's previous utterance. Expansions can only include the child's previous utterance and 1-2 additional words. There are several types of expansions which are coded.

    a. **Word Expansion [LX] =** The adult expands the child's word(s). The adult must repeat every content word in the child's previous utterance to expand. They do not have to repeat linguistic others. If the child's utterance is at target level, the adult can expand by repeating the child's utterance and adding 1-2 words (at least one must be a content word). The expansion must be grammatically correct.

2. **No expansion [NX]:** The adult does not expand a communicative child act that can be expanded. The adult could be attempting to expand the child's previous utterance but changes the child's communicative function, adds too many words, OR does not repeat all of the content words in the child's utterance. If the adult only adds a linguistic other(s) to the child's previous utterance, it is not an expansion [nx]. Adding an article is *not* an expansion.

    Example:
    c {grabs}.
    a do you want this **[nx]**?

    c want ball.
    a here's the ball **[nx]**.

    c drive car [u].
    a drive the car [mt][**nx**].

3. **Impossible to expand [IX]:** It is impossible for the adult to expand the child's previous utterance. Adult utterances that do not follow child utterances (consecutive adult turns) are coded [ix]. Adult utterances that follow completely unintelligible [pcv] child utterances unaccompanied by gestures or child vocalizations should be coded [ix]. Adult utterances that follow gestures [g] should be coded as [ix]. If the child's utterance is partially intelligible, the adult should expand the word(s) that are intelligible. Adult utterances that follow a child action [t] are also considered impossible to expand [ix].

    Milieu prompts are also considered [ix] because the adult cannot both prompt and expand.

    Examples:
    c {vocalizes}.
    a {ball} [ix].

    c xxx [pcv].

a dog [ix].

a say ball [ix].
c xx baby [w][u]..
a oh you're right [nx].

c {pours beans} [t].
a {pours beans} pour [ix].

Expansions in Relation to Target Level

Expansion rules vary depending on what is being expanded (the child's utterance), what the adult expands with (the added words), and what the adult creates by expanding (the adult's utterance). The following section gives examples of how an adult utterance should be coded, based on the relationship between the adult utterance and the preceding child utterance. The section also outlines correct and incorrect expansions as well as the relationship between adult target codes and expansion codes. This is not a list of every possible combination of expansion and target codes.

Please see **Adult Targets** for complete definitions of each target code.

Expanding a Target Level Utterance
If the child's utterance is a target, the adult can add 1-2 words to the child's previous utterance. Linguistic others do not count to make the child's utterance above target level and the adult does not have to repeat them in an expansion. At least one of the added words must be a content word. The adult must not change the function of the child's previous utterance.

If the adult adds 1-2 words (at least one content word), it is an expansion and an expansion target **[lx][xt]**.

Examples:
(1-word targets)
c broke.
a I broke it [lx][xt].

(2-word targets)
c green on.
a green on the slide [lx][xt].

If the adult replaces the child's word with a more specific word, it is an expansion and a specific target **[lx][at]**.

Examples:
(1-word targets)
c bug.
a bee [lx][at].

(2-word targets)
c drive the bus.
a drive the schoolbus [lx][at].

If the adult adds 1-2 words (at least one content word), but the expanded utterance is grammatically incorrect, it is NOT an expansion and is a grammatical error **[nx][ge].**

Examples:
(1-word targets)
c cat.
a two cat [nx][ge].

c cow.
a moo cow [nx][ge].

(2-word targets)
c dirty baby.
a dirty baby wash [nx][ge].

If the adult adds 3 or more words (at least one content word), it is not an expansion and is above target **[nx][ab].**

Examples:
(1-word targets)
c car.
a oh my car drive/3s [nx][ab].

(2-word targets)
c want cookie/s.
a there are cookie/s in the jar over there [nx][ab].

If the adult adds 1-2 words (at least one content word), but changes the child's utterance into question form, it is not an expansion and is a question target **[nx][qt].** This is because the adult is not matching the intent of the child.

Examples:
(1-word targets)
c blanket.
a blue blanket [nx][qt]?

(2-word targets)
c I'm alldone.
a oh you're alldone [nx][qt]?

If the adult repeats the child's utterance in the form of a question, it is not an expansion and is question target **[nx][qt].**

Examples:
(1-word targets)
c sleepy.
a sleepy [nx][qt]?

(2-word targets)
c want the car.
a want the car [nx][qt]?

*if the child's utterance is in the form of a question and the adult expands or repeats in question form, do not use this code.

If the adult only adds a linguistic other to the child's previous utterance, it is not an expansion and is a target with linguistic others **[nx][ht].**

Examples:
(1-word targets)
c key.
a here/'s the key [nx][ht].

(2-word targets)
c drive the car.
a yeah drive the car [nx][ht].

Expanding a Grammatical Error
If the child's utterance is at or above target level* but not grammatically correct, the adult should ONLY correct the child's grammatical or contextual error. They should not add any words. The adult must not change the function of the child's previous utterance.
*If the child's utterance is below target level and is grammatically, contextually, or morphologically incorrect, the adult can BOTH correct the error AND add words to make the utterance a target.

If the adult replaces the child's grammatically or contextually incorrect word(s) to make a correct target, it is an expansion and a target **[lx][at].**

Examples:
(1-word targets)
c mouses.
a mice [lx][at].

(2-word targets)
c me eat.
a I eat [lx][at].

If the adult adds 1-2 words to the child's grammatically or contextually incorrect utterance, it is not an expansion and is a grammatical error **[nx][ge]**.

Examples:
(1-word targets)
c mouses.
a mouses eat [nx][ge].

(2-word targets)
c me eat.
a me eat the food [nx][ge].

If the adult corrects the child's error and adds 1-2 words, it is not an expansion and is a proximal target **[nx][pt]**.

Examples:
(1-word targets)
c mouses.
a mice eat [nx][pt].

(2-word targets)
c me eat.
a I eat the food [nx][pt].

Expanding an Above Target Utterance
If the child's utterance is above target level, the adult can add 1-2 words to the child's previous utterance. At least one of the words must be a content word. The adult must not change the function of the child's previous utterance.

If the adult adds 1-2 words (at least one content word), it is a correct expansion and an expansion target **[lx][xt]**.

Examples:
(1-word targets)
c want bubble/s.
a I want the bubble/s [lx][xt].

(2-word targets)
c big yellow ball.
a I want the big yellow ball[lx][xt].

If the adult adds 1-2 words (at least one content word), but the expanded utterance is grammatically incorrect, it is NOT an expansion and is a grammatical error **[nx][ge].**

Examples:
(1-word targets)
c baby run/3s.
a baby run/3s sleepy [lx][ge].

c he slide/3s.
a down he slide/3s [lx][ge].

Expanding a Below Target Utterance
If the child's utterance is below target, the adult can add 1-2 words and/or make the child's utterance a target. At least one of the added words must be a content word. The adult must not change the function of the child's previous utterance.

If the adult expands the child's utterance to include a specific target, it is an expansion and a target **[lx][at].**

Examples:
(1-word targets)
c uhoh.
a uhoh fall [lx][at].

(2-word targets)
c frog.
a frog in [lx][at].

c there red.
a there/'s the red ball [lx][at].

(3-word targets)
c uhoh.
a uhoh the block/s fell down [lx][at].

If the adult adds 1-2 words, but the expanded utterance is below the child's target level, it is an expansion and below target level **[lx][ab].** This is only applicable to children with 1-word targets when the adult models a modifier or a modifier with linguistic others.

Examples:
(1-word targets)
c {points}.
a {points} pretty [ab].

(2-word targets)
c car.
a this car [lx][ab].

If the adult adds 1-2 words, and one of the added words is a linguistic other, making the adult's utterance include a target and a linguistic other, it is an expansion and is a target with others **[lx][ht]**.

(2-word targets)
c ball.
a wow a big ball [lx][ht].

If the adult adds 1-2 words to a below-target-level child utterance, making the adult's utterance 1-2 words above the child's target level, it is an expansion and is a proximal target **[lx][pt]**.

Examples:
(1-word targets)
c that.
a red car [lx][pt].

(2-word targets)
c catch.
a we catch the ball [lx][pt].

If the adult adds 1-2 words and expands the child's utterance to target level, but the expanded utterance is grammatically incorrect, it is NOT an expansion and is a grammatical error **[nx][ab].**

Examples:
(1-word targets)
c no.
a no pour [nx][ab].

c byebye.
a puzzle byebye [nx][ab].

(2-word targets)
c hop.

a bunny hop [nx][ab].

c car.
a car stuck [nx][ab].

If the adult adds 3 or more words, and the adult's utterance is 1-2 words above target level, it is not an expansion and is a proximal target **[nx][pt]**.

Examples:
(1-word targets)
c {grabs}.
a {gives} you want the car [nx][pt].

(2-word targets)
c mine.
a that/'s my yellow ball [nx][pt].

If the adult adds 3 or more words, and the adult's utterance is 3-4 words above the target level (including others), it is not an expansion and is above target **[nx][ab].**

Examples:
(1-word targets)
c hereyougo.
a hereyougo you gave it to me [nx][ab].

(2-word targets)
c yellow.
a oh i want the yellow playdoh [nx][ab].

If the child's utterance is below target level but includes a content word, and the adult only adds a linguistic other(s), it is not an expansion and is below target level **[nx][ab]**. This does not apply to children with 1-word targets.

Example:
(2-word targets)
c drive.
a oh drive [nx][ab].

If the child's utterance is below target level and does not include any content words, and the adult only adds a linguistic other(s), it is not an expansion and is a linguistic other **[nx][ab]**.

Example:
(1-word targets)
c {points}.
a {points} that [nx][ab].

Expanding Linguistic Others
If the child ONLY says a linguistic other, the adult can either repeat the Other and add 1-2 words OR replace the Other with 1-2 words (one must be a content word). If the adult replaces the Other, they must match the child's intent.

If the child says a linguistic other and the adult adds a target, it is an expansion and a target **[lx][at]**.

Examples:
(1-word targets)
c ohno.
a ohno help [lx][at].

(2-word targets)
c herewego.
a herewego car/s drive [lx][at].

If the child says a linguistic other and the adult replaces it with a target (matching the child's intent), it is an expansion and a target **[lx][at]**.

Examples:
(1-word targets)
c ohno.
a help [lx].

(2-word targets)
c herewego.
a car/s drive [lx][at].

If the child says a linguistic other that represents a sound, such as *moo* or *woof,* and the adult adds a target in a way that the Other functions as a noun or verb, it is an expansion and an expansion target **[lx][xt]**.

Example:
(1-word targets)
c choochoo.
a drive the choochoo [lx][xt].

NOTES:

- If the adult is repeating a linguistic other from the child's previous utterance, it does NOT affect the adult's target code.
  Example:
  (2-word targets)
  c oh red.
  a oh red ball [lx][at].
- The adult can drop their own name from the child's previous utterance when they are expanding it.
  Example:
  c help me suzanne.
  a help me spread the blanket **[lx]**.
- If the adult only substitutes "this" for "that," "you" for "me," "your" for "mine," or "I" for "me" it is NOT considered an expansion.
- Articles, "of," "for," and "with" do not count as additional words for an expansion.
- When "to" is used in conjunction with an infinitive, as in *to go*, it does not count as an extra word in an expansion.
- Unmatched turns [UT] are considered adult turns in which it is impossible to expand [IX] unless they are ONLY unmatched because the adult's utterance is unrelated or non-

contingent and the child's previous utterance could have been expanded, in which case they should be coded [NX].

Example:
c car/s.
a hey I think there/'s a puzzle on the shelf [ut][nx].

- Milieu prompts are considered [IX].

Joint Attention: Adult uses a JA strategy in conjunction with speech.

1. **Joint Attention Used [JA]:** Adult uses a JA strategy in combination with verbal. Points, shows, and gives count as applicable JA strategies. This does not need to be coded for the child.

   Example:
   a {points} car go/3s down [mt][lx][xt][na][ja].
   a {gives} red car [mt][gx][xt][na][ja].

2. **No Joint Attention Used [NJ]:** Adult does not use any joint attention strategy.

   Example:
   a down the slide [mt][lx][xt][na][nj].

Time Delay Strategies

Time Delay: A time delay is a nonverbal way of prompting the child to request an object, action or assistance. A Time Delay occurs when an adult uses an expectant look while holding a toy out of reach, waiting to perform an action the child wants (i.e., not opening a box or not winding a toy while looking expectantly at child), or sabotaging a child's routine (i.e. stopping cars from going down the track, putting hand over ball chute, looking at child expectantly or oriented toward the child and waiting for a child to respond).

- A time delay should be overt
- A time delay must begin with the adult having the child's attention

The following are considered time delay strategies:

a. Assistance: creating a situation in which the child needs the adult's help
   Examples: Bottles, bags, jars, etc. that the child cannot open; toys the child cannot assemble alone; wind-up toys the child cannot operate

b. Inadequate portions: providing a small amount of a desired material
   Examples: Pouring a small amount of water into a tub; putting only a small ball of playdoh on the table; squirting only a tiny amount of paint in the dish
c. Choice Making: the adult holds up two options and waits from the child to communicate (this should be done without any words).
d. Waiting with routine: the adult sets up a routine modeling the target, and then waits to see if the child produces the target.
   Example: The adult and child pour beans together and the adult says "pour" after each time they pour the beans. The 3rd time, the adult holds the beans up and but does not pour the beans and looks at the child expectantly until he communicates/requests.
e. Waiting with cue: the adult sets up the environment so that the objects cue the child.
   Example: The adult holds the shoe up to the baby's foot and looks at the child expectantly until he communicates/requests.

Each TD episode is scored, depending on how the episode is carried out by the adult. This score represents the quality and correctness of the episode.

Time Delay Scoring

Time Delay scores go on a separate line in the transcript. When scoring a time delay, insert a line on the transcript after the last adult utterance involved in the time delay (e.g. labeling the object).
Example:
a {holds up choice}.
c {grabs}.
a {gives} ball.
+[td3]

Time Delay Scoring Guidelines
Outstanding Performance **[td3]**
The adult demonstrates a high quality Time Delay. The adult must: 1. Start the Time Delay naturally so that it does not disrupt play. 2. Wait for a clear request from the child before giving the object/action. 3. Give the requested object/action at the end of the Time Delay. 4. Label the object/action with a language target within one second of giving it. 5. CHOICE ONLY – present two objects that have distinctly different language targets at the child's target level.
Not Great Teaching **[td2]**
The adult demonstrates a Time Delay with one of the following issues: 1. Does not wait for a clear request (accepts {look} only) – EXCEPT CHOICE. 2. Gives the requested object/action before using a language target.
Confusing to the Child **[td1]**
The adult demonstrates a Time Delay with one of the following issues: 1. The adult does not label the requested object/action with a language target OR does not repeat/expand when the child requests using a language target. 2. CHOICE ONLY - Does not wait for a clear child request (accepts {look} only). 3. CHOICE ONLY – does not present two objects that have distinctly different language targets at the child's target level.
Punishing to the Child **[td0]**
The adult demonstrates a Time Delay with one of the following issues: 1. The time delay is NOT natural and interrupts play. 2. The adult does not give the requested object/action to the child at the end of the Time Delay.
Child is Not Interested **[tli]**
The child is not interested in the object/action and the adult abandons the Time Delay appropriately by not giving the child the object/action.

Outstanding Performance [td3]

1. **Start the Time Delay naturally so that it does not disrupt play.** The adult should naturally have control over any involved object(s) before the beginning the time delay, and should not disrput the play interactions to begin the time delay.

2. **Wait for a clear request from the child before giving the object/action.** The adult must wait for the child to request. Requests are child-specific; some children must make a verbal request while other, more subtle requests might just touch the adult's hand. If in doubt on the status of the request, give the adult the benefit of the doubt and assume the child is requesting. If the child does not request, the adult should abandon the episode without giving the object/action.
   The child must request using words (verbal or ASL) and/or a communicative gesture for the adult to receive a **[td3]**.

3. **Give the requested object/action at the end of the Time Delay.** If the child requests the object/action, the adult should give it to them. If the child requests the object/action and the adult gives it to them, score **[td3]**.

4. **Label the object/action with a language target within one second of giving it.** If the child requests the object/action, the adult must end the episode by giving the object/action and labeling it within one second. The words must be based on how the child responds to the time delay. Follow the flowchart below to determine how the adult should respond at the end of the episode.

5. **CHOICE ONLY – Present two objects that have distinctly different language targets at the child's target level.** When presenting a choice between two objects, the adult should do so with two specific and different language targets in mind. If the objects are too similar, it will be confusing for the child to (a) make a choice and (b) associate the objects with words.
   For example, if the child has 1-word language targets, the adult should not present a choice between two cars of different colors, because colors are not 1-word language targets, so if the adult wants to associate the objects with 1-word language targets, they are essentially presenting a choice between "car" or "car." This is confusing for the child.

Not Great Teaching [td2]

1. **Does not wait for a clear request (accepts {look} only) – EXCEPT CHOICE.** If the child does not clearly request the object/action with words or a gesture and the adult gives the object/action, score **[td2].**

2. **Gives the requested object/action before using a language target.** The adult should maintain control of the object until they are ending the Time Delay. If the adult loses control of the object (or objects involved in action) before they end the Time Delay, in such a way that the child gains control and the adult then labels the object, score **[td2]**.

Confusing to the Child [td1]

1. **The adult does not label the requested object/action with a language target.** The adult must end the Time Delay by modeling target language.
   If the child does not use a language target when requesting, and the adult does not model a language target, score **[td1]**.
   If the child requests using a target and the adult does not expand or repeat the target, score **[td1]**.

2. **CHOICE ONLY - Does not wait for a clear child request (accepts {look} only).** If the child does not clearly request with words or a gesture and the adult gives one or both of the objects, score **[td1]**.

3. **CHOICE ONLY – does not present two objects that have distinctly different language targets at the child's target level.** When presenting a choice between two objects, the adult should do so with two specific and different language targets in mind.
   If the adult presents a choice TD with two indistinct objects, score **[td1]**.

Punishing to the Child [td0]

1. **The time delay is NOT natural and interrupts play.** The adult should naturally have control over any involved object(s) before the beginning the time delay, and should not disrput the play interactions to begin the time delay If the adult takes toys away from the child before beginning the time delay, either to use the toys in the time delay or to gain the child's full attention, this is considered unnatural – score **[td0].**
   If, while the child is playing, the adult clears the table of all toys and holds up two choices, this is considered unnatural – score **[td0]**

2. **The adult does not give the requested object/action to the child at the end of the Time Delay.** If the child requests the object/action, the adult should give it to them.
   If the child requests the object/action and the adult does not give it to them, score **[td0].**

Child is Not Interested [tli]

If the child is not interested in the object/action and the adult abandons the TD correctly by <u>not giving</u> the object/action, score as a **[tli]**.

Prompting Strategies (Coding Milieu Episodes)

Milieu episodes (prompting episodes) are a sequence of prompts often in response to the child's request, sometimes elicited by a Time Delay. Milieu episodes BEGIN when the adult does one of the following milieu teaching procedures and INCLUDES at least one of the following: open question, choice question or model prompt:

Open question: Question or statement that requires a verbal or nonverbal communicative response from the child that provides information that the adult does not already have (i.e., there is not a prescribed or "correct" answer). Not all real questions start a milieu episode. To start a milieu episode the real question must:

- Imply that the child make a request
  Example: "Which one should we use?" → open question that triggers a milieu episode
  Example: "What is your favorite color?" → open question that does not trigger a milieu episode
- Contain the words "we", "should", OR "want".
- "What do you say" will be considered an Open Prompt ONLY when it is used in response to a child request.

Open questions provide the least amount of support for the child.

Holding up a truck and an airplane and asking "What do you want" does not give the child any clue as to the name of the objects you are holding. They must understand that they have to say something in exchange for the object they desire. Then they must find the word "truck" or "airplane" in their brains and bring it out as language. So even though holding up a truck and an airplane is functioning as a choice, it is the language of "What do you want" that makes that question an open question.

Choice Prompt: A choice question is an either/or question that requires a verbal or nonverbal communicative response from the child that provides information that the adult does not already have (i.e., there is not a prescribed or "correct" answer).

Choice questions provide a higher level of support for the child. Holding up a truck and an airplane and asking "Do you want the truck or the airplane?" gives the child the words for the objects you are holding. This offers more support than an open question in which the language is not directly modeled for the child. It also makes it a bit more clear that the child needs to make a verbal attempt to say the name of the object they want in exchange for that object.

Model Prompt: A model prompt is a word, phrase, or sentence that the adult states with the intention that the child will imitate. The adult may say, "Say . . ." or emphatically state the word(s) to be imitated so it is clear to the child that the adult is prompting the child to imitate the words/actions. "Can you say…" counts as a model prompt, as does "tell me. . ." except in the case of "tell me what you want," which is considered an Open Question.

Model prompts offer the most support for the child. Holding up the truck and saying "Say 'truck'" lets the child know exactly what the word is for the object you are holding and it lets them know the expectation that you want them to say that exact word in exchange for the truck.

Each milieu episode may have one or several of these techniques. If the adult is trying to get the child to produce the same or a very similar utterance it is considered to be part of the same episode. Prompts that require the same kind of information from the child are grouped into the same episode:

Same Episode
a what do you want?
c roll ball
a say I want the ball to roll down the hill
c i want the ball to roll.

Different Episodes
A say this is a cow
c (no response for 2 seconds)
a say I want ice cream
c NO!
a what is this?

Each Milieu episode is scored depending on how the episode is carried out by the adult. This score represents the quality and correctness of the episode. There are 9 quality indicators of the milieu episode (described more fully below), with each indicator receiving 0 to 2 points (for a maximum score of 10).

There are 3 types of episodes:

1. Milieu episodes that require a child verbal response and is in response to a request [me]

2. Milieu episodes in which the child loses interest [mli]. To be coded as [mli], the child must have requested the object or action at some point during the episode. To be coded as [mli] the adult must also not give the object that was being prompted (since the child lost interest). These episodes do not receive a score.

3. Milieu episodes in which the child never had interest and then the adult intentionally abandons the episode ***after only one prompt*** because they have realized that the child isn't interested [mac]. To be scored as [mac – milieu abandoned correctly], there must be a secondary adult behavior (e.g., shakes head, says "you don't want …", the trainer interrupts the episode and the parent stops prompting). To be coded as [mac] the adult must also not give the object that was being prompted (since the child never had interest). If the child does not request and the adult abandons after giving more than one prompt, score the episode as normal – it cannot be a [mac]. If the child does request and the adult starts prompting about an object in which the child is not interested, the adult can prompt ***only once*** before realizing the child is uninterested and abandoning the episode [mac]. These episodes do not receive a score.

Milieu Episode Scoring

Milieu Episode scores go on a separate line in the transcript. When scoring a milieu episode, insert a line on the transcript after the last adult utterance involved in the episode (e.g. labeling the object/action).
Example:
a say car.
c {grabs}.
a say car.
c car.
a car {gives}.
+[me3]

Milieu Episode Scoring Guidelines
Outstanding Performance **+[me3]**
The adult demonstrates a high-quality Milieu Episode. The adult must: 1. Begin the Milieu Episode naturally and in response to a non-target child request. 2. Prompt a language target at the child's target level. 3. Prompt the same words throughout the episode. 4. Use the correct prompting sequence. 5. Give the child adequate time to respond. 6. Stop prompting when the child loses interest, says the prompted words, or responds to an open question with a target request. 7. Give the child the prompted and requested object/action at the end of the Milieu Episode. 8. Label the object/action with the prompted language target.
Not Great Teaching **+[me2]**
The adult demonstrates a Milieu Episode with one of the following issues: 1. Begins the Milieu Episode at a time when the child is NOT requesting. 2. Prompts below the child's target level or using a non-target word. 3. Does not model target language when ending the episode (giving the object/action).
Confusing to the Child **+[me1]**
The adult demonstrates a Milieu Episode with one of the following issues: 1. Changes the prompted words during the Milieu Episode. 2. Uses the incorrect prompting sequence 3. Gives the object inappropriately or loses control of the object.
Punishing to the Child **+[me0]**
The adult demonstrates a Milieu Episode with one of the following issues: 1. Prompts above the proximal target level. 2. Continues prompting after the child responds with the prompted words. 3. Continues prompting after the child has lost interest in the prompted object/action. 4. Begins the Milieu Episode in response to a child target request. 5. Does not give the object at the end of the episode. 6. Does not give the child adequate time to respond. 7. The Milieu Episode begins in a way that is NOT natural and disrupts play.
Child Loses Interest **+[mli]**
The child loses interest in the object/action and the adult abandons the Milieu Episode appropriately by not giving the child the prompted object/action.
Milieu Abandoned Correctly **+[mac]**
The child was NEVER interested in the Milieu Episode, and the adult realizes it after ONE PROMPT and abandons the episode appropriately by not giving the prompted object/action.

Outstanding Performance [me3]

1. **Begins the Milieu Episode naturally and in response to a <u>non-target</u> child request.** The episode must begin naturally, in such a way that it does not disrupt play. The adult should not do anything to demand the child's attention, such as taking away toys, clearing play space, etc.
   The episode should also begin in response to a <u>non-target</u> child request. If the child is requesting using a target, there is no reason to prompt them. If the child does not want whatever you are prompting, there is also no reason to prompt them.

2. **Prompts a language target at the child's target level.** The adult should prompt a language target at the child's target level to teach the child the language target. Targets are chosen by the therapist for the child and vary between children (see **Adult Target**).

3. **Prompts the same words throughout the episode.** The adult should not change the words they are prompting within an episode because this is confusing to the child. This includes adding or taking away words between prompts. This only applies to Choice Prompts and Model Prompts. The wording of the choices should match the wording of the Model prompt.
   Examples:

(1-word targets)	(2-word targets)
a ball or car?	a want the house or want the fish?
c {grabs car}.	c fish.
a say car.	a say want the fish.

4. **Uses the correct prompting sequence.** The prompting sequence is as follows: Open Question→Choice Prompt → Model Prompt (Say prompt).
   The adult is not required to use all of these options, but they cannot be used out of this order (e.g. model prompt → open question). The adult also may not use more than 2 prompts in each category.
   If the child does not respond to an Open Question and/or Choice Prompt with the prompted target, then the adult **must** give at least one Model Prompt.
   If the child does not respond to the first Model Prompt with the prompted target, the adult **must** give the Model Prompt a second time.
   If the child does not say all of the correct speech sounds (e.g., "ca" for cat), the adult has the option of giving the model procedure again, or phonologically recasting/expanding.

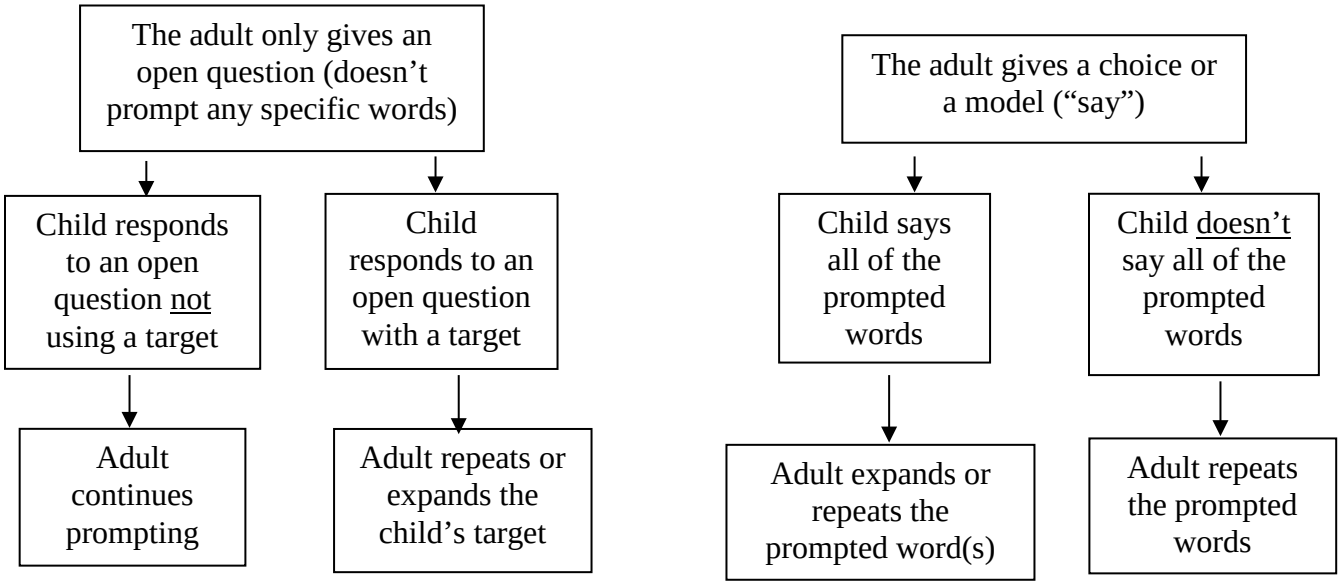
5. **Gives the child adequate time to respond.** The adult must give the child at least **3 seconds** to respond after <u>all prompts</u>. This applies only to prompts – non-prompt questions such as "what color is this" do not count as prompts and it does not matter if the adult waits 3 seconds after these utterances.

6. **Stops prompting when the child loses interest, says the prompted words, or responds to an open question with a target request.** This is a measure of "over-prompting." The child needs to learn to respond to prompts in order to receive a desired object – if the adult continues to prompt beyond the expected number of prompts, this will frustrate the child. The same is true if the child says the words the adult prompts and the adult continues to prompt.
   It is also counterproductive to continue to prompt an object/action that the child no longer desires – the child will have no motivation to respond to the prompts. This is where control of the item is important – if the child is able to take the desired object before the end of the episode, he will have no motivation to respond to the prompts since he already has his reward.

7. **Gives the child the prompted and requested object/action at the end of the Milieu Episode.** The adult must give the child the prompted and requested action or object regardless of whether they completed the prompting sequence correctly.
   They should only give the object if the child shows interest in the object or action.
   If the episode does not begin in response to a request for an object/action, and the adult prompts an object/action, the child must show overt interest in the prompted object/action (reach, point, give) or respond with the prompted word(s) for the adult to correctly give the prompted object/action at the end.

If the adult goes through the entire prompting sequence they should give the prompted object/action unless the child is blatantly uninterested.
The adult should give the prompted & requested object/action within **2 seconds** of ending the episode unless the adult is physically having trouble doing so (ex: the child wants the jar open and it takes the adult more than 2 seconds to open it).

8. **Labels the object/action with the prompted language target**. The adult must end the episode by labeling the prompted and requested object/action with the prompted language target within one second of intentionally giving it. The language used by the adult to end the episode should be based on how the child responds to the episode. Follow the flowchart below to determine how the adult should end the episode. If the adult does something not listed, the episode should not be scored [me3].



Not Great Teaching [me2]

1. **Begins the Milieu Episode at a time when the child is NOT requesting.** If the child is not requesting, and the adult begins a Milieu Episode, it is considered not great teaching [me2]. This is because the point of Milieu Episodes is to use opportunities when the child is requesting with below-target-level language to teach them targets. The child's desire for an object/action motivates them to respond and receiving the object/action at the end of the episode reinforces them for responding or at least acquiescing to prompting.

2. **Prompts below the child's target level or using a non-target word.** If the adult prompts a below target or non-target word (such as a linguistic other) it is considered not great teaching [me2] because it is not helpful to teach the child non-target words. This is different from prompting above-target level words because below and non-target words are not necessarily more difficult for the child to say, they are just not as useful as targets are for the child to learn.

3. **Does not model target language when ending the episode.** If the adult does not model target language at the end of the Milieu Episode it is considered not great teaching [me2] because they are not teaching the child a language target.

Confusing to the Child [me1]

1. **Changes the prompted words during the Milieu Episode.** This only applies to Choice Prompts and Model Prompts. If the adult only asks an open question, this is not applicable. If the adult adds or takes away any words between prompts, score **[me1]**.

Example:
a say doll/s.
c x.
a say want the doll/s.

2. **Uses the incorrect prompting sequence.** The prompting sequence is as follows: Open Question→Choice Prompt → Model Prompt (Say prompt).
   The adult is not required to use all of these options, but they cannot be used out of this order (e.g. model prompt → open question). The adult also may not use more than 2 prompts in each category.
   If the child does not respond to an Open Question and/or Choice Prompt with the prompted target, then the adult must give at least one Model Prompt.
   If the child does not respond to the first Model Prompt with the prompted target, the adult must give the Model Prompt a second time.
   If the child does not say all of the correct speech sounds (e.g., "ca" for cat), the adult has the option of giving the model procedure again, or phonologically recasting/expanding.

   If the adult goes out of the above order, score **[me1].**
   If the adult uses more than 2 prompts in a category, score **[me1].**
   If the adult fails to give 2 Model Prompts when required, score **[me1].**
   If the adult starts the episode with a yes/no question, score **[me1].**
   If the adult uses a yes/no or test prompt, score **[me1].**

   If the adult starts an episode with a yes/no or a test question they do not get credit for following the correct prompting sequence. The same is true if they insert a faux *prompt* yes/no question into the milieu episode; however, do not penalize the adult if they are merely responding to the child within the episode.
   Example:
   a what is this?
   a say elephant. –**[me1]**

   a do you want the puzzle?
   c {nods}.
   a say puzzle. –**[me1]**

3. **Gives the object inappropriately or loses control of the object. .** The adult must give the child the prompted and requested action or object regardless of whether they completed the prompting sequence correctly. They should only give the object if the child shows interest in the object or action. If the episode does not begin in response to a request for an object/action, and the adult prompts an object/action, the child must show overt interest in the prompted object/action (reach, point, give) or respond with the prompted word(s) for the adult to correctly give the prompted object/action at the end. The adult should give the prompted & requested object/action within **2 seconds** of ending the episode unless the adult is physically having trouble doing so (ex: the child wants the jar open and it takes the adult more than 2 seconds to open it). If the adult goes through the entire prompting sequence they should give the prompted object/action unless the child is blatantly uninterested.

   If the adult gives or loses control of the prompted and requested action or object before the episode has ended, score **[me1].**
   If the child lost interest in the action or object and the adult continues to prompt and gives it anyway, score **[me1].**
   If the episode does not begin in response to a request and the adult does not give the child time to respond between the adult prompting and ending the episode, score **[me1].**

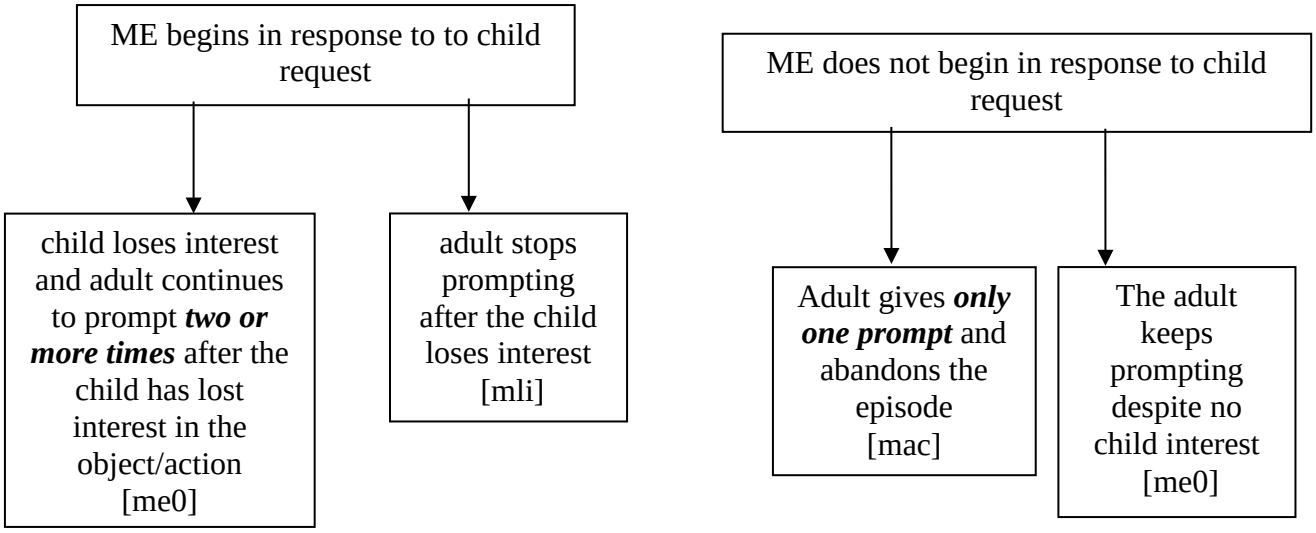
Punishing to the Child [me0]

1. **Prompts above the proximal target level.** If the prompted words are more than 2 words above the child's target level, score **[me0].** The word "say" does not count.
   Example:
   (1-word)
   a say <u>give me the red cup</u>. – **[me0]**

2. **Continues prompting after the child responds with the prompted words. Continues prompting after the child has lost interest in the prompted object/action.** This is a measure of "over-prompting." The child needs to learn to respond to prompts in order to receive a desired object – if the adult continues to prompt beyond the expected number of prompts, this will frustrate the child. The same is true if the child says the words the adult prompts and the adult continues to prompt.
   If the adult continues to prompt after the child says the prompted target, score **[me0].**

3. **Continues prompting after the child has lost interest in the prompted object/action.** It is also counterproductive to continue to prompt an object/action that the child no longer desires – the child will have no motivation to respond to the prompts. This is where control of the item is important – if the child is able to take the desired object before the end of the episode, he will have no motivation to respond to the prompts since he already has his reward.
   If the adult continues to prompt after the child does not remain interested in the object or action being prompted, score **[me0].**
   If the child gains control of the object/action and the adult continues to prompt, score **[me0].**

   Use the following flowchart to decide if it should be scored [me0], [mli], or [mac].



4. **Begins the Milieu Episode in response to a child <u>target</u> request.** If the child is requesting using a target, there is no reason to prompt them. This only applies to language targets at the child's current target level. Language targets are child-specific and each child may have words that do not count as targets at his/her level, as specified by the therapist.
   If the child uses a language target to request and the adult begins a Milieu Episode, score **[me0]**.

5. **Does not give the object at the end of the episode.** If the child requests the object/action at the beginning of the ME or becomes interested in the prompted object/action during the episode, and the adult does not give the object/action, score **[me0]**.

6. **Does not give the child adequate time to respond.** The adult must give the child 3 seconds to respond between prompts. This only applies to ME prompts, not to yes/no questions or any other turns the adult may take during the ME. If the adult does not give the child 3 seconds to respond after a ME prompt, score **[me0]**.

7. **The Milieu Episode begins in a way that is NOT natural and disrupts play.** The initiation of episodes that *overtly* disrupt the interaction or involve hoarding of toys or taking toys away from the child should be scored [me0]. This is a measure of the initiation of the episode; some children do not respond well to prompting and the episode itself will be disruptive because the child does not like being prompted. This is not a measure of the child's response – it is a measure of if the episode flows naturally with the play.
   Examples:
   The adult takes the Mr. Potatohead hat out of the child's hand and holds it up to Mr. Potatohead and waits – disruptive **[me0].**
   While the child is playing, the adult clears the table of all toys and holds up two choices – hoarding **[me0].**

Appendix F: Examples of CDC Caregiver Education Materials

Early Math Skills

18 months

Early Number Skills

- Most children use a few number words without understanding quantity

- Between the ages of one and two some children will begin to understand the concepts "more" and "enough" or "all done"
  - May want more cookies
  - Will also say "no" or "no more" or "all done" when they are satisfied.

Tips for Home

- Practice counting throughout the day
  - Crackers at Snack
  - Socks going in the laundry
  - Pieces in a puzzle
  - Blocks in a tower

- Model for toddlers.
  - "We have two puppies."
  - "That tower has three blocks"

Geometry: Shapes and Space

- Toddlers explore objects by filling and emptying containers (e.g. with sand or water) and begin to understand that different sized containers will hold more or less.
- Many one year olds understand that when an object is hidden from view it still exists, but is just hiding
- Complete simple insert puzzles
- Between the ages of 1 and 2 children figure out how to match the same sized objects with other
  - Circles with Circles
  - Squares with Squares

Tips for Home

- Fill containers together.
  - Put blocks, toys, socks into bins or containers.
  - Discuss how the containers are empty, or fill.
    - “This won’t fit! It is full”.
  - Discuss which containers hold the most or more.
    - That container is small, it will hold fewer blocks.
    - This box is big, it will hold more blocks.

Comparisons and Problem Solving

- Between 18 and 24 months children understand the concepts of "same" and "different"

Tips for Home

- Talk about toys, blocks, clothes, that are similar, sharing how they are the same.
  - These sheep are the same!
  - These circles are red. They are the same shape and color.
  - Here is a square and this is a triangle. These shapes are different.

Patterns and Reasoning

- Toddlers are still be learning there is an order to the day (e.g. We wash hands before Meals and snack)
- Children show a greater understanding of the daily time sequence (e.g. time to eat, nape time, etc).
- Some toddlers may notice patterns in clothing, shape and color sequences

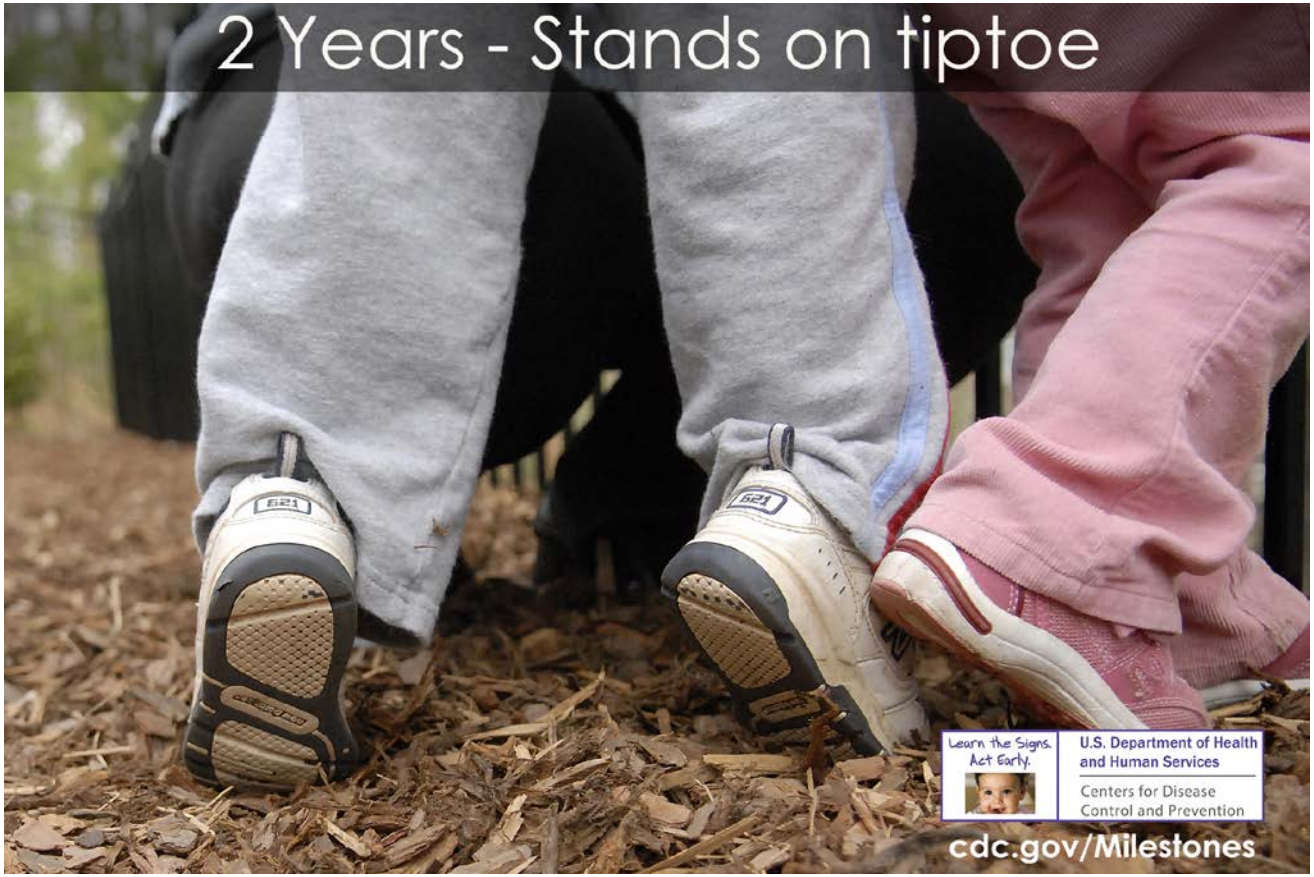
Tips for Home

- Try using First we _____ Then_____.
- In one minute it will be time for _____.
- When your child requests something that occurs later in the day, or later in the routine, let them know what activity it occurs after.
  - We will get in the car to grammy's after we pick up our toys.

Movement and Physical Development

2 Years

Children at 2 years stand on their tiptoes



Children at 2 years kick balls

Children at 2 years begin to run

Children at 2 years climb on furniture without help

Children at 2 years walk up and down stairs holding on

Children at 2 years throw balls overhand

Children at 2 years make or copy straight lines and circles

Ideas to help physical and motor development include:

- Play parade or follow the leader with your child.
- Help your child explore things around him/her by taking him/her on a walk or wagon ride.
- Encourage as much free play as much as possible. It helps your child stay active and strong and helps him develop motor skills.
- Play matching games with your child, like shape sorting and simple puzzles
- Help your child with dressing and feeding himself/herself
- Play imitation or matching games with actions like clapping, high fives, hands in the air, touching toes, stomping feet).

Appendix G: Procedural Fidelity

Parent Training Fidelity	
SETTNG THE STAGE / OBSERVE AND OPPORTUNITIES TO EMBED	
Item	1 = YES 0 = NOT OBSERVED
Therapists gathers updates on **child and family** listens and encourages caregiver reflection	
Therapist asks caregiver to update **intervention implementation** since last visit- listens, encourages caregiver reflection and sets up problem solving as needed.	
Therapist shares information related to general child development and family intersts- connects learning targets to functional outcomes and priorities to increase caregiver knowledge and reasources.	
Therapist clarifies session targets, strategies, and routines jointly--faciliates caregiver participation and decision making in the discussion.	
Therapist reviews the day's plan (e.g., toys, routines, session order)	
Setting the Stage Subscores (Max = 5)	0
TEACH: Direct Instruction of Parent	
Item	1 = YES 0 = NOT OBSERVED
Therapist introduces developmental topic for the day: List below 1)	
Therapist reviews developmental milestones associated with the developmental topic for the day (Indicate times below) 1) 2)	
Therapist models, verbally walks through, or shows a video of 1 example of each strategy (indiciate times below) 1) 2)	
Therapist engages parent in discussion regarding whether his or her child has reached developmental milestones (indiciate times below) 1) 2)	
Teach Subscore (Max = 4)	**0**
MODEL : Demonstrate Developmental Strategies for Parent	
Item	1 = YES 0 = NOT Observed
IN PERSON: Therapist and parent discuss how to practice developmental milestones during typical routines and activities	

DISTANCE: Therapist and parent discuss how to practice developmental milestones during typical routines and activities.	
Model Subscore (Max= 1)	0
COACH PLAY Use Caregiver coaching strategies	
Item	1 = YES 0 = NOT OBSERVED
Parent plays for a minimum of 10 minutes and a maximum of 15 minutes (5 min must be consecutive)	
Therapist does not use any caregiver coaching strategies	
Therapist does not give any specific positive feedback or training feedback.	
Provides general feedback on caregiver and child behaviors and interactions teaches and encourages caregiver to participate	
Play Session Subscore (Max=4)	**0**
COACH ROUTINES: Use Caregiver coaching strategies	
Item	1 = YES 0 = NOT OBSERVED
Routines last for minimum of 5 min	
Therapist does not use any caregiver coaching strategies	
Therapist does not give specific praise or training feedback	
Provides general feedback on caregiver and child behaviors and interactons-teaches and encourages caregiver to participate	
Coach session Subscore (Max=4)	0
REVIEW PLAY and ROUTINES	
Item	1 = YES 0 = NOT OBSERVED
Therapist asks questions to promote caregiver reflrection or review of an activity or routine. comments to promote caregiver	
Therapist does not create a plan for any specific strategy use.	
Therapist engages the parent in reflective discussion by using at least 1 probing question, OR, if the parent initiates reflective talk, therapist gives reflective feedback in response.	
Ending Session Subscore (Max= 3)	**0**
Total Score	**0**
Fidelity Percentage	**0**

Parent Training Fidelity	
SETTNG THE STAGE / OBSERVE AND OPPORTUNITIES TO EMBED	
Item	1 = YES 0 = NOT OBSERVED
Therapists gathers updates on **child and family** listens and encourages caregiver reflection	
Therapist asks caregiver to update **intervention implementation** since last visit- listens, encourages caregiver reflection and sets up problem solving as needed.	
Therapist shares information related to general child development and family intersts- connects learning targets to functional outcomes and priorities to increase caregiver knowledge and reasources.	
Therapist clarifies session targets, strategies, and routines jointly-- faciliates caregiver participation and decision making in the discussion.	
Therapist reviews the day's plan (e.g., toys, routines, session order)	
Setting the Stage Subscores (Max = 5)	0
TEACH: Direct Instruction of Parent	
Item	1 = YES 0 = NOT OBSERVED
Therapist reminds parents of the 1-2 strategies for the day (list below) (1) (2)	
Therapist reviews the rationale behind each of the 1-2 strategies (indiciate times below) (1) (2)	
Therapist models, verbally walks through, or shows a video of 1 example of eachof the 1-2 strategy (indiciate times below) (1) (2)	
Therapist engages the parent in role play, or verbal "what if" scenarios to practice use of the strategies 1) 2)	
Teach Subscore (Max = 4)	**0**
MODEL : Demonstrate Developmental Strategies for Parent	
Item	1 = YES 0 = NOT Observed
IN PERSON: Therapist plays for a minimum of 5 minutes and a maximum of 10 minutes (consecutive)	
DISTANCE: Therapist and parent discuss successful implementation of the strategy from previous session, using video examples, example transcripts, or verbal walk throughs.	

Model Subscore (Max= 1)	0
COACH PLAY Use Caregiver coaching strategies	
Item	1 = YES 0 = NOT OBSERVED
Parent plays for a minimum of 10 minutes and a maximum of 15 minutes	
Therapist uses caregiver coaching strategies to highlight targets of the day at least 2 times each (indiciate times below) (1): (2):	
Therapist gives caregiver specific positive feedback at least one time every minute of the caregiver session:	
Provides general feedback on caregiver and child behaviors and interactions teaches and encourages caregiver to participate	
Play Session Subscore (Max=4)	**0**
COACH ROUTINES: Use Caregiver coaching strategies	
Item	1 = YES 0 = NOT OBSERVED
Routines last for minimum of 5 min	
Therapist uses coaching strategies to offer at least 1 suggestion to improve selected routine:	
Therapist gives caregiver specific praise or training feedback at least once per routine:	
Provides general feedback on caregiver and child behaviors and interactons-teaches and encourages caregiver to participate	
Coach session Subscore (Max=4)	0
REVIEW PLAY and ROUTINES	
Item	1 = YES 0 = NOT OBSERVED
Therapist asks questions to promote caregiver reflrection or review of an activity or routine. comments to promote caregiver reflection and review of a routine or the session--identifies what works for caregiver and child (Indiciate example and times below) Exmaple/Time:	
Therapist summarizes how the caregiver used the target strategies.(Indiciate example and times below). Example/time:	

Therapist engages caregiver to lead development of a "best plan of action for embedding intervention in multiple routines and activities throughotu the day- facilitates caregiver leadership and decision making: Time/Example:	
Therapist engages the parent in reflective discussion by using at least 1 probing question, OR, if the parent initiates reflective talk, therapist gives reflective feedback in response.	
Ending Session Subscore (Max= 4)	**0**
Total Score	**0**
Fidelity Percentage	**0**

Parent Training Fidelity	
SETTNG THE STAGE / OBSERVE AND OPPORTUNITIES TO EMBED	
Item	1 = YES 0 = NOT OBSERVED
Therapists gathers updates on **child and family** listens and encourages caregiver reflection	
Therapist asks caregiver to update **intervention implementation** since last visit- listens, encourages caregiver reflection and sets up problem solving as needed.	
Setting the Stage Subscores (Max = 2)	0
COACH PLAY Use Caregiver coaching strategies	
Item	1 = YES 0 = NOT OBSERVED
Parent plays for a minimum of 10 minutes and a maximum of 15 minutes (5 min must be consecutive)	
Therapist does not use any caregiver coaching strategies	
Therapist does not give any specific positive feedback or training feedback.	
Provides general feedback on caregiver and child behaviors and interactions teaches and encourages caregiver to participate	
Play Session Subscore (Max=4)	**0**
COACH ROUTINES: Use Caregiver coaching strategies	
Item	1 = YES 0 = NOT OBSERVED
Routines last for minimum of 5 min	
Therapist does not use any caregiver coaching strategies	
Therapist does not give specific praise or training feedback	
Provides general feedback on caregiver and child behaviors and interactons-teaches and encourages caregiver to participate	
Coach session Subscore (Max=4)	0
REVIEW PLAY and ROUTINES	
Item	1 = YES 0 = NOT OBSERVED
Therapist asks questions to promote caregiver reflrection or review of an activity or routine. comments to promote caregiver	
Therapist engages the parent in reflective discussion by using at least 1 probing question, OR, if the parent initiates reflective talk, therapist gives reflective feedback in response.	
Ending Session Subscore (Max= 2)	**0**
Total Score	**0**
Fidelity Percentage	**0**

Appendix H: Social Validity

Intervention Goals	Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5
The language and communication goals addressed during sessions make sense for my child.	1	2	3	4	5
The language and communication goals addressed during sessions are important for my child's development and meaningful to me and my family.	1	2	3	4	5
Intervention Procedures					
My coach's suggestions are easy to follow.	1	2	3	4	5
I am able to use program strategies during typical activities and routines.	1	2	3	4	5
The duration of our sessions is acceptable for my family.	1	2	3	4	5
Intervention Effects					
The sessions are effective in helping me learn language support strategies to help my child	1	2	3	4	5
The sessions are effective in improving my child's language and communication skills.	1	2	3	4	5
I would recommend this program to other parents of children with language delays.	1	2	3	4	5