

Distance Video-Teleconferencing in Early Intervention: Pilot Study of a Naturalistic Parent-Implemented Language Intervention

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Abstract

Maternal verbal responsiveness in naturally occurring interactions is known to facilitate language development for children with neurodevelopmental disorders. The present study used a series of A-B replications to examine proximal effects of a naturalistic language intervention on the use of specific language support strategies by mothers of eight young children with an autism spectrum disorder (ASD). Distal effects on child communication also were examined. The intervention consisted of four monthly parent education lessons, each paired with face-to-face clinician coaching of a play-based parent-child interaction. In addition, 12 distance coaching sessions were implemented via desktop video-teleconferencing (VTC). Parents increased their use of verbal responses that followed into their child's focus of attention and responded to child communication acts. Parents also increased the frequency with which they prompted child communication. Increases in parent strategy use were observed during both on-site and distance coaching sessions. Implications for future research are discussed.

Keywords

parent-child interaction, autism spectrum disorder, language/communication intervention, parent education, naturalistic, video-teleconference

Responsive verbal language input from parents has been found to make an important contribution to early language development for children without disabilities (e.g., Tamis-LeMonda & Bornstein, 2002) as well as for children at risk for, or with, developmental delays (e.g., McDuffie & Yoder, 2010; Siller & Sigman, 2002; Warren, Brady, Sterling, Fleming, & Marquis, 2010). Responsive verbal language follows the child's lead, is affectively positive, and is provided contingently as the parent talks about his or her child's focus of attention or responds to his or her child's nonverbal or verbal communicative message (Bornstein, Tamis-LeMonda, & Haynes, 1999; Yoder, Kaiser, Alpert, & Fischer, 1993). Such parental input facilitates early language learning by making the correspondence between words and their referents explicit while minimizing the cognitive and attentional resources that children must devote to such learning. Increases in parent verbal responsiveness have been targeted in intervention programs for young children with autism spectrum disorder (ASD) but with considerable variation in efficacy (Green et al., 2010; Ingersoll & Gergans, 2007; Venker, McDuffie, Ellis Weismer, & Abbeduto, 2012; Yoder & Stone, 2006).

Parent-Implemented Language Interventions

Relative to clinician-implemented intervention approaches, there are several advantages to training parents as interventionists. Parents can embed language teaching into naturally occurring routines and activities, thereby providing numerous opportunities for turn taking and communicative interactions throughout the day (Kashinath, Woods, & Goldstein, 2006). In addition, child learning in naturalistic contexts with naturally occurring reinforcers is more likely to generalize to new situations and to be maintained over time (Kaiser, Hancock, & Hester, 1998). Finally, parent training programs are cost-effective and provide a higher

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intensity of exposure to intervention content than is possible in clinician-implemented treatments (Ingersoll & Gergans, 2007).

Numerous studies have demonstrated that maternal verbal responsiveness can be increased within the context of an intervention that includes a parent education component (Kaiser et al., 1996). The most consistent changes in parent and child outcomes, however, have been observed when parents received coaching as part of program participation (Kaiser, Hancock, & Trent, 2007). Such findings emphasize the importance of providing parents with opportunities to practice targeted skills with their child while receiving guidance, feedback, and support from an interventionist. Unfortunately, the time-intensive nature of coaching and performance feedback may prevent interventionists from optimally using these strategies.

Increasing Intervention Intensity and Generalization Through Desktop Video-Teleconferencing (VTC)

A recent meta-analysis of parent-implemented language interventions for children between 18 and 60 months of age (Roberts & Kaiser, 2011) reported that relatively few intervention activities actually were conducted within family homes, although this represents the setting most frequently identified as the natural environment for families of young children (Hebbler et al., 2007). Seven of the 18 studies included in this meta-analysis did not include any home-based sessions; the remaining 11 studies provided, on average, only 4 hr of home-based training across the entire duration of each intervention program.

The use of desktop VTC offers a potential method to encourage and support parents' use of development-enhancing activities within the home (Wilcox & Woods, 2011). A growing body of research supports the use of VTC to deliver educational assessments and interventions to children with disabilities (e.g., Gibson, Pennington, Stenhoff, & Hopper, 2010; Ludlow & Duff, 2002; Machalicek et al., 2009; Vismara, Young, Stahmer, Griffith, & Rogers, 2009). In addition, the use of VTC is consistent with principles that support enhancing the capacity of parents to engage their children in learning opportunities using toys, materials, routines, and activities in the home (Kashinath et al., 2006). At the present time, there are no published studies reporting the effects of targeting maternal verbal responsiveness through desktop VTC.

Research Questions

The purpose of the present study was to (a) gather preliminary data on the efficacy of a maternal-implemented

naturalistic language intervention, and (b) evaluate the effectiveness of combining face-to-face parent education and coaching with parent coaching provided at a distance using desktop VTC. The following research questions were addressed:

Research Question 1: Does participation in the intervention program lead to increases in parent talking about the child's focus of attention during play?

Research Question 2: Does participation in the intervention program lead to increases in (a) parent use of communication prompts and (b) child prompted communication acts?

Research Question 3: Does participation in the intervention program lead to increases in parent contingent verbal responses to child communication acts?

Research Question 4: Does parent use of targeted strategies during distance coaching sessions equal or exceed strategy use during on-site coaching sessions?

Method

Participants and Setting

Two cohorts of participants were enrolled; each cohort consisted of four children and their mothers. Participating children included four males and four females. Families were recruited from early childhood programs located throughout a Midwestern state and all children met the following criteria: (a) community or research diagnosis of an ASD, (b) between 2 and 6 years of age, (c) fewer than 10 different spoken words used on a daily basis, (d) English was the primary language spoken in the home, and (e) no uncorrected sensory or motor impairments severe enough to preclude processing and responding to verbal language input. A battery of standardized tests and informant report measures were administered by an experienced speech/language clinician to assess each child's communication, language, and cognitive skills. Dyad characteristics and assessment battery results are presented for each participating dyad in Table 1.

Four parent education lessons were provided face to face in a university-based clinic once per month (Weeks 1, 5, 9, and 13). Each lesson was immediately followed by a clinician coaching session. In addition, 12 weekly coaching sessions were provided to each family in their home using desktop VTC, with three weekly distance sessions following each monthly clinic-based session. Pretreatment assessments and baseline data collection were conducted during face-to-face visits in the clinic. During baseline and on-site coaching sessions, data were collected by observers via a

Table 1. Characteristics of Participating Dyads.

	Dyad 1	Dyad 2	Dyad 3	Dyad 4	Dyad 5	Dyad 6	Dyad 7	Dyad 8
Chronological age	4–9	2–5	2–8	4–3	3–8	3–5	2–3	5–9
Words understood ^a	44	208	197	49	287	211	25	164
Words produced ^a	0	33	0	1	113	134	3	54
Comprehension age equivalent ^b	0–10	1–3	1–9	1–1	1–3	1–3	1–3	1–9
Production age equivalent ^b	0–10	1–7	0–11	1–5	1–10	1–8	1–5	1–10
Nonverbal developmental level ^c	2–2	2–3	2–3	1–8	2–3	2–2	2–1	2–9
Maternal age	35	38	38	26	37	34	31	35
Maternal years of education	16+	12	16+	14	14	16	16	12

^aMacArthur-Bates Communicative Development Inventory: Words and Gestures (MCDI-VWG; Fenson et al., 2007). Raw scores from the 396-item vocabulary checklist are reported. ^bPreschool Language Scales, Fourth Edition (PLS-4; Zimmerman, Steiner, & Pond, 2007). Age-equivalent scores are reported for the Auditory Comprehension and Expressive Communication subscales. ^cMullen Scales of Early Learning (MSEL; Mullen, 1995). Age-equivalent scores are reported for the Visual Reception subscale.

one-way observation window. On-site sessions were digitally captured using video-recording equipment. Distance coaching sessions were initiated by the speech/language clinician from a university office located an average of 82 miles (range = 8–191 miles) from participants' homes.

VTC Equipment

Equipment loaned to each family consisted of a 13.3 inches 2.4 GHz/250 GB hard drive/SuperDrive MacBook™ laptop computer and an external Logitech QuickCam Pro 9000™ camera. The camera was connected to the laptop and positioned so that the speech/language clinician could view the area in the home where the session took place. The clinician used the same model of laptop and initiated video calls using the built-in iSight™ web camera and Skype™ software. Distance sessions were captured using eCamm call recording software. Computers were connected to broadband Internet by Ethernet cable or wireless connection. Confidentiality of data transmission was secured through 128-bit advanced encryption.

Design of the Intervention Program

Utilizing a quasiexperimental design, a series of A-B replications were used to assess the preliminary promise of the intervention during on-site and distance coaching sessions. For Research Questions 1 to 3, visual analysis was used to examine changes in each dependent variable. Nonparametric statistics were used to address Research Question 4.

Structure of the Intervention Program

Baseline sessions. Within each cohort of four dyads, baseline lengths were set at 3, 6, 9, and 11 sessions, respectively, and dyads were randomly assigned to the predetermined baseline session lengths. Dyads in Cohort 1 are referred to as 1

to 4, whereas dyads in Cohort 2 are referred to as 5 to 8. Dyads 1 and 5 were the first to enter baseline in their respective cohorts, with an additional pair of dyads entering the study each week for the following 3 weeks. Each baseline session lasted 10 min. Baseline sessions for Dyads 1 and 5 were collected during a single day. Baseline sessions for Dyads 2, 3, 7, and 8 were collected over 2 days, with a week separating each day of data collection. Baseline sessions for Dyads 4 and 6 were collected over 3 days, with a week separating each day of data collection. For each baseline session, the dyad was provided with three developmentally appropriate toys, and the mother was instructed to play with her child as she usually would. A new toy set was provided for each baseline session, and breaks were taken between sessions to complete other testing or as needed by the child.

Parent education lessons. An on-site parent education lesson was presented individually to each parent at the clinic during Study Weeks 1, 5, 9, and 13. These lessons lasted approximately 90 min and were implemented by a licensed speech/language pathologist (the first author) and a graduate-level speech/language clinician (the second or third author), who also served as the coach for that family. Child care was provided during parent education lessons to facilitate parent participation. Materials included written handouts and accompanying PowerPoint™ presentations describing the lesson content. Video-recorded examples were embedded within each PowerPoint™ to provide models of targeted parent strategies. Parent education lessons provided opportunities for discussion, role-playing, and joint problem solving by clinician and parent. Lesson 1 introduced the use of verbal descriptions corresponding to the child's focus of attention (i.e., follow-in commenting), use of preferred activities, and noncontingent reinforcement to increase engagement in play routines. Lesson 2 introduced the use of indirect prompting strategies (i.e., environmental arrangement, time delay, and choice making) and

contingent verbal responding to child communication acts (i.e., interpreting and expanding). Lesson 3 targeted taking an active role in the child's play, managing play materials, and expanding and modeling new play actions. Lesson 4 introduced the use of questions to prompt child communication acts and interactive book reading. In this article, we report on the parent responsive verbal strategies targeted in Lessons 1 and 2.

Face-to-face parent coaching. Each on-site parent education lesson was followed immediately by a face-to-face coaching session implemented by one of the graduate-level speech/language clinicians. Clinicians were trained and supervised by the first author using direct observation, video modeling, role-play, and performance feedback. The following coaching strategies were targeted: conversation/information sharing, observation, direct teaching, demonstration with verbal description, guided practice with feedback, caregiver performance feedback, and joint problem solving/reflection (Friedman, Woods, & Salisbury, 2012). During face-to-face coaching sessions (Study Weeks 1, 5, 9, and 13), the clinician focused on helping the mother to engage her child in play and to recognize opportunities for using the responsive verbal interaction strategies that had been introduced during the prior parent education lesson(s). Prior to each face-to-face coaching session, the clinician and mother jointly developed a plan for that session. During face-to-face coaching, the interventionist observed the mother, demonstrated strategy use with the child, and provided opportunities for joint problem solving and guided practice with feedback. The interventionist provided (a) suggestions for what the mother might do (e.g., "this would be a good time to give him some positive touch"; "try handing him one of the blocks"), (b) praise or acknowledgment for a verbal or physical act by the parent (e.g., "I liked the way you expanded when he said 'ball'"), and (c) verbal models of what the parent might say (e.g., "Do you want cow or bear?"). Each on-site coaching session ended with discussion of when and how the targeted strategies might be used at home.

Distance parent coaching. Following the first on-site parent education and accompanying face-to-face coaching session, each family was loaned distance VTC equipment consisting of a laptop computer and camera. Guidelines for preparation and implementation of the distance sessions were reviewed. Once the family returned home, a practice session was conducted without the child present to resolve any technical or connectivity issues, to select a location in the home for the distance sessions, and to optimize web camera placement.

Twelve distance sessions were provided for each dyad, with one distance coaching session held during each of the 3 weeks following an on-site visit (Study Weeks 2, 3, 4, 6,

7, 8, 10, 11, 12, 14, 15, and 16). Distance sessions were implemented by the same speech/language clinician who provided the family's on-site coaching and used the same procedures as face-to-face coaching. Each participating parent participated in each planned on-site and distance parent coaching session for a total of four on-site visits and 12 distance sessions.

Intervention Targets

Follow-in commenting. This category of responsiveness was defined as parent utterances that followed into the child's focus of attention and verbally described what the child was doing or playing with immediately prior to the parent response (McDuffie & Yoder, 2010). This type of parent utterance did not convey an expectation that the child provides a behavioral or communicative response to the parent.

Indirect communication prompts. Prompts for child communication were considered to be indirect because they did not involve imitation prompts (e.g., "say _____") or questions (e.g., "What do you want?"). Targeted prompting strategies included environmental arrangement (Hancock & Kaiser, 2006), time delay (Warren & Kaiser, 1986), and providing opportunities for choice making within and between activities (McCormick, Jolivet, & Ridgley, 2003).

Prompted child communication acts. Prompted child communication acts included any child nonverbal or verbal acts of intentional communication that followed within 3 s of the use of environmental arrangement, choice making, or time delay by the parent.

Total child communication acts. Total child communication acts included all nonverbal and verbal child acts of intentional communication whether imitative, prompted, or spontaneous.

Parent verbal responses to child communication acts. Parents were taught to respond contingently to their child by *interpreting* nonverbal communication acts and *expanding* verbal communication acts. When *interpreting*, the parent uses a noun, verb, and/or function word to linguistically encode the presumed meaning of the child's nonverbal communication act (Yoder & Warren, 2001). When *expanding*, the parent adds semantic or grammatical information in response to a child imitative, prompted, or spontaneous verbal utterance (Yoder, Spruytenburg, Edwards, & Davies, 1995).

Data Collection and Coding

Data were collected on parent strategy use and child communication acts and coded live by a trained observer during

Table 2. Clinician Fidelity of Implementation: Means (Ranges).

Clinician behavior	Dyad 1	Dyad 2	Dyad 3	Dyad 4	Dyad 5	Dyad 6	Dyad 7	Dyad 8
Engages in conversation and information sharing with parent	4.75 (4–5)	4.75 (4–5)	4.75 (4–5)	4.75 (4–5)	4.75 (4–5)	4.75 (4–5)	4.75 (4–5)	5.00 (5)
Encourages parent to follow child's lead in play	5.00 (5)	5.00 (5)	5.00 (5)	5.00 (5)	5.00 (5)	5.00 (5)	5.00 (5)	4.75 (4–5)
Encourages parent to use simplified language	5.00 (5)	4.75 (4–5)	4.75 (4–5)	4.25 (4–5)	4.75 (4–5)	4.75 (4–5)	5.00 (5)	5.00 (5)
Models language describing child's focus of attention	5.00 (5)	5.00 (5)	5.00 (5)	5.00 (5)	5.00 (5)	5.00 (5)	5.00 (5)	5.00 (5)
Models language in response to child communication acts	5.00 (5)	5.00 (5)	4.75 (4–5)	4.25 (4–5)	4.75 (4–5)	4.00 (4)	4.75 (4–5)	4.5 (4–5)
Provides guidance and ongoing feedback during activities	5.00 (5)	5.00 (5)	5.00 (5)	5.00 (5)	5.00 (5)	5.00 (5)	5.00 (5)	5.00 (5)
Provides descriptive praise for successful strategy use	5.00 (5)	4.75 (4–5)	5.00 (5)	5.00 (5)	4.50 (4–5)	4.75 (4–5)	5.00 (5)	5.00 (5)
Models strategy use with accompanying explanation ^a	4.75 (4–5)	5.00 (5)	4.75 (4–5)	5.00 (5)	5.00 (5)	5.00 (5)	5.00 (5)	5.00 (5)
Actively listens and problem solves with parent	4.50 (4–5)	5.00 (5)	4.50 (4–5)	5.00 (5)	4.50 (4–5)	5.00 (5)	5.00 (5)	5.00 (5)

^aOn-site sessions only.

10-min baseline parent/child play samples and at the approximate midpoint of each face-to-face or distance coaching session. During the sample, the clinician left the room (or, in the case of distance sessions, muted the laptop microphone) and did not interact with or provide feedback to the parent.

Partial interval coding was used to measure parent descriptions of the child's ongoing focus of attention, and data for this variable are reported as the percentage of 10-s intervals during which parents used follow-in commenting. The remaining dependent variables were coded as frequency counts. Indirect prompting was reported as a composite variable representing the summed frequency with which parents used each targeted type of indirect prompt. Prompted child communication acts were reported as a composite variable representing the summed frequency of nonverbal and verbal child communication acts that followed within 3 s of a parent prompt. Total child communication acts were reported as a composite variable representing the summed frequency of child spontaneous and prompted communication acts, both verbal and nonverbal. Parent contingent verbal responses were reported as a composite variable representing the summed frequency with which parents responded by using either *interpreting* or *expanding* within 3 s of a child communication act.

Fidelity of clinician coaching. A trained observer, who was not involved in delivering the intervention, uses a 10-item task analysis to code on-site and distance coaching sessions to evaluate the fidelity with which each clinician implemented coaching and performance feedback procedures. Four randomly selected sessions (one on-site and three distance

sessions) were coded for each dyad. Each step of the task analysis was scored on a 5-point scale, with a score of 5 indicating that the clinician engaged in the described behavior throughout the session and a score of 1 indicating that the clinician failed to engage in the described behavior. A score of 4 and 3 indicated that the clinician engaged in the described most of the time the described behavior was indicated and some of the time the described behavior was indicated, respectively. Item descriptions and mean scores for procedural fidelity of clinician implementation for each dyad are presented in Table 2.

Interobserver agreement. Dependent variables were coded live by the clinician during each experimental session and a second independent observer coded a random selection of 25% of all experimental sessions from digital recordings. The records for both observers were compared on a point-by-point basis. Percentage agreement was calculated for each dependent variable using the following formula: number of agreements divided by the number of agreements plus disagreements. This quotient was then multiplied by 100. Interobserver agreement for each dyad and dependent variable is presented in Table 3.

Results

Intervention Effects on Parent Use of Language-Facilitation Strategies

Parent follow-in commenting. Figures 1 and 2 display the percentage of 10-s intervals during which mothers verbally described their child's focus of attention following the first

Table 3. Interobserver Agreement for Each Dependent Variable: Means (Ranges).

Dyad	Dependent variable	Experimental phase	
		Baseline M% (range)	Intervention M% (range)
1	Parent follow-in comments	88 (83–92)	84 (80–90)
	Parent communication prompts	82 (78–89)	88 (84–92)
	Parent interprets/expands	90 (88–97)	92 (86–96)
	Child prompted communication acts	88 (64–94)	84 (80–90)
	Child total communication acts	87 (83–90)	85 (80–90)
2	Parent follow-in comments	81 (75–87)	85 (82–88)
	Parent communication prompts	92 (88–96)	90 (88–94)
	Parent interprets/expands	94 (92–96)	90 (88–92)
	Child prompted communication acts	88 (82–94)	86 (84–90)
	Child total communication acts	86 (82–94)	84 (80–88)
3	Parent follow-in comments	85 (80–92)	79 (72–83)
	Parent communication prompts	86 (84–90)	84 (78–89)
	Parent interprets/expands	88 (80–90)	88 (84–90)
	Child prompted communication acts	92 (86–94)	89 (85–92)
	Child total communication acts	94 (92–97)	92 (89–94)
4	Parent follow-in comments	86 (82–88)	89 (82–100)
	Parent communication prompts	88 (84–90)	85 (79–88)
	Parent interprets/expands	90 (86–92)	89 (86–92)
	Child prompted communication acts	86 (80–89)	90 (88–95)
	Child total communication acts	81 (75–86)	85 (80–88)
5	Parent follow-in comments	82 (77–87)	83 (75–88)
	Parent communication prompts	88 (80–92)	85 (82–89)
	Parent interprets/expands	90 (86–94)	83 (77–86)
	Child prompted communication acts	86 (82–89)	84 (80–88)
	Child total communication acts	84 (80–88)	87 (84–90)
6	Parent follow-in comments	88 (85–90)	82 (73–92)
	Parent communication prompts	92 (87–94)	87 (81–90)
	Parent interprets/expands	94 (90–95)	90 (87–93)
	Child prompted communication acts	88 (80–90)	86 (80–90)
	Child total communication acts	86 (80–88)	88 (84–92)
7	Parent follow-in comments	85 (82–90)	83 (70–97)
	Parent communication prompts	90 (85–94)	91 (86–93)
	Parent interprets/expands	92 (88–96)	88 (80–92)
	Child prompted communication acts	88 (83–91)	90 (87–94)
	Child total communication acts	86 (83–90)	84 (79–88)
8	Parent follow-in comments	86 (84–92)	84 (82–88)
	Parent communication prompts	88 (84–95)	86 (80–88)
	Parent interprets/expands	84 (80–88)	86 (82–91)
	Child prompted communication acts	92 (89–95)	90 (86–94)
	Child total communication acts	85 (78–89)	88 (84–92)

on-site parent education lesson and associated coaching session for Dyads 1 to 4 and 5 to 8, respectively. During baseline, each mother used follow-in commenting at low but relatively stable levels ($M_{\text{Follow-in commenting}} = 21.57$, range = 2–42). Following the first on-site parent education lesson and coaching session, each mother improved in the use of follow-in commenting, as demonstrated by the change

in level of the data paths ($M_{\text{Follow-in commenting}} = 47.75$, range = 35–55). Parent follow-in commenting remained stable during the 15 remaining intervention sessions ($M_{\text{Follow-in commenting}} = 45.55$, range = 21–55).

Indirect strategies to prompt communication. Indirect prompting strategies were introduced to parents during the second

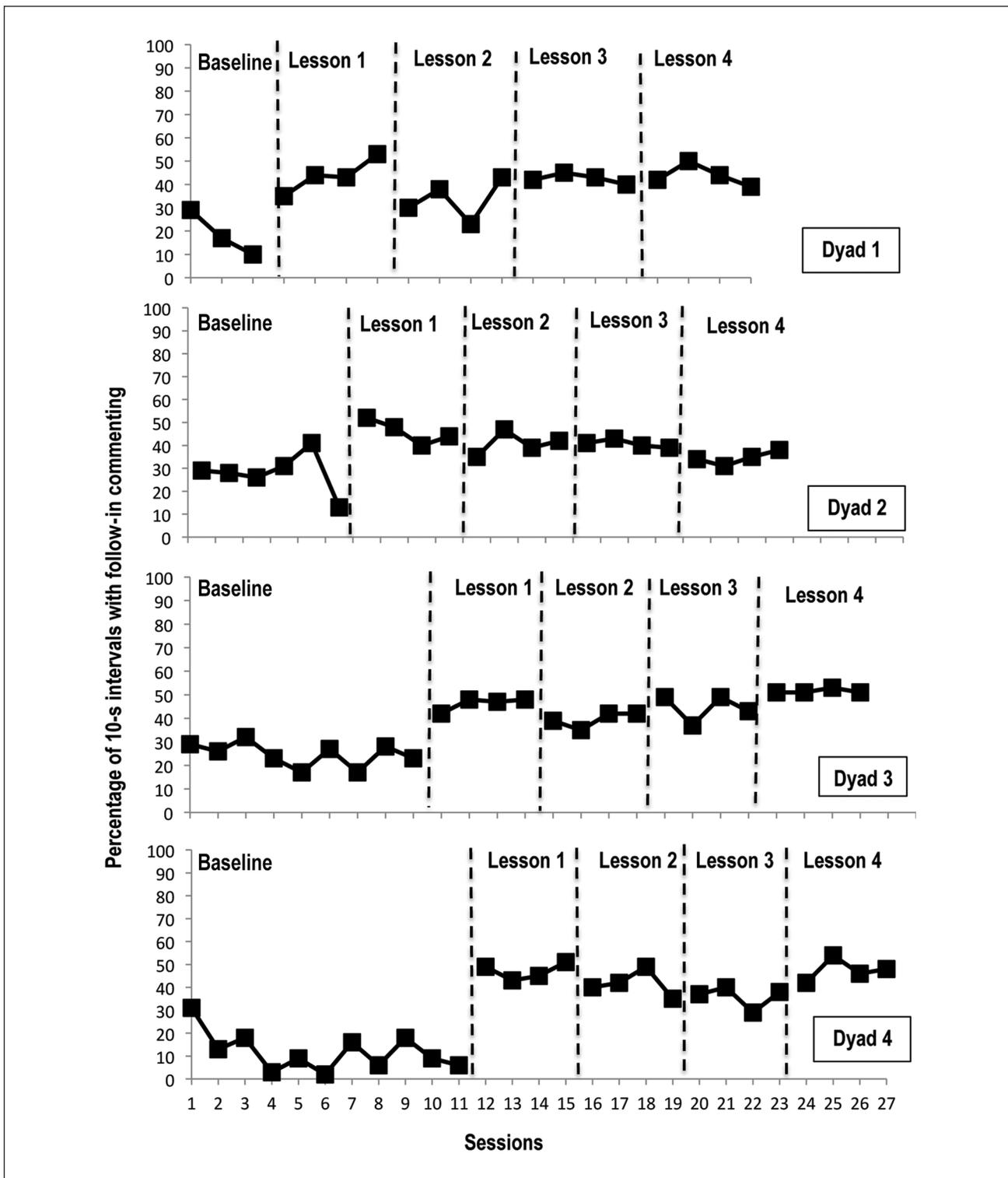


Figure 1. Percentage of 10-s intervals during which mothers used follow-in commenting for Dyads 1, 2, 3, and 4.

parent education lesson and associated on-site coaching session (Week 5). Table 4 displays the frequencies with which (a) parents used indirect communication prompting

strategies and (b) children responded to these prompts by producing a nonverbal or verbal communication act. To facilitate interpretation of the functional relationship

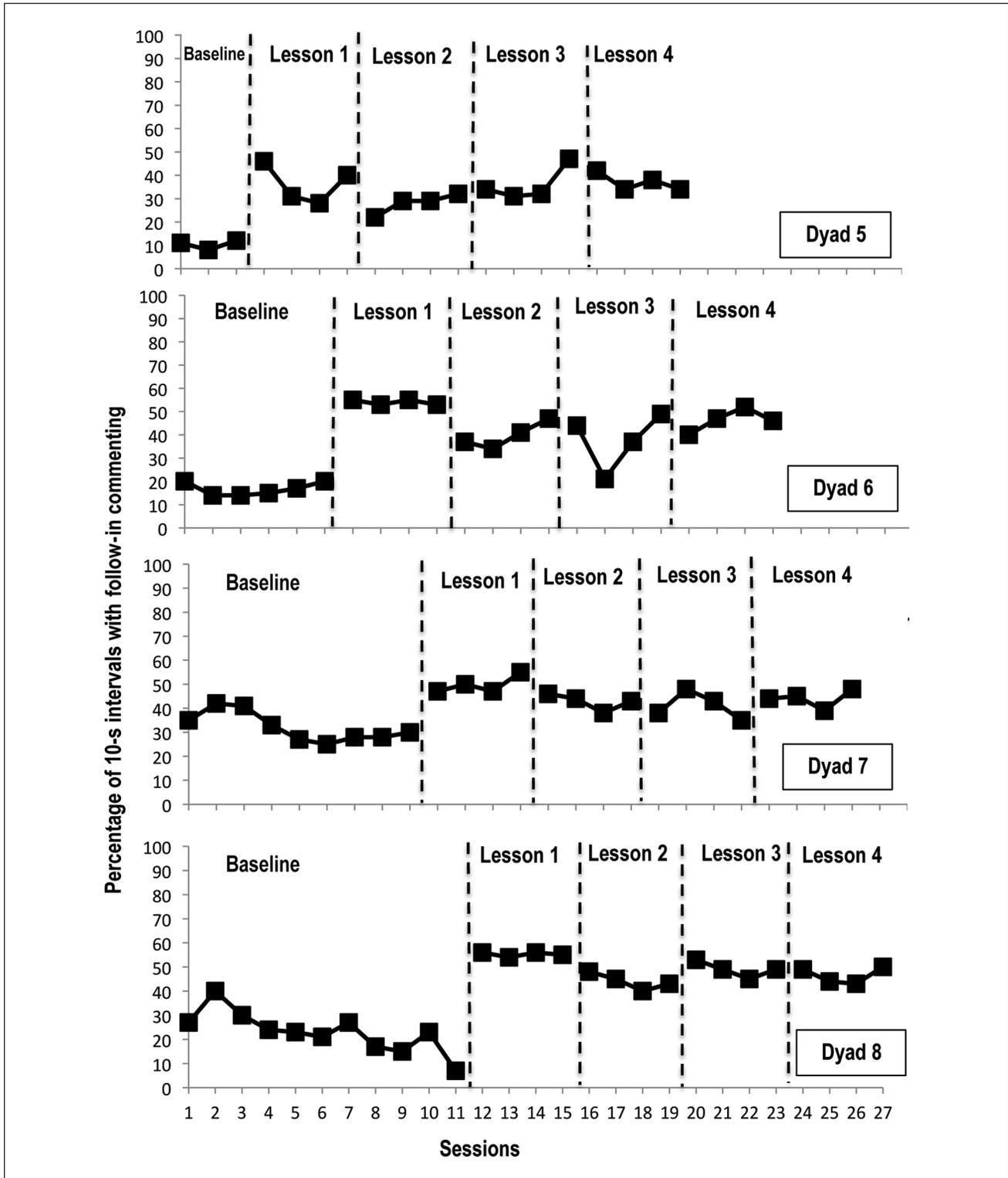


Figure 2. Percentage of 10-s intervals during which mothers used follow-in commenting for Dyads 5, 6, 7, and 8.

between parent and child behaviors for each dyad, the values included in Table 4 represent averages across all baseline and intervention sessions. With the exception of Dyad 1, both parent prompts and child prompted communication

acts remained very low or at zero levels during baseline and throughout the first 4 weeks of the intervention ($M_{Prompts} = 1.33$, range = 0–9; $M_{Child\ prompted\ communication\ acts} = .97$, range = 0–8). With the exception of Dyad 2, parent prompts and

Table 4. Summarized Results: Frequency of Parent Prompts and Child Prompted Communication Acts (Verbal and Nonverbal) for Each Dyad.

Dyad	Dependent variable	
	Parent prompts	Child prompted communication acts
	<i>M</i> frequency (range)	<i>M</i> frequency (range)
1		
Baseline	3.43 (0–22)	3.43 (0–22)
Intervention	11.50 (0–33)	10.00 (0–28)
2		
Baseline	0.00 (0–0)	0.00 (0–0)
Intervention	3.75 (0–15)	3.67 (0–11)
3		
Baseline	1.31 (0–6)	0.85 (0–5)
Intervention	11.17 (5–22)	10.50 (4–16)
4		
Baseline	0.13 (0–1)	0.07 (0–1)
Intervention	13.50 (1–21)	8.33 (1–17)
5		
Baseline	0.57 (0–4)	0.14 (0–1)
Intervention	10.08 (0–19)	7.89 (0–18)
6		
Baseline	2.90 (0–9)	2.50 (0–9)
Intervention	20.17 (9–29)	16.33 (6–28)
7		
Baseline	0.62 (0–3)	0.46 (0–2)
Intervention	8.92 (2–19)	5.92 (1–15)
8		
Baseline	2.40 (0–7)	2.40 (0–6)
Intervention	28.58 (14–44)	21.17 (8–40)

subsequent child prompted communication acts immediately increased over baseline levels following the second parent education/coaching session ($M_{\text{Prompts}} = 16.25$, range = 2–29; $M_{\text{Child prompted communication acts}} = 11.5$, range = 0–27) and decreased slightly over the 11 remaining sessions ($M_{\text{Prompts}} = 13.20$, range = 0–33; $M_{\text{Child prompted communication acts}} = 8.98$, range = 0–28).

Contingent verbal responses to child communication acts. Table 5 displays the frequencies with which (a) children produced nonverbal or verbal communication acts and (b) parents responded contingently by either interpreting or expanding these acts. As was the case in Table 4, the values included in Table 5 represent averages across all baseline and intervention sessions. With the exception of Dyads 1 and 2, contingent verbal responses to child communication acts remained very low or at zero levels during baseline and prior to introduction of these strategies during Study Week 5 ($M_{\text{Parent interpret/expand}} = 3.68$, range = 0–21). On introduction of the second parent education and coaching sessions, all parents showed an immediate increase in using interpreting or expanding to respond to child communication acts ($M_{\text{Parent interpret/expand}} = 21.63$, range = 2–35).

Table 5. Summarized Results: Frequency of Child Total Communication Acts and Parent Contingent Verbal Responses (Interprets/Expands) for Each Dyad.

Dyad	Dependent variable	
	Child communication acts	Parent contingent verbal responses
	<i>M</i> frequency (range)	<i>M</i> frequency (range)
1		
Baseline	5.71 (0–22)	3.43 (0–21)
Intervention	13.67 (0–28)	11.50 (3–28)
2		
Baseline	26.30 (3–48)	9.80 (0–17)
Intervention	48.75 (30–74)	30.58 (19–55)
3		
Baseline	5.08 (1–14)	2.38 (1–6)
Intervention	17.67 (6–42)	15.33 (5–41)
4		
Baseline	3.06 (1–12)	0.53 (0–6)
Intervention	14.92 (5–21)	13.33 (5–20)
5		
Baseline	4.86 (1–8)	0.57 (0–2)
Intervention	23.17 (2–35)	16.00 (1–24)
6		
Baseline	16.60 (5–32)	4.40 (0–12)
Intervention	22.80 (22–55)	10.70 (19–35)
7		
Baseline	7.31 (3–16)	3.46 (0–11)
Intervention	32.17 (11–46)	22.83 (7–35)
8		
Baseline	12.40 (5–30)	4.67 (0–16)
Intervention	54.60 (23–79)	36.00 (16–64)

Efficacy of Desktop VTC to Deliver Parent Coaching

Mean summary scores for face-to-face and distance coaching sessions are displayed graphically in Figure 3. Figure 3 displays the mean percentage of 10-s intervals during which parents used follow-in commenting. Figures 4 and 5 display the mean frequency with which parents used communication prompting strategies and responded contingently (i.e., interpreting and expanding) to child communication acts, respectively. Wilcoxon signed-rank tests were used to examine whether use of these strategies, introduced to parents during on-site sessions, maintained during subsequent distance sessions. Means for the on-site sessions were derived by summing the total for each category of parent strategy use during face-to-face coaching sessions and dividing by 4 (the number of on-site sessions). Means for the distance coaching sessions were derived by summing the totals for each category of parent strategy use during distance VTC sessions and dividing by 12 (the number of distance sessions).

No significant differences between settings were observed for any of the targeted parent strategies. Median scores for parent use of follow-in commenting during on-site

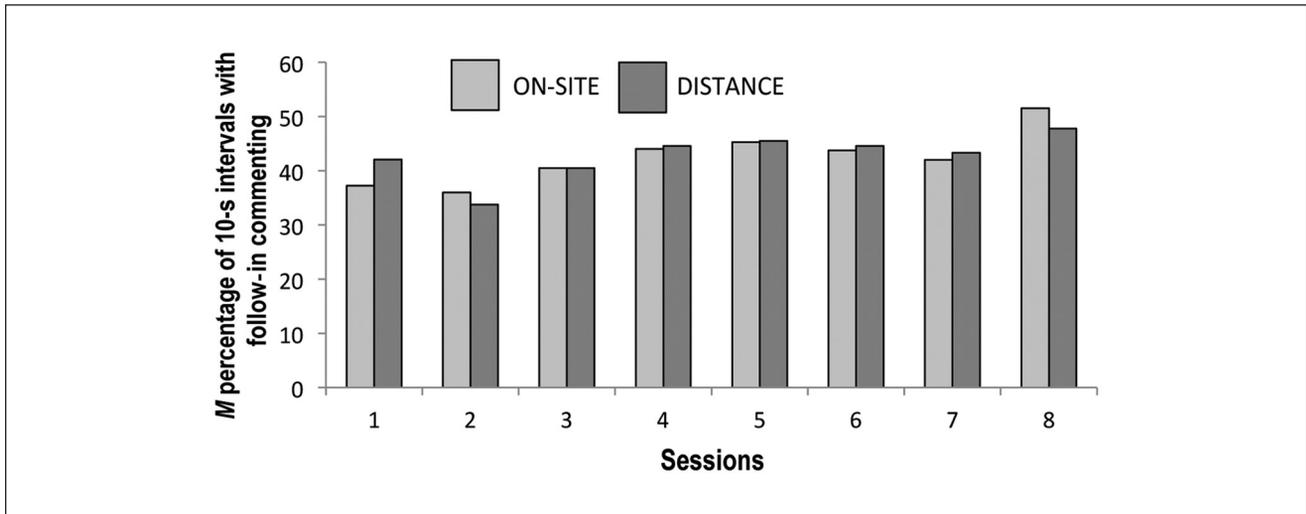


Figure 3. Mean percentage of 10-s intervals during which parents used follow-in commenting.

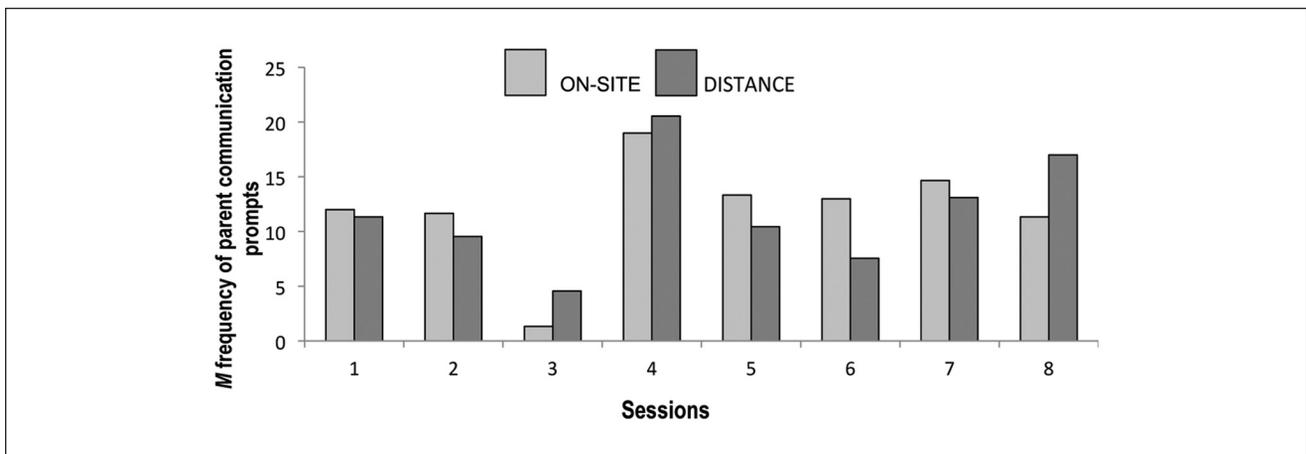


Figure 4. Mean frequency of parent communication prompts.

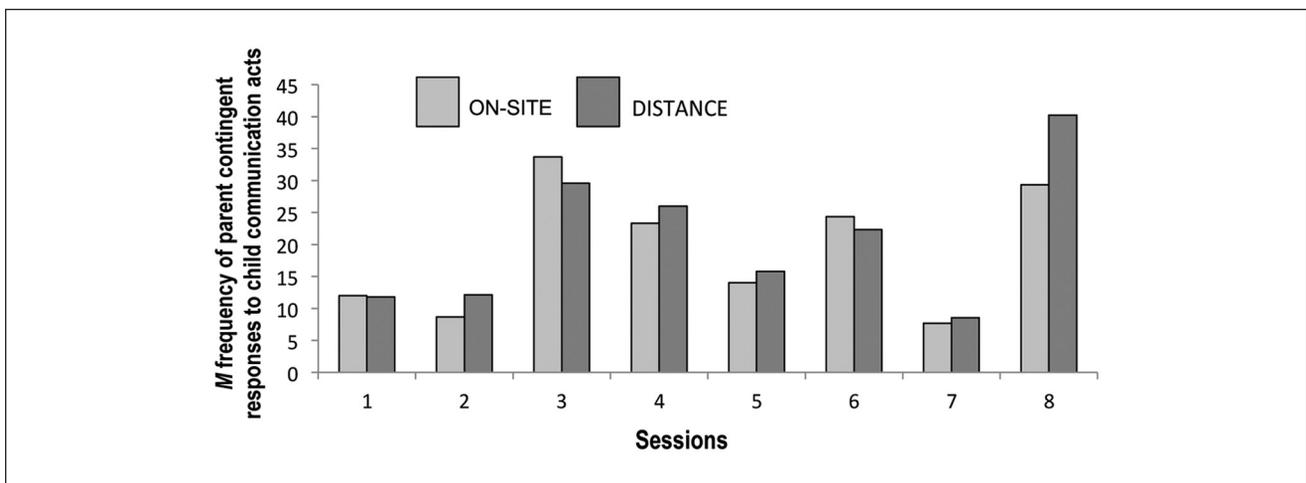


Figure 5. Mean frequency of parent contingent responses to child communication acts (i.e., interpret and expand).

and distance sessions were 42.88 and 43.96, respectively, $Z = -.507$, exact $p = .612$. For parent communication prompts, median scores for on-site and distance sessions were 12.50 and 10.89, respectively, $Z = -.210$, exact $p = .833$. Median scores for parent verbal responses to child communication acts during on-site and distance sessions were 18.67 and 19.56, respectively, $Z = -.840$, exact $p = .401$. These findings suggest that, on average, parent use of strategies introduced during on-site parent education lessons and associated face-to-face coaching sessions were maintained during distance sessions provided via VTC.

Social validity. Following the intervention, parents were mailed a 15-item survey aimed at assessing the acceptability and feasibility of the parent education lessons, and face-to-face and distance coaching sessions. Parents were asked to return their anonymous surveys in a postage paid envelope. A 7-point Likert-type scale provided numerical ratings ranging from 1 = *I strongly disagree* to 7 = *I strongly agree*. All eight parents returned their surveys, and results are summarized in Table 6.

Discussion

The present study was designed to evaluate the preliminary efficacy of a naturalistic language intervention implemented by speech/language clinicians and provided to mothers of minimally verbal young children with ASD. The intervention was designed to teach each mother to use a set of responsive verbal interaction strategies to increase the amount of appropriately scaffolded verbal input that each child received. Parent education and clinician coaching were provided on-site at a university-based clinic, with 12 additional coaching sessions delivered to the family's home by means of desktop VTC. By its very nature, distance implementation lends itself to the provision of family-centered intervention services because the clinician is not physically present during the session and cannot directly interact with the child. Including both face-to-face and distance sessions within the same program allowed an initial evaluation of the relative effectiveness of distance technology for use in early language intervention.

Does Participation in the Intervention Program Lead to Increases in Parent Language That Follows Into and Describes the Child's Focus of Attention?

Optimal levels of verbal language input from responsive parents can, over time, contribute to enhanced child language learning (Warren & Yoder, 1997). All of the strategies targeted in the present study were selected based on their utility for providing salient and easily processed verbal language information to children. The first strategy introduced

Table 6. Results of Parent Social Validity Survey.

	M	Range
Overall program		
The effect of the intervention on child's communication skills	6.25	(5–7)
Recommend to other parents of children with autism	7.00	(7)
Benefit of the program compared with intervention involving child only	6.38	(4–7)
Overall impression of value of this program for child and family	6.75	(6–7)
On-site parent education and coaching		
Content of the information presented during parent education sessions	6.38	(6–7)
Written information presented during parent education sessions	6.00	(5–7)
Strategies for supporting language were new to parent	5.75	(5–7)
Coaching sessions provided opportunities to practice strategies	6.63	(5–7)
Benefit from coaching and modeling of strategies by SLP	6.63	(5–7)
Ease of using parent strategies at home	6.50	(6–7)
Number of face-to-face sessions	4.50	(4–5)
Length of face-to-face sessions	4.25	(4–5)
Distance VTC sessions		
Distance coaching sessions were helpful	6.63	(5–7)
Number of distance coaching sessions	4.88	(4–7)
Benefit of distance sessions relative to face-to-face sessions	6.00	(3–7)

Abbreviations: SLP, speech–language pathologist; VTC, video–teleconferencing.

Note. 1 = *strongly disagree*; 4 = *neither agree nor disagree*; 7 = *strongly agree*.

was parent use of follow-in commenting; that is, providing verbal language input that directly corresponds to the child's ongoing focus of attention without conveying an expectation that the child respond to the parent or modify his or her ongoing actions. As the result of the intervention program, we expected to observe increases in the percentage of intervals during which parents used follow-in commenting while interacting with their child. We found that parents learned to use follow-in commenting to describe their children's play and immediately increased their use of this strategy following the first intervention session.

Does Participation in the Intervention Program Lead to Increases in (a) Parent Communication Prompts and (b) Child Prompted Communication Acts?

Responding contingently to child communication acts is an efficient way for children to receive developmentally advanced language input from responsive parents. Young

children with ASD, however, are likely to be infrequent communicators (Chiang & Carter, 2008; Stone, Ousley, Yoder, Hogan, & Hepburn, 1997), thereby limiting opportunities for parents to use the latter strategy. Thus, parents were introduced to strategies for prompting child nonverbal and verbal communication acts through the use of environmental arrangement and time delay, and by providing opportunities for choice making within and between activities. As the result of the intervention, we expected increases in the frequency with which parents used these indirect strategies to prompt child communication. We also expected a concomitant increase in the frequency with which children produced prompted communication acts. Intervention effects on parent prompting, however, were stronger than effects of parent prompting on child communication acts. The latter finding may be related to the indirect nature of such prompts.

Does Participation in the Intervention Program Lead to Increases in Parent Use of Contingent Verbal Responses to Child Communication Acts (i.e., Interpreting and Expanding)?

The final language-facilitation strategy introduced to parents was that of providing contingent verbal language input in response to child communication acts. Thus, parents were taught to interpret nonverbal communication acts and expand verbal communication acts. As the result of the intervention, we expected increases in the frequency with which parents provided developmentally advanced language in response to child communication acts. Not surprisingly, parent use of interpreting and expanding generally corresponded to the frequency with which children produced communication acts. For some dyads, however, parents were more proficient in the use of prompting than in interpreting and expanding the resultant child communication acts. These parents might have benefited from additional practice in recognizing and responding to their child's communication, especially with regard to responding to nonverbal communication acts that may be quite subtle and more difficult for parents to recognize.

Does Parent Use of Targeted Strategies During Distance Coaching Sessions Equal or Exceed Strategy Use During On-Site Coaching Sessions?

Parent strategy use was expected to increase from baseline levels and maintain over the course of the intervention during face-to-face and distance coaching sessions. Failure to observe a significant location effect in parent use of targeted strategies would lend support to the premise that parent coaching sessions can be implemented effectively by

means of desktop VTC. Results indicated that, on average, parents used each targeted strategy just as frequently during distance sessions as they did during face-to-face coaching sessions conducted at the university clinic. This finding provides preliminary support for the continued use of distance technology in the provision of early language interventions. As mentioned previously, one potential benefit of VTC is that interventions delivered in this manner are directed exclusively to the parent, as the interventionist is not able to interact directly with the child. In addition, this delivery format ensures that materials used during intervention sessions are those found in the home environment and not items brought into the home by the interventionist. Finally, use of VTC allows the delivery of intervention services in a cost-effective manner that limits the burden of travel on both parents and interventionists.

Limitations of the Present Study

The present study had several limitations. As a pilot study, the intervention included only 16 sessions provided over 4 months. Although mothers clearly did learn to use new skills, the brief time frame of the intervention certainly limited the number of intervention targets introduced, the ability of the mothers to practice and consolidate newly learned skills, and the likelihood of observing more distal effects on child language outcomes. However, it should be noted that most mothers judged the length of the intervention to be adequate or even a little too long. An additional limitation is that no measures of generalized strategy use were obtained as part of the present study. Although the topic of using targeted strategies in contexts other than play was discussed frequently with mothers, we did not directly coach or sample the use of targeted strategies in daily routines. A further limitation of the present study was the predetermined length of time that elapsed between each parent education session. It is likely that different mothers needed different lengths of time to become proficient in using targeted strategies. Finally, the present study did not include a postintervention follow-up, which would have allowed us to assess parent maintenance of targeted strategy use and to assess the distal effects of the intervention on child communication and language outcomes.

Future Directions

Anecdotally, several child characteristics substantially influenced maternal ability to implement the targeted intervention strategies successfully. Chief among these child factors were challenging behaviors (e.g., tantrums, throwing, hitting, and self-injury) that negatively affected the amount of time that children were actively engaged during coaching sessions. Opportunities for mothers to use targeted strategies also were limited by child inattention and limited interest in toys. Future extensions of this intervention

should focus on decreasing challenging behaviors and maximizing child engagement. We recommend collaboration between the speech/language clinician and a board certified behavior analyst (BCBA) or other behavioral support specialist to ensure that child engagement is maximized, thus facilitating the ability of parents to use targeted intervention strategies more efficiently.

It is important that future research efforts be directed toward establishing and evaluating methods for providing distance coaching during family routines other than play. When an early interventionist visits a family in their home, he or she can take advantage of naturally occurring routines and activities and can follow along as the parent and child move throughout the home. Clearly, requiring the parent to move a laptop and camera during transitions between activities presents some logistical issues that will need to be addressed. However, the importance of providing children with responsive verbal language input during daily routines cannot be overstated and deserves continued attention as early intervention programs develop and refine procedures for the use of VTC.

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