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Parent Coaching in a Multimodal Communication Intervention for Children with Autism

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Abstract

Social-communication deficits associated with autism spectrum disorder often lead to undesirable outcomes in other domains, such as interpersonal relationships, employment, and participation in community activities. Parents may be ideal implementers of interventions to address these deficits when provided with instruction that is efficacious and feasible. This study evaluated a web-based group training and multimodal communication protocol of individualized parent coaching to improve parent implementation of communication intervention components. Results indicated a moderate functional relation between the parent-coaching intervention and parent implementation of the instructional behaviors. Implications and suggestions for future research are discussed.

Keywords

autism spectrum disorder, multimodal communication intervention, parent coaching, behavioral strategies, augmentative and alternative communication

Approximately 1 in 45 children are diagnosed with autism spectrum disorder (ASD: Zablotsky et al., 2015). Parents of children with ASD spend more time supporting activities of daily living and navigating educational decisions compared with parents of children with other disabilities and typically developing children (DeGrace, 2004; McCann et al., 2012; Smith et al., 2010). As a result, parents of children with ASD experience higher levels of stress than other parents (Hayes & Watson, 2013). Specific stressors include limited resources (Smith et al., 2010), decreased sense of competence (Iadarola et al., 2018), high demands imposed by symptomatology associated with ASD (Rivard et al., 2014), and the need to advocate for effective treatment and intervention (Shepherd et al., 2017). Fortunately, parents can learn strategies to support their children and quickly generalize skills across activities and settings using everyday materials (Brown & Woods, 2015; Powers et al., 1992).

Children with ASD make faster progress in social communication and receptive language skills when their parents receive in-home training (Wetherby et al., 2014). Parents who are taught to work with their children report an increased sense of competence and lower levels of stress, which can increase the likelihood that they will implement strategies they are taught in new environments with high levels of fidelity (Iadarola et al., 2018; Wainer & Ingersoll, 2013). Parents of children with ASD can be effectively coached to support the development of their children's social communication skills (Bellomo, 2016; Hall et al., 2016; Hong et al., 2016a, 2016b; Ingersoll et al., 2016; Nunes & Hanline, 2007; Wright & Kaiser, 2017). Previous studies typically focus on strategies for decreasing problem behavior (Lindgren et al., 2016; Suess et al., 2014) or increasing functional living skills (Powers et al., 1992) with few studies addressing in-home training to improve functional communication (Elder et al., 2011; Park et al., 2011).

Educators can be a particularly helpful resource for parents of children with ASD. Their familiarity with students and knowledge of efficacious interventions can enable them to support parents in individualizing and implementing interventions that fit the family's daily routine (Josilowski & Morris, 2019; Koegel et al., 2020). Identifying strategies

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that may be easily implemented by parents, equip educators to instruct parents on naturalistic strategies that blend well within the family's routines (Gena et al., 2016; Lane et al., 2016). For example, discrete trial training, incidental teaching, milieu teaching, and other strategies increase different types of language and communication skills (e.g., request, initiation, response, longer sentences, and greater diversity of vocabulary) for individuals with ASD (Coleman & Xu, 2018; Gillett & LeBlanc, 2007; Lane et al., 2016). Many of these programs incorporate the strategies of modeling and expanding language, environmental arrangement, and prompting (Coleman & Xu, 2018; Gillett & LeBlanc, 2007; (Kaiser & Roberts, 2013; Lane et al., 2016). Lane and colleagues (2016) implemented an effective coaching model to increase naturalistic strategies used during play, including environmental arrangement and modeling. Another study trained parents, using rehearsal and feedback, to implement the natural language paradigm to increase their children's language skills (Gillett & LeBlanc, 2007). Kaiser and Roberts (2013) used coaching and feedback to teach parents enhanced milieu teaching, which incorporated modeling and prompting, to increase language in preschool children with disabilities. Finally, Coleman and Xu (2018) adapted training procedures that used roleplaying and feedback to teach a mother how to model and prompt her child's communication skills.

Well-qualified professionals are a critical support for achieving the benefits of parent coaching. For example, many parent-led interventions lack measures of implementation fidelity (Hong et al., 2016b; Roberts & Kaiser, 2011). Educators may be best positioned to address this issue, if provided with a succinct and feasible training protocol, including providing parents with performance feedback to improve their implementation (Ingersoll et al., 2019). To date, no studies examine the use of a training protocol to teach a standard method or skill to parents rather than a treatment package (Hong et al., 2016b; Schertz et al., 2018). Law and colleagues (2018) suggested identifying components that were necessary in increasing communication skills. In addition, other researchers suggest expanding research to racially and culturally diverse populations (Schertz et al., 2018).

This study evaluated the effects of a brief web-based group training with individual in-home parent coaching on a multimodal communication (MMC) intervention protocol implemented by parents. The research question explores whether there is a functional relation between parent coaching in the MMC intervention protocol and parents' frequency of implementation of intervention elements to teach children with ASD to communicate. Generalization and maintenance of skills learned by parents and social validity as reported by the parents and coaches were also examined.

Method

Participants

All study participants were recruited from families participating in a larger state-funded service project that provided multicontext coaching of multimodal, naturalistic communication interventions for parents of children with ASD and prioritized serving families that are from diverse backgrounds or reside in rural areas. Once parents completed the application form and the consent forms, the first and second authors screened potential participants for inclusion. Participation required the parent to identify his or her child as (a) having ASD, (b) under age 22, and (c) having moderate or moderate to mild communication deficits (e.g., can speak, but has limited social interaction; require substantial support in speech and/or communication). During the recruitment period of the current study, 11 potential parent participants completed the application form. Five of the child participants from these families did not meet the inclusion criteria, and three of the potential participants lost contact before the parent interview or the parent training webinar. Therefore, 3 triad/dyads were included in the current study. Parents were asked to participate in weekly parent-coaching sessions. ASD symptoms and communication skill levels were confirmed via the Autism Spectrum Rating Scale (Goldstein & Naglieri, 2009) and Social Communication Questionnaire (Rutter et al., 2003). The three participants had diverse social communication profiles; however, the intervention was designed to teach parents to employ evidence-based strategies that addressed their own child's unique needs, thus, the variance in intervention targets was not a problem.

Triad A. Tang, a 15-year-old male at the time of the study, spoke fluently and clearly, with stronger expressive than receptive language skills. However, he tended to perseverate on topics of his interest (e.g., sports) rather than comment and ask questions for others' opinions. Tang's parents, Pei and Ju, participated in this study. Ju was a 54-year-old Caucasian male with a bachelor's degree. Pei was a 50-year-old Asian female with a master's degree. Both were Tang's main caregivers and did not have previous training in behavior therapy or experience in working with individuals with ASD or other disabilities.

Dyad B. Zong, a 5-year-old male at the time of the study, used gesture point, words, and short phrases to communicate his needs, but only when prompted. Zong's mother, Jing, a 31-year-old Hispanic female, participated in this study. Her educational background was some college coursework. She was Zong's main caregiver and had experience in working with individuals with ASD or other disabilities in school settings.

Dyad C. Jie, a 6-year-old male at the time of the study, communicated and requested using gesture point and single words. At the beginning of the current study, he just started learning to use augmentative and alternative communication (AAC). Jie's mother, Tzu, participated in this study. She was a 36-year-old African American female with a master's degree in special education. She was Jie's main caregiver and had experience in working with individuals with disabilities.

Settings

All participating parents completed the intervention package via a synchronous group webinar and engaged in individual coaching sessions in their homes. Home settings were naturalistic and unchanged by the interventionist. Parents identified locations and activities within the home that would be conducive to communication. Triad A used the dining and living rooms, Dyad B used the living room, and Dyad C, the living room and playroom. For generalization sessions, Triad A did not change settings, Dyad B's setting was Zong's bedroom, and Dyad C's setting was outside the house.

Coach

The coach (first author) was a second-year doctoral student in special education, and held master's degrees in early childhood education and special education. She had approximately 6 years of experience working with individuals with ASD, received training in intervention components, and was supervised by a board certified behavior analyst-doctoral level (second author). The coach had no prior relationship with study participants.

Parent Training Webinar and Coaching Content

The intervention package included a 2-hr synchronous group webinar with follow-up individual coaching sessions. All parent participants completed an online webinar, conducted by two researchers and supervised by a third. The parents all used their home computers and web-cameras. The webinar content focused on foundational communication strategies that each parent would implement, which was reinforced during individual coaching sessions. A PowerPoint handout was provided to parents, which defined and provided evidence for the use of intervention components, as well as how-to procedures, and examples. Verbal instruction, skill modeling, scenario analysis, and practice activities were conducted via webinar.

Individual coaching was conducted face-to-face in the participants' homes following the webinar. Coaching sessions were designed to last between 5 and 30 min, depending on the family's needs. The structured open-ended MMC instructional protocol for coaching included reviewing the prior session, introducing a new focus, and reviewing performance. The coach provided instructions for each target behavior, explanation of the graphed results of all target behaviors, immediate verbal feedback, and written weekly performance feedback. This structure taught parents to accurately implement the intervention components (i.e., communication incentives, modeling, prompting, and expanding) using an MMC system (i.e., multiple methods of communication such as speech and AAC). The coaching protocol is available in Appendix 1 (Liao et al., 2019).

Design

This study used a multiple probe design with a baseline, intervention, and maintenance phase for communication intervention strategy in each strand of the design. Baseline began randomly with Triad A and lasted until target behavior data demonstrated low rates of communication and confirmed a need for behavior change and intervention. Introduction of intervention for the second and third leg of the design began after a demonstration of stability or effect in the prior leg. Stability ranged from 0% to 30% for the last three data points.

Dependent Measure and Data Probes

The dependent measure in this study was parent behaviors, defined as the percentage of intervals during which the intervention component was accurately implemented. For each 3-min session, using the probe data sheet, coders recorded target behavior if it was displayed at any point during the previous 10-s interval (i.e., partial-interval recording). Four intervention components coded were (a) communication incentives (i.e., preparing the natural environment to teach communication, incorporating motivation, and using communicative temptations and/or routine interruptions), (b) modeling (i.e., verbally or physically modeling communication), (c) prompting (i.e., using a verbal, gestural, or physical prompt to redirect or prompt the child to use the appropriate communication skills), and (d) expanding (i.e., verbally or physically modeling new vocabulary, longer sentences or phrases, or conversational turns).

Parent coaching targeted behavioral skills the parent used infrequently or not at all, identified via parent interviews and confirmed by low rates of baseline data. Parent participants naturally and frequently used at least one of the intervention components (e.g., model in Triad A); thus, baseline indicated no intervention was needed for those components. Parent behaviors targeted for Triad A were to prompt and expand, for Dyad B to incentivize communication, model, and prompt, and for Dyad C to model and prompt (see Table 1 for more details). Data were collected

Table 1. Operational Behavioral Definitions.

Parent behaviors	Operational definitions	Examples
Communication Incentives (Dyad B)	• Preparing the natural environment with materials, people, activities, and routines that provide opportunities or new items to teach communication • Incorporating motivation by using rewards, social praise; interspersing mastered skills, or affirming what child said "yes" • Communicative temptations and/or routine interruptions	• Parent places the child's preferred items (e.g., toys, iPad), provides the child's preferred activities (e.g., watching sports video), or provides new materials in the child's line of sight but out of the child's reach • When the child requests, parent praises or reinforces the child and provides the item the child requests (e.g., agreeing with what the child said: "Yes, that's right!" "They are!" or "I see!"; praising for letting the other person speak: "Thanks for letting me talk.")
Modeling (Dyads B and C)	• Modeling communication verbally without telling the child, "say ___." • Modeling communicative behaviors physically	• Parent models how to request by saying "I want Mickey Mouse." • Parent taps the AAC device or demonstrate a gesture to request "I want Mickey Mouse."
Prompting (Triad A, Dyad B and C)	• Using a verbal, gestural, or physical prompt to redirect or prompt the child to use the appropriate communication skill	• Parent directly tells the child "You say, I want Mickey Mouse," or "You say, I like sports because it's exciting." • Parent holds the child's hand to tap the icons "I want" and "Mickey Mouse" on the AAC device to request
Expanding (Triad A)	• Modeling new vocabulary, longer sentences or phrases, or conversational turns verbally or physically • When the child uses voice or at least one word to request, the parent models longer sentences	• Based on the child's answer or comments (e.g., "Yes! I like it"), the parent asks for longer sentences or completed answers (e.g., "Why do you like it?" or "Tell me more!")

Note. AAC = augmentative and alternative communication.

from 3-min videos using 10-s partial-interval recording. To score parents' fidelity with intervention components, the coach and a second observer watched videos and recorded any target behavior that was accurately implemented at any point during each 10-s interval.

Procedures

Parent interview. The coach interviewed the parents using a semistructured interview form developed by the authors to gather information about the child's current level of communication, current mode(s) of communication, contexts in which communication breakdowns occur, and communication goals for the child. Information obtained in the interview assisted the coach in developing the intervention plan for each family.

Baseline phase. During each baseline data probe, the coach assisted the parents in setting up a situation that would be conducive for the children to communicate and for the parents to provide instruction. The coach instructed parents to interact with their child as they normally would for the 3-min data collection probe. The coach did not teach or provide any instructions or feedback regarding performance to parents (baseline coaching procedures in Appendix 2 of Liao et al., 2019).

Coaching intervention phase. Each parent participant was coached to accurately implement intervention components, including communication incentives, modeling, prompting, and expanding. The coach focused on expansion only after parents improved in the first three components of the intervention. Coaching sessions used an open-ended protocol available from the second author. Each coaching session started with a review of written feedback from the previous meeting, including behavior specific praise statements for correct implementation of intervention components and suggestions for improvement (Kaiser & Hancock, 2003). The coach next gave verbal instructions and remodeled the highlighted skill. For example, regarding communication incentives, the parent was asked to prepare the natural environment for communication, to follow the child's lead (e.g., talking

about what the child would like to talk about or playing with toys that the child wants to play with), and to refrain from giving demands. After modeling, parents participated in a roleplay and received performance feedback. Feedback sessions were terminated at the conclusion of the roleplay when the coach observed accurate fidelity to the strategy.

Then, parents implemented the learned skills with their child, and the coach recorded a 3-minute video data probe. The coach turned on the camera when the parents showed that they were ready and started talking to their children. Only the first 3-min video segments were collected and analyzed. The intervention included immediate performance feedback by the coach as well as week-delayed feedback. Behavior-specific praise was given, followed by a highlight of corrective feedback. Modeling and roleplay followed.

Maintenance phase. The coach showed and explained a graph with data for all of the target behaviors to each parent participant, but no instruction or roleplay for intervention components were provided before video recording. Parents implemented the learned skills with their child, and the coach recorded a 3-min video. Feedback was given after each session, as conducted during the intervention phase. For each family, collection of two maintenance data points occurred after 3 weeks and 6 weeks following the conclusion of the intervention.

Generalization. Generalization data were collected during activities or settings, selected by the parents and coach that were different than those targeted for intervention. Generalization data were collected across the baseline, intervention, and maintenance phases. No explicit instruction was provided related to generalization sessions and no feedback was provided to the participants.

Social Validity

An anonymous parent survey was adapted from the Treatment Evaluation Inventory Short Form (TEI-SF; Kelley et al., 1989) and Parent Satisfaction Survey (Washburn, 2012) to gauge parents' perception of the feasibility and acceptability of the protocol and overall satisfaction with the parent coaching (see Appendix 3 for parent survey; Liao et al., 2019). The 14-question survey used a 5-point Likert-type scale and included (a) 10 questions rated from 1 (*strongly disagree*) to 5 (*strongly agree*), (b) 1 dichotomous item, and (c) 3 questions soliciting written responses. The survey was sent after the last coaching session was completed.

Interobserver Agreement

Interobserver agreement (IOA) data were collected for at least 20% of baseline and intervention data points, as well as 50% of each triad/dyad's maintenance data. The observers were first-year doctoral students in a special education program who had experience in working with individuals with ASD. They received training for data coding and scored higher than 80% agreement before independent scoring. Overall, IOA was consistently high, with an average of 92%, across all participant observations; however, IOA was 78% in one of Jing's early sessions due to a misunderstanding of the operational definition of communication incentives. After the coach and co-observer discussed the disagreement and retrained, the percent agreement in all remaining sessions was higher than 80% (see Appendix 4 for the average percent of IOA for each participant and behavior; Liao et al., 2019).

Dosage

Individual parent coaching occurred weekly across 12 sessions for Dyad B (63 min 37 s in total; ranging between 6 min 30 s and 16 min 8 s each session) and Dyad C (55 min 20 s in total; ranging 7 min and 8 min 39 s each session), and 13 sessions for Triad A (110 min 49 s in total; ranging 11 min 51 s to 19 min 36 s each session). Overall, sessions averaged 10 min 56 s across all dose-measured sessions in three triad/dyads.

Procedural Integrity

Two observers were randomly assigned to watch the recorded videos to evaluate if the coach conducted individual parent coaching completely and accurately by using a procedural integrity checklist. Observers were the same as those who collected all data, except the coach did not record data for procedural integrity to avoid bias. Procedures followed steps described in the baseline and intervention sections, and included items listed in Appendices 1 and 2 (procedural integrity checklists; Liao et al., 2019). Procedural integrity data were collected from 4 baseline sessions (1 session from Triad A, 1 session from Dyad B, and 2 sessions from Dyad C), 9 intervention sessions (3 sessions from each triad/dyad), and 3 maintenance sessions (1 session from each triad/dyad). Procedural integrity data collection occurred for at least 20% of baseline, intervention, and maintenance sessions. Procedural integrity across all phases and sessions recorded was 100%. Furthermore, IOA data collection took place for sessions that evaluated procedural integrity. IOA collection took place on at least 20% of baseline, intervention, and maintenance procedural integrity data. IOA on procedural integrity averaged 100% for all phases (see Appendix 5; Liao et al., 2019).

Data Analysis

We evaluated parent implementation of intervention components visually by examining patterns in the data as the

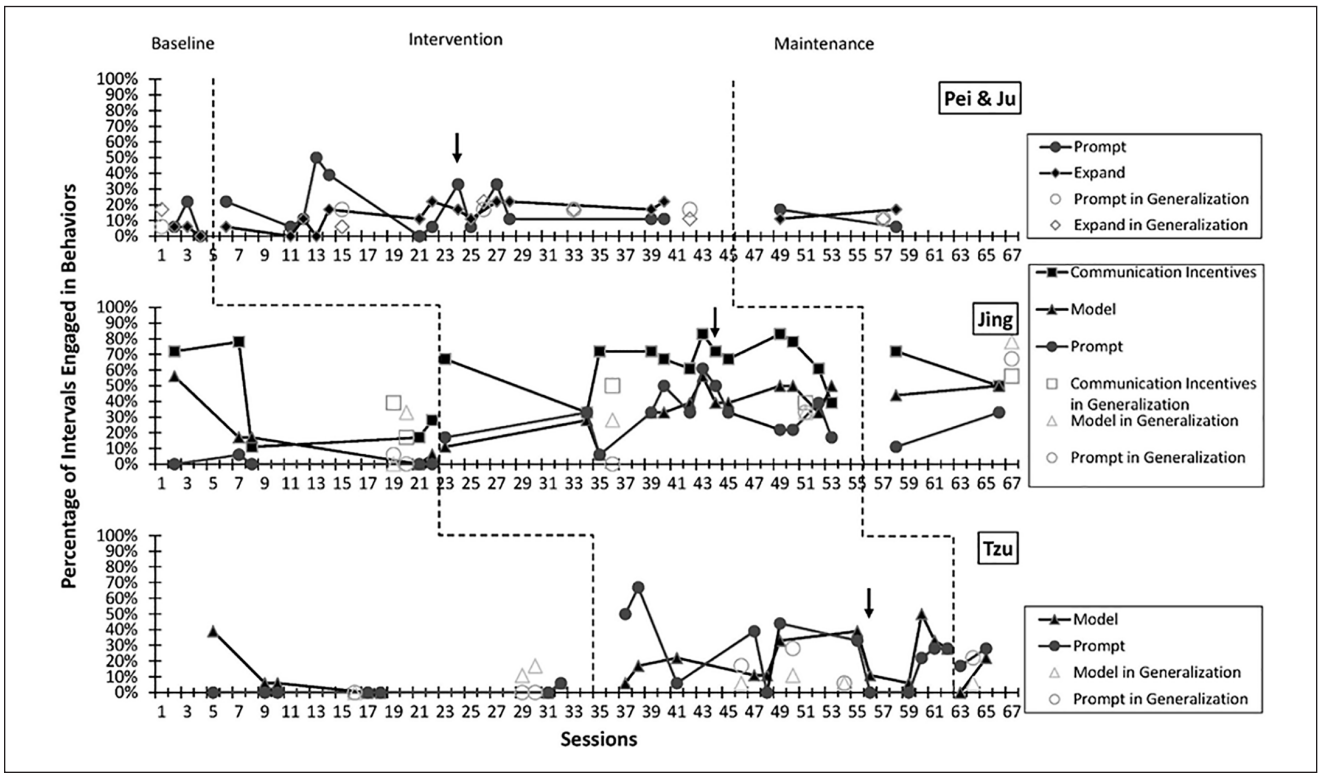

Figure 1. Percentage of intervals engaged in behaviors by parents.
Note. Arrow = prompt fading initiated.

phases changed from baseline to intervention and maintenance (Gliner et al., 2000), including analyses of within and across phase changes in variability, level, and trend of data points (Byun et al., 2017). A functional relation was determined through visual analysis independently by each author. An exception with regard to visual analysis was made for prompting. Given our hypothesis that prompting would initially increase, followed by a decrease upon instruction in prompt fading, prompting was visually analyzed for trend and variability, but not overall level.

Results

Overall results of the online webinar and sessions of individual coaching with feedback produced three demonstrations of effect in a multiple probe across participant design, indicative of a functional relation. Social validity ratings of parents indicated a successful treatment.

Visual Analysis of Parent Implementation of Intervention Components

Results for parent implementation of intervention components are presented in Figure 1. Parent intervention behaviors were part of a package, with multiple behaviors taught at once. Thus, results for all of the target parent behaviors are graphed and presented together. For ease of visual interpretation, we have provided graphs for the intervention components that were highlighted by the parent coach (i.e., first author) in treatment sessions (see Appendix 6–9 for percentage of intervals parents engaged in for each component, graphed with one component per figure; Liao et al., 2019).

Pei and Ju (Triad A)—Prompting & Expanding

Prompting. During baseline, Pei and Ju used few prompts (M = 9.33), with a slightly decreasing trend and some variability (range = 6–22). During intervention, the rate of prompt use was moderate (M = 18.38), with a slightly increasing trend in the first few data points and then decreasing as Pei and Ju faded prompts during the last six data points of intervention (range = 0–50). As expected early in the intervention phase, there was an upward trend in prompts within the first few intervention data points, and a decreasing trend as the intervention progressed—as Pei and Ju were instructed to decrease the use of prompts to encourage the child's independent communication behaviors. Although we anticipated an increasing trend in prompting for the first six data points and a decreasing trend in prompting for the last six data points of intervention, the data did

not follow that pattern for this participant. Prompts appeared to begin to decrease prior to the coach focusing on prompt fading. Data remained highly variable in both phases. During maintenance, Pei and Ju's use of prompts remained at nearly equal to their performance during prompt fading. Generalization data demonstrated relatively same levels in prompting in all phases.

Expanding. In baseline, expanding was at a low rate ($M = 4$), with a slightly decreasing trend and stable data (range = 0–6). During intervention, the rate of expansion used was moderate ($M = 13.69$), with a slightly increasing trend, and some variability (range = 0–22). In comparison to baseline, the level of expansion was higher during intervention, trend increased, and data were more variable. Pei and Ju were not taught to use a set number of given behaviors because they were expected to react to their child's communication and to implement components of the intervention as naturally as possible; thus, high variability for all of the intervention components was anticipated. During maintenance, expanding was at low levels and comparable to the last portion of intervention, but the parents used expanding more than in baseline ($M = 14$; range 11–17). Overall generalization data showed levels of expanding similar to performance within each phase ($M = 14$; range 6–22).

Jing (Dyad B)—Communication incentives, modeling, and prompting

Communication incentives. In baseline, Jing used high levels of communication incentives during the first two data points, dropping to a low rate beginning with the third data point and remaining low ($M = 41$). Trend decreased during baseline and was highly variable (range 11–78). During intervention, communication incentives occurred at a moderate rate ($M = 66$). Trend gradually increased throughout most of intervention, but decreased during the last four data points. There was moderate variability during intervention (range 33–83). Compared with baseline, the overall level of communication incentives was higher during intervention. Trend increased compared to baseline and data were similarly variable. Jing's maintenance levels of communication incentives were equal to levels in the last portion of intervention and above baseline levels ($M = 61$; range 50–72). Generalization data of communication incentives occurred at similar level to performance in target contexts in all phases ($M = 40.2$; range 17–56).

Modeling. Jing had previous experience in applied behavior analysis strategies. Accordingly, in baseline, she engaged in some modeling behaviors at a moderate rate during the first data point and low rates for the remainder of baseline ($M = 19.2$). The trend began decreasing in baseline with little variability (range 0–56). During intervention, modeling occurred at a moderate rate overall, with an increasing trend (lower rates initially then increasing), and moderate variability ($M = 35.92$; range 6–56). In comparison to baseline, modeling overall occurred at higher levels during intervention with an increased trend and higher variability. During maintenance, modeling was at a moderate level, similar to the last portion of intervention, but higher than in baseline ($M = 47$; range 44–50). In baseline and intervention phases, modeling occurred at a moderate level for generalization contexts and at a high level in maintenance; levels in intervention and maintenance phases were similar to performance in the target context ($M = 34.4$; range 0–78).

Prompting. In baseline, prompting behavior was at a low rate with a level trend and little variability ($M = 1.2$; range 0–6). During intervention, prompts occurred at a moderate rate overall, with trend increasing in the first portion of intervention and then decreasing as Jing faded prompts during the last six data points of intervention. As anticipated, data then had an increasing trend in prompt for the first seven data points and a decreasing trend in prompt for the last six data points of intervention. There was some variability in the data. The trend initially increased when compared with the flat baseline trend, while decreasing during the last portion of intervention as the child used more spontaneous communication. There was more variability in intervention in contrast to baseline. During maintenance, Jing's use of prompting was the same as in the last portion of the fading phase. Prompting for generalization occurred at levels similar to the target context, across the phases.

Tzu (Dyad C)—Modeling and prompting

Modeling. In baseline, modeling occurred at a moderate rate during the first data point, then dramatically dropped to a low and stable rate, with an overall decreasing trend. There was little variability ($M = 8$; range 0–39). During intervention, Tzu used modeling at an overall low-to-moderate rate. There was an increasing trend and high variability ($M = 22.25$; range 6–50). In comparison baseline data, level of modeling was higher during intervention. The trend gradually increased compared with baseline trend and there was more variability in intervention compared with baseline. During maintenance, Tzu used modeling at a low rate. However, the data were higher than in baseline ($M = 11$; range 0–22). Generalization data for modeling were at a low level throughout all phases ($M = 8.14$; range 0–17).

Prompting. In baseline, Tzu used no prompting until only a slight increase for the last data point. Data were stable and had little trend ($M = 8$; range 0–39). During intervention, there was an overall decreasing trend, with a high rate initially then decreasing trend throughout intervention as expected due to the prompt fading process. Data were

highly variable (M = 26.41; range 0–67). The data were followed by the pattern of what we anticipated an increasing trend in prompt for the first seven data points and a decreasing trend in prompt for the last six data points of intervention. There was an overall decreasing trend in intervention compared to baseline and data were more highly variable during intervention than baseline. During maintenance, Tzu used the same amount of prompting as used in the last portion of the prompt fading phase. Tzu used no prompting during baseline for the generalization context and showed an increasing trend in intervention and maintenance phases when compared with baseline phase.

Social Validity

An anonymous survey was used to evaluate parents' perceptions of the feasibility and acceptability of the protocol and to ascertain their overall satisfaction with parent coaching (see Appendix 3 for the parent survey; Liao et al., 2019). Two participants completed all questions, resulting in an average score of 3.25 out of 5.00 for the webinar, and 5.00 for individual parent coaching. Participants chose "strongly agree" or "agree" in response to the majority of the questions on the survey. Written feedback from parents indicated parent coaching was helpful to their children, and one-on-one instruction and personalized guidance were what they liked most about their experiences. Feedback also included the suggestion to make the webinar less theoretical by giving more examples and simplifying terminology. Overall, brief sessions were more feasible for parents, more easily integrated into their typical routines, and took less time for data collection.

Discussion

This study evaluated the effects of a brief webinar training and in-home parent-coaching protocol on the implementation accuracy of intervention components by parents. Based on the information obtained from the interview and baseline data of each parent's use of the key intervention components, the coach selected the 2–3 components that the parents infrequently used independently. Target parent behaviors for Triad A and Dyad C were low and stable in baseline. For Dyad B, Jing's baseline data in communication incentives and modeling were more variable than for the other families. In the initial sessions, she frequently used behavioral strategies she learned before this current study in her role as a paraeducator (e.g., modeled to make requests or showed different materials to entice Zong to play with her). However, she did not continue to use these strategies in later baseline sessions, so the coach still selected communication incentives and modeling as target behaviors. Each of the parents improved in the use of all of their targeted intervention components during intervention and maintained similar rates during the maintenance phase at 3- and 6-weeks post intervention cessation. According to the child's communication attempts, parents were able to use prompts with increasing frequency, then fade their use rather successfully. Parents also generalized their use of these components to contexts outside of those targeted.

The variability in the parent behaviors warrants discussion, but it was expected. This intervention was developed to be natural to implement and feasible for parents to incorporate into their regular routines and activities. By design, parents were instructed to (a) use the intervention components as needed to promote communication skills in their children, (b) be responsive to their children's attempts to communicate, (c) provide opportunities for which their children would be motivated to communicate, and (d) use the components in a manner that felt natural, not forced. Parents were not, for example, asked to meet a particular criterion for use of the components. As a result, the parent behaviors were variable compared with interventions with set criteria (e.g., use each intervention component three times per session.). Parents demonstrated some, though lower, rates of improvement for the use of all components overall, use of communication incentives, use of modeling, and expanding on children's communication attempts. Overall, the brief webinar and structured but open-ended coaching appeared to change (increase) parent use of strategies, which are intended to impact child communication behavior. Furthermore, there was variability in parent implementation of individual behavioral strategies implemented. It is likely that this relates to the parents' motivation and determination of the acceptability of each strategy and emphasizes the necessity of obtaining parent buy-in in intervention implementation. Finally, the coach in this study was not already familiar with the families; educators who are already working with the children in question may be better suited to individualize the training protocol to encourage parents to better apply their knowledge of the strategies taught.

Implications for Practice and Research

The outcomes of this study are interesting for both research and for practical and social value. The inverse relationship between a tightly controlled study intervention protocol and the likely adoption and sustainability by families remains a challenge for demonstrating experimental control and functional relations. Measurement error is possible when treatment sessions vary in duration as the opportunities to respond and communicate are not stable across time, nor equal across intervals. Future research may consider the development of additional methods for reporting on complex behaviors such as communication or the use of video probes or distance viewing throughout an intervention cycle to generate longer periods of data-collection time in a way

that is less invasive but allows for enough data to produce stability through longer samples of behavior. Furthermore, social validity was incorporated more broadly than the administration of a single parent questionnaire. That is, we implemented the intervention in a manner that attended to the natural environment and contexts of the parents and their children (e.g., sought parent input in selection of priority treatment outcomes, selection of communication modalities, provided corrective and positive feedback to the parents).

This study expands on prior literature in additional aspects. Parent-implemented interventions may be a cost-effect means of increasing communication outcomes compared with business-as-usual treatment (i.e., Bellomo, 2016; Hong et al., 2016b; Nunes & Hanline, 2007; Wright & Kaiser, 2017). As noted in prior research, home-school partnerships are critical given the challenges that children with ASD often have generalizing skills across settings and communicative partners (Hong et al., 2016a; Leaf et al., 2018). This is particularly true for communication, which is ubiquitous. The current study directly addressed and measured the impacts on generalization.

In addition, this study contributes data demonstrating the efficacy of a structured parent-coaching protocol and instructional content, previously noted by Hong et al. (2016b) to be absent in the literature. Much of the prior research on parent-implemented interventions for communication lacked measures of parent implementation fidelity (Hong et al., 2016b; Roberts & Kaiser, 2011). We extend this body of work by including measures of parent implementation of specific treatment components.

Furthermore, we considered a number of aspects related to social validity of the intervention for parents, replicating and extending prior work. In particular, a thorough preintervention interview was conducted with parents to determine their priorities for their children's communication development. Based on the information provided by parents and baseline data, an intervention plan was developed to review with parents and to check their satisfaction with selected outcomes and strategies to be implemented. Coaching sessions enabled coaches to have weekly check-ins with parents, make adjustments related to parent preference and concerns, and to communicate supporting evidence of the strategies' effectiveness in prior research.

Limitations and Future Research

Despite the described contributions, there are some limitations to this study and questions remaining for future research. We did not evaluate the impact of the webinar on parent from the parent coaching, limiting our ability to distinguish the active and necessary ingredients for the package as a whole. Given the rapidly expanding populations of people with ASD, accessibility of treatment has become a hurdle. This parent-coaching protocol appears to be effective; however, investigations of provision of these services via telehealth would offer the potential to expand services beyond geographic boundaries (Hall et al., 2016; Knutsen et al., 2016). The coaching protocol should be examined for flexibility. For example, upon evaluation near the end of the standard number of treatment sessions, there may be particular parent or child participants that require extended coaching. Furthermore, future research should investigate whether parents have higher fidelity of implementation when interventions include procedures and outcomes they value and find feasible to implement. Although not present for participants in this study, some children with ASD engage in challenging behaviors, which may warrant the development of intervention components that replace behaviors with more socially acceptable forms of communication.

Conclusion

In summary, this investigation supports the use of parent-coaching intervention in addressing the needs of children with ASD. As demonstrated here, parents can improve their implementation of instructional behaviors with the assistance of a coach. This study represents important steps in providing parent-coaching intervention and evaluating the effects of parent implementation of intervention components. The findings of this study highlight the importance of procedures and factors that influence the parent implementation of behavioral strategies for delivering intervention for children with ASD, as well as parents' perceptions of the feasibility and acceptability of the protocol. These results are crucial for developing parent-coaching plans and informing future decisions about delivering services for families of children with ASD.

Declaration of Conflicting Interests

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