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ORIGINAL PAPER

A Parent-Implemented Shared-Reading Intervention to Promote Communication Skills of Preschoolers with Autism Spectrum Disorder

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Abstract
In the current study, we examined the effect of a parent-implemented early communication intervention during shared book reading. Three mothers of children with autism spectrum disorder were trained and coached to use a set of reading techniques and evidenced-based naturalistic communication teaching strategies (i.e., modeling, mand-model, and time delay). Using a multiple-baseline design across behaviors, the following three components were examined: (a) the mothers' use of reading techniques with fidelity, (b) the mothers' rate and fidelity in using the three naturalistic teaching strategies, and (c) the children's communication outcomes. After training and coaching, the mothers used the reading techniques and naturalistic teaching strategies with high fidelity. The children initiated more communicative acts upon their mothers' use of time delay.

Keywords Autism · Parents · Language · Communication · Shared reading · Storybook

Symptoms of autism spectrum disorder (ASD) manifest themselves in the first years of life, characterized by difficulties in social communication and interaction and the presence of restricted and repetitive behaviors and interests (American Psychiatric Association 2013). In young children with ASD, such social communication deficits can include infrequent use of gestures and coordinated communication, delayed speech, and limited imitation skills (Biggs and Meadan 2018). Thus, it is critical to teach communication skills at early ages and promote positive outcomes in social interaction skills for children with ASD (Dubin and Lieberman-Betz 2019).

Naturalistic Communication Interventions

Many experts in early ASD interventions agree upon naturalistic developmental behavioral interventions (NDBIs) as recommended practice for working with young children with or at risk for ASD (Bruinsma et al. 2019; Schreibman et al. 2015). NDBIs are grounded in the idea that learning opportunities for young children should occur naturally within meaningful contexts and in a developmentally-appropriate manner (Schreibman et al. 2015). Thus, children's natural caregivers, often parents, are optimal partners in helping promote the acquisition of skills within their family's daily routines. Parent-implemented intervention is an evidence-based practice for young children with ASD (Wong et al. 2015), and reviews of the literature highlight the effectiveness of parent-implemented intervention in supporting young children with ASD and their families (Bradshaw et al. 2015; Meadan et al. 2009; Siller and Morgan 2018). Numerous NDBI models are delivered via a parent-implemented approach to facilitate repeated use of strategies, targeting a wide range of both child and caregiver outcomes (e.g., Kasari et al. 2015; Rogers et al. 2019; Wetherby et al. 2014).

Naturalistic teaching is an effective component of NDBIs and refers to functional skills being taught to a child within, "everyday life, particularly social-communication learning via interactive, meaningful exchanges with others… and the child's typical daily interactions, experiences, and routines, with multiple materials and by multiple people" (Schreibman et al. 2015, p. 2416).When focusing on social communication development, which is a common intervention target for young children with ASD, caregivers can use naturalistic communication teaching (NCT) strategies to

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promote social communication skills in the context of daily routines (e.g., Dubin and Lieberman-Betz 2019; Biggs and Meadan 2018). Three frequently used NCT strategies are (a) *modeling* which means demonstrating spoken words, signs, and/or desired responses, (b) *mand-model* which means giving a mand in a form of a vocal request for a response, a question, or a choice that is maintained by a reinforcer, and (c) *time delay* which means providing a stimulus to the child and then waiting approximately 3 to 7 s for the child to initiate communication (Akamoglu and Meadan 2019; Meadan et al. 2014). Researchers have reported that after receiving coaching, parents can implement specific NCT strategies with fidelity, and also stressed the importance of implementation across daily routines (e.g., Brown and Woods 2015; Roberts et al. 2014). Recently, some studies have begun to explore the use of NCT strategies specifically within the context of book sharing, a common everyday activity for young children and their caregivers that can be used to promote social communication development in a natural, developmentally-appropriate manner (Akamoglu and Meadan 2019; D'Agostino et al. 2020).

Shared Reading

Shared reading is a broad term used to describe the act of adults reading aloud to children, while encouraging interaction by asking questions or engaging in a discussion about the book (D'Agostino et al. 2020; Fleury and Hugh 2018). Shared reading exposes children to age-appropriate language, literacy, and communication and because it can be a natural routine for many families, shared reading is especially suited to promote children's communication skills at home (Akemoglu et al. 2020; Whalon et al. 2015). Shared reading is based on the reciprocal and interactive communication exchanges between the parent and child. Thus, shared reading can be modified to meet the needs of young children with ASD by emphasizing the interactive nature of the activity and having the parent interact with the book by commenting, questioning, and giving the child opportunities to communicate (Towson et al. 2016). Through this balanced interaction, the goal becomes increasing the child's participation and engagement in the interaction (Akamoglu and Meadan 2019; D'Agostino et al. 2020). Shared reading has been shown to improve both verbal (e.g., commenting, responding, initiating) and nonverbal (e.g., pointing and gesturing) communication skills. Particularly for children with ASD, the following communication improvements have been documented: responding to adult questions (Akamoglu and Meadan 2019; Fleury and Schwartz 2017; Whalon et al. 2015) and initiating questions or comments (Akamoglu and Meadan 2019; D'Agostino et al. 2020; Fleury and Schwartz 2017; Whalon et al. 2015). For example, D'Agostino et al. (2020) and Whalon et al. (2015) included children with ASD and examined the effects of dialogic reading, which is a shared reading method that utilizes open-ended questions to expand on children's comments and ideas on children's initiations and responses to questions. Whalon et al. (2015) reported that the participating children improved their verbal participation and engagement and D'Agostino et al. (2020) reported that all three children learned to initiate verbal comments but only two children acquired independent responding.

Children with ASD can have difficulties in social communication which may interfere with a child's ability to participate in shared reading (Fleury and Hugh 2018). Therefore, it is necessary to use instructional prompts that provide additional supports to facilitate the use of verbal and nonverbal communication to participate in shared reading. Such prompts have been shown to support the sustained participation of children with ASD, including visual supports (D'Agostino et al. 2020; Fleury and Schwartz 2017), attention-getter prompts (Akamoglu and Meadan 2019; Lorio and Woods 2020), intentional pauses with expectant looks (Akamoglu and Meadan 2019; Whalon et al. 2015), and a least-to-most prompting hierarchy (D'Agostino et al. 2020).

To monitor and encourage caregivers' use of strategies, researchers often develop and utilize fidelity checklists or self-monitoring tools. For example, Lorio and Woods (2020) coached Head Start educators and used a laminated self-monitoring bookmark summarizing items on the self-assessment checklist to support them during book reading sessions. The educators were able to monitor their own fidelity by reviewing the bookmark before and during each session. The authors reported that educators' intervention fidelity increased. Such tools can be used to maintain high fidelity levels after training educators and parents as well (Marturana and Woods 2012).

Parent-Implemented Communication Strategies-Storybook (PiCSS)

PiCSS is a parent-implemented intervention that combines naturalistic teaching with shared reading to promote social communication development in young children (Akamoglu and Meadan 2019) Akamoglu and Meadan (2019) coached two parents on use of specific reading techniques categorized as *before* (presenting the book, initial question), *during* (praise statements and attention getters), and *after* (closure question) and on three specific NCT strategies (modeling, mand-model, and time delay). Both parents increased the rate of use of reading techniques and used the NCT strategies with high fidelity. The authors reported that one of the participating children was diagnosed with ASD and the other had cerebral palsy and that both children had higher rates of communicative responses and

initiations during coaching phases compared to the baseline phase.

Results from the original PiCSS study has shown that training and coaching parents of children with ASD and other DD to use specific reading techniques and NCT strategies during shared reading results in parent behavior and child communicative changes. However, there is only one study to date demonstrating the efficacy of the PiCSS as a parent-implemented intervention. Although PiCSS produced notable parent and child changes in some aspects of communicative participation, the findings were limited to White, educated and high-income families, and functional relation was not investigated specifically between parents' performances and their intervention fidelity in reading techniques.

The purpose of the current study was to systematically replicate Akamoglu and Meadan's (2019) study with a specific focus on children with ASD. The study aimed to teach and coach parents on use of a set of reading techniques and NCT strategies with their children with ASD and to promote their children's communicative responses and initiations during shared reading. The current study was different than Akamoglu and Meadan's study as in the following: (a) only children with ASD were recruited; (b) family demographics (racial and educational background) were more diverse; (c) intervention fidelity through a bookmark checklist was also included to support self-reflection and maintenance of learned reading techniques; and (d) three NCT strategies (modeling, mand-model, and time delay) were grouped (see Method). In this study, reading techniques (RTs) refer to a particular way the parent reads the book. NCT strategies refer to specific strategies to achieve an overall goal.

The following research questions were investigated:

1. Is there a functional relation between training and coaching parents to use reading techniques and increases in parents' intervention fidelity in use of reading techniques?
2. Is there a functional relation between training and coaching parents to use specific NCT strategies (modeling, mand-model, time delay) during shared reading and the parents' rate and fidelity of strategy use?
3. Is there a functional relation between parents' implementation of the NCT and their children's communication skills?
4. Do parents perceive the PiCSS program as socially valid?

Method

Participants and Settings

After receiving approval from by the Institutional Review Board, we recruited families through parent support groups, autism and speech clinics and other early intervention providers. Potential participant families met with the researchers and if they met eligibility criteria signed informed consent forms. Inclusion criteria were (a) the children's age must be between 3 and 5 years; (b) the child must have a diagnosis of ASD as reported in their individualized education plan (IEP); (c) the parent reports that the child had a vocabulary of at least 25–50 functional spoken words; (d) the parent reports that the child could sit still for storybook reading for at least 3–5 min; (e) the parent reports that the child has an interest in storybooks; (f) the parent reports being available to participate in all intervention sessions; and (g) English must have been the family's first language. As a token of appreciation for participation, the families were given a total of $200 ($50 at the beginning and $150 at the end of the study) and several storybooks to keep. Five parents of different children who met the inclusion criteria contacted the researchers and three families who expressed interest in participating were included as participants. Children with ASD were identified via educational diagnosis. Educational diagnoses are typically made by members of the child's IEP team and may in fact confirm a medical autism diagnosis. For the current study, parents were asked to report whether the child had a diagnosis of ASD listed on their IEP. All intervention and assessment sessions were conducted in the families' homes, except for RS who requested for the last few sessions to be held on campus. The primary researcher (first author) met with each family 2–3 times per week across each phase for 8 weeks in total.

Parents and Children

KD was a married mother with two children with ASD. She and her husband, both White, lived in a town near a university and earned between $65,000 and $85,000 annually. KD was a substitute teacher with a bachelor's degree in education. She reported that they read storybooks every day with her son, JD who was diagnosed with ASD when he was 2 years old. At the beginning of the study, JD was 38 months old, attended an inclusive preschool, and received applied behavior analysis therapy. JD spoke in a soft voice and used a combination of phrases, gestures, and signs to communicate with others.

RS was an African American, single mother with three children. She had a high school diploma, worked

in multiple hourly paid jobs, and her annual household income was less than $10,000. Her son, JS, was diagnosed with ASD when he was 3 years old. At the beginning of the study, he was 71 months old and he received speech and occupational therapy at his inclusive preschool. He primarily used gestures and sounds and occasionally single words to communicate with others. He would cry to obtain attention or an object and say "No" to reject something.

KJ was a married mother with one son. She and her husband, both White, lived in a rural area, approximately 15 min from the nearest town, and earned between $45,000 and $65,000 annually. KJ had a high school diploma and worked full time. Her son, WJ, was diagnosed with ASD when he was 2 years old. At the beginning of the study, WJ was 44 months old, communicated primarily through sounds and gestures, and produced a few functional words. He would hold a parent's hand and lead him or her toward what he wanted. He would say, "No" or "I don't want" to reject something. See Table 1 for children's initial assessment data.

Storybooks

For baseline, the researcher selected five books from the *Read Together, Talk Together* Kit A (RTTT; Pearson Early Learning 2006) for each parent to use with her child. During post-training and coaching phases, 15 books featuring the Little Critter series by Mercer Mayer were selected and used. This series was also used in studies by D'Agostino et al. (2020) and Crowe et al. (2004). Before each session, the parent randomly selected two of the five books during baseline and two of the 15 books during intervention. The child selected one of those two books to be read during each session, thus, repetition of books occurred at times.

Experimental Design

A multiple-baseline design across behaviors (reading techniques and NCT strategies) within each family was used to assess the effects of the training and coaching on parents' fidelity and rate and children's communication behaviors (Akamoglu and Meadan 2019; Meadan et al. 2014). In this design, each family served as its own control. The design allowed three demonstrations of a basic effect within each family (i.e., across the three teaching strategies taught in the intervention) and replication across the three families.

Procedures

Baseline

During the baseline sessions, the mothers used the five books and were instructed to read as they typically would. The first author (coach) videotaped the parent–child reading interactions and no discussion about the parent–child reading interaction occurred.

Intervention

The independent variables were parent training and coaching on reading techniques and the NCT strategies (modeling, mand-model, and time delay). The first independent variable was related to the frequency and accuracy of parents' use of target reading techniques listed on the reading fidelity checklist (Fig. 1). Each parent was given a fidelity checklist in the form of a laminated bookmark during training (see Lorio and Woods 2020 for a similar checklist). The laminated bookmark did not have the point columns but otherwise it was identical to the checklist in Fig. 1. We completed the fidelity checklist to evaluate each video recorded book reading session, basing parent performance on several RTs

Table 1 Initial child assessment data

Measure	WJ	JD	JS
*MCDI words and gestures Words understood Words produced	155/350 (out of 396) 153/282 (out of 396)		
MCDI words and sentences Words produced		337 (out of 680)	42/72 (out of 680)
PLS-5 TLS	56 (1st percentile)	84 (14th percentile)	51 (1st percentile)
ASQ-SE-2	230 (36 months) (cutoff score: 105)	310 (36 months) (cutoff score = 105)	195 (60 months) (cutoff score = 95)
GRTR-R	2/2 (below average)	12/13 (average)	10/11 (below average)

MCDI MacArthur-Bates communication development inventory (Fenson et al. 2002), *words produced* number of reported expressive words, *PLS-5* preschool language scale, 5th Ed (Zimmerman et al. 2012), *TLS* total language score, *ASQ-SE-2* ages and stages questionnaire: social emotional 2nd ed (Squires et al. 2002), *GRTR-R* get ready to read-revised (Whitehurst and Lonigan 2010)

*Out of 396 words

Before Book Reading	Points available	Points earned
1. Review the fidelity checklist	**1**	
2. Sit in a comfortable and distraction free corner/area	**1**	
3. Offer two book choices	**1**	
4. Present the book: Say the **title** and **author** of the book to your child before beginning to read	**2**	
Total possible points:	**5 points**	
During Book Reading		
1. Use each modeling and mand-model strategy at least 3 times	**6**	
2. Use time delay strategy at least 3 times	**3**	
3. Provide feedback and encouragement statements at least 3 times	**3**	
4. Use attention getters every time your child is distracted	**1**	
Total possible points:	**13 points**	
After Book Reading		
1. Say, "All done" or "The end"	**1**	
2. Thank your child for reading with you	**1**	
Total possible points:	**2 points**	
Grand total available:	**20 points**	
Total earned: __/20 x 100 = __%		

Fig. 1 Book reading fidelity checklist. Item 1 in Before Book Reading was adopted from Lorio and Woods (2020)

utilized before, during, and after book reading sessions. In total, the fidelity checklist included 10 techniques worth a total of 20 points.

Regarding NCT strategies, because both modeling and mand-model strategies are used to elicit responses from children (Akamoglu and Meadan 2019; Meadan et al. 2016), modeling and mand-model were grouped together and hereafter will be referred to as one behavior called "modeling + mand-model." Time delay strategy was used to promote initiation skills. Both RTs and NCT strategies were operationally defined with examples (see Table 2).

Training The first phase of intervention included two separate, hour-long parent-training sessions, one on RT and one on NCT strategies, without the child present. Both training consisted of the following components: (a) handouts that includes definitions and examples of RTs and NCT strategies were given; (b) video examples of parents using the RT or NCT strategies were shown; (c) the mother practiced the RT or NCT strategies with the researcher; (d) suggestions and feedback were provided to the mother; and (e) the researcher reviewed the training and addressed questions and concerns. After the mothers received two separate trainings, three post-training data points were collected with no coaching. Post-training data was collected to determine whether or not training alone was sufficient to alter the parents' performance.

Fidelity of Implementation of Training The researcher completed training checklists separately in each training for each family. To assess reliability of the fidelity measure, a second observer (second author), watched the video-recorded training sessions and rated the presence and absence of steps on the fidelity checklists for all six of the training sessions. Fidelity of implementation for the training sessions was 96.6% (range 90–100).

Coaching The parents were coached by the first author. The coaching procedures included the following components: (a) the mother and researcher reviewed the target RT or NCT strategy before the reading session; (b) feedback on the previous session was provided by showing the video clip and giving direct feedback on what the mother did well and what needed improvement; (c) the mother and child engaged in shared reading; (d) the researcher observed the parent–child reading sessions without interrupting; (e) the mother reflected on her own performance; (f) suggestions and feedback were provided to the mother; and (g) the researcher addressed the mother's concerns or questions.

Table 2 Definitions of reading techniques

Group	Reading technique	Example
Before book reading	1. Review the Fidelity Checklist: Have the bookmark available by you and review the items one more time before you begin reading 2. Sit in a comfortable and distraction free corner/area: Design a specific, comfortable seating space for reading 3. Offer two book choices: Offer two books by shuffling from the list of books 4. Presenting the Book: Say the *title* and *author* of the book to your child before beginning to read	1. Parent reads the items on the bookmark and puts it in a reachable distance for her 2. Parent creates an area that has either a chair, sofa, or cushions with no audio or visual distractions and uses that area consistently 3. "Do you want to read the *Goodnight Gorilla, or I Was So Mad?"* or *"Which one do you want to read?"* 4. This is "I Was So Mad. Mercer Meyer wrote the words."
During book reading	1. Use each modeling and mand-model strategy at least 3 times: Model a vocabulary word from the book and ask open-ended and choice questions about story or character 2. Use time delay strategy at least 3 times: Point to a picture, leave a sentence or phrase incomplete, and look expectantly at your child 3. Provide feedback/encouragement statements at least 3 times: Praise your child for sitting still and/or participating. Acknowledge his/her communication attempts 4. Attention Getters: Use words and gestures to maintain your child's attention on the storybook	1. Parent says, *"truck"* or *"blue train"* or asks, "*Where is the gorilla going?*" 2. Parent says, "*This is a*_____," and the child completes the sentence by saying, "*Ball*." 3. *"Good job sitting nicely with mommy!* 4. *"Wow!" or "Look at this"* with animated voice
After book reading	1. Say, "All done" or "The end" to indicate the end of the activity 2. Thank your child for reading with you:	1. The parent reads the last page, says, *"The end"* and closes the book 2. The parent says, *"Thank you for reading with me today."*

The coaching phases proceeded in the following order: (a) RTs; (b) modeling + mand-model; and (c) time delay. Although there is not an established criterion for intervention targeting parent intervention fidelity, many researchers choose 80% as their criterion level (Akamoglu and Meadan 2019; Lorio and Woods 2020; Meadan et al. 2016). In the current study, the parents worked with the coach to reach the 80% fidelity criterion level two consecutive sessions both in reading techniques and NCT strategies.

Fidelity of Implementation of Coaching The researcher completed a checklist with all procedural steps of the coaching protocol for each coaching session with each family. To assess reliability of the fidelity measure, the second author watched 36.8% of the coaching sessions (seven sessions out of 19 sessions from all families) and rated the presence and absence of steps on the fidelity checklists. Across the seven sessions and all coaching phases, the second observer assessed fidelity of implementation at 95.9% (range: 86.71–100). We calculated point-by-point agreement, counting the number of agreements divided by the number of agreements and disagreements, multiplied by 100. Point-by-point agreement between the two observers was 96.9%.

Maintenance We collected two types of maintenance data: *maintenance with other coaching* and *post-intervention maintenance* in each family's home. We are using the term *maintenance with other coaching* to refer to data we collected after the coaching of a specific strategy ended and during the time coaching on a new strategy had started. For example, once coaching on the modeling + mand-model strategies were completed, we coached the parent on the time delay strategy. The parents were videotaped, and we coded the modeling + mand-model strategy as maintenance data because the coaching on modeling + mand-model was completed. We also collected data after all coaching had ended and we refer to these data as *post-intervention maintenance*. Similar to baseline sessions, during post-intervention maintenance sessions, the parent was asked to read the same five storybooks with the child that they were provided for the baseline phase. Reading interactions were videotaped, and coaching was not provided.

Data Collection

We collected observational data to answer the first three research questions and qualitative data through social validity interviews to answer the fourth question.

Observational Data

We selected an event recording measurement system to capture and tally the parents' use of strategy and children's communication behaviors (Ledford and Gast 2018). This intervention addressed four dependent variables (DVs) specific to the first three research questions. The parent DVs included (a) parents' reading fidelity checklist on the bookmark (DV1); (b) parents' fidelity of NCT strategy use

(DV2); and (c) parents' rate of NCT strategy use (DV3). The secondary DV was children's communicative behaviors (DV4), including verbal (using spoken words) and nonverbal (gestures, pointing, reaching) responses and initiations. The children's communication topography will be addressed in another report. We coded all videos using a coding manual with operational definitions of the DVs which is available upon request from the authors.

Parent Observational Data For reading fidelity, the researchers completed the 20-point fidelity checklist to evaluate each recorded session, basing parent performance on 10 reading techniques (Fig. 1). The first item on the checklist was coded as N/A for all baseline sessions because parents did not yet have a fidelity checklist (bookmark). A fidelity percentage was calculated for each book reading session by dividing the number of points earned by 20 and multiplying by 100. The goal of providing a checklist with assigned points was to help parents understand that providing frequent RTs and NCT strategies is important, but they do not need to stress to reach a specific number. Thus, the ultimate goal was to teach the parents to use the strategies and techniques but also to be somewhat flexible (see Harn et al. 2013).

Regarding parents' rate in use of NCT strategies, each NCT strategy (modeling, mand-model and time delay) was first tally coded based on occurrence using a coding form and converted into percentage by dividing the number of total occurrences by the number of minutes for each session. We coded parents' fidelity of implementation on a scale of 1 = *low-fidelity* to 4 = *high-fidelity* (Akamoglu and Meadan 2019; Meadan et al. 2016). We calculated the percentage of high-fidelity strategy use for each strategy per session by dividing occasions of high-fidelity strategy use (modeling + mand-model or time delay) by the total frequency of that specific strategy use (modeling + mand-model or time delay). For example, to receive a score of Fidelity 4 in modeling + mand-model, the parent had to complete the following steps: (a) establish joint attention; (b) present a verbal model (e.g., this is a gorilla) or mand-model (i.e., ask a choice or open-ended question); (c) wait 3–5 s for the child to respond; and (d) respond to the child's behavior (see also Akamoglu and Meadan 2019; Meadan et al. 2016). The fidelity score dropped based on number of steps missing.

Child Observational Data We collected child data on verbal (commenting, responding) and nonverbal (pointing, gesturing) responses and initiations. We coded child responses per opportunity, and occurrences within 3 s of the parents' use of a strategy counted as a response. To calculate the percentage of child responses, we recorded the number of child responses per opportunity provided by a parent, and then divided the number of responses by the number of opportunities multiplied by 100. We tally coded initiations per occurrence following the parent's use of time delay.

Interobserver Agreement (IOA) The first and second authors were the primary and secondary observers, respectively. The secondary observer, a doctoral candidate during the study period and blind to the intervention phases, coded the randomly assigned sessions. The primary observer coded all sessions and trained the secondary observer on the coding procedures. Both coders coded a subset of videos, compared the results and discussed any disagreements. The observers met 2–3 times per week and this process was repeated until the observers reached at least 80% agreement for each coding category (type of NCT strategy, fidelity level of NCT strategy, child's communicative behavior, and fidelity checklist). The observers were considered to be in agreement when they both identified the time of event with a 3-s window of the occurrence of a DV and had the same codes for each of the DV categories. Once the observers achieved at least 80% agreement, the secondary coder was randomly assigned 33% of the sessions across each phase to code independently (see Table 3). The primary and secondary observers met when agreements dipped below 80% to compare their codes and come to consensus on disagreements. IOA was calculated for each coded category as point-by-point agreement by counting the number of agreements divided by the number of agreements plus disagreements, multiplied by 100.

Data Analysis

Observational Data

To determine the effects of the training and coaching on parents' fidelity and rate and children's communication behaviors, data on each behavior were graphed individually for each parent–child dyad across the four phases of the study. Data analysis procedures concentrated on visual inspection of graphs to identify a functional relation. Primary analyses included identification of level, trend, and variability within graphs with secondary analyses focusing on immediacy of effect.

Social Validity

To examine the fourth research question about the social validity, we used subjective evaluation methods (Kazdin 1977). The research team conducted semi-structured interviews with parents. The first author conducted the preintervention interviews and the second author conducted the postintervention interviews to minimize bias in parents' responses. Interviews lasted approximately 30 min each and were video recorded. The interview questions were adapted

Table 3 Interobserver agreement (IOA) by phase

Family	Phase (n, % of sessions coded)	Coded Categories: NCT strategy (average, range)	Fidelity score (average, range)	Child behaviors (average, range)	Reading fidelity checklist (average, range)
KD & JD	Baseline	95.6	90	90	90
	(3, 60)	(86–100)	(70–100)	(70–100)	(85–95)
	Post-training	84.8	79	81.3	92.5
	(2, 66)	(83–86)	(75–83)	(76–86)	(90–95)
	Coaching: Modeling + Mand-model	100	94	88.2	85
	(1, 33)	–	–	–	–
	Coaching: Time delay	100	85.7	85.7	90
	(1, 33)	–	–	–	–
RS & JS	Baseline	83.6	81.6	83.6	92.5
	(4, 80)	(50–100)	(50–100)	(50–100)	(85–95)
	Post-training	85.5	81	90.5	90
	(2, 66)	(80–91)	(80–82)	(90–91)	(85–90)
	Coaching: Modeling + Mand-model	91.5	82	82	95
	(1, 50)	–	–	–	–
	Coaching: Time delay	83	80.5	89	92.5
	(2, 50)	(75–91)	(75–86)	(83–95)	(90–95)
KJ & WJ	Baseline	83	83	83	86.5
	(3, 60)	(50–100)	(50–100)	(50–100)	(85–90)
	Post-training	79	80	86	92.5
	(2, 50)	(78–80)	(80–80)	(85–87)	(85–100)
	Coaching: Modeling + Mand-model	84	88	84	85
	(1, 33)	–	–	–	–
	Coaching: Time delay	84.5	83	80	90
	(2, 66)	(83–86)	(75–90.5)	(68–92)	(85–95)

Averages and ranges are presented as percentages (%)

IOA Interobserver agreement

from the ones used in Akamoglu and Meadan (2019) regarding the goals, procedures, and outcomes of the PiCSS program. The interviews were transcribed and analyzed line by line by the two authors. The research team members first independently coded the interviews then and met to reach consensus. The data analysis process included development of codes, grouping codes into categories, and, finally, the development of themes (Creswell 2012). To promote trustworthiness of the findings, the following quality indicators for qualitative research were used: (a) development of appropriate interview questions, (b) use of adequate mechanism to record and transcribe interviews and (c) credibility measures (Brantlinger et al. 2005).

Results

The mean length of book reading sessions in the baseline, coaching modeling + mand-model, coaching time delay, and post-intervention maintenance phases was 3.22 min, 4.90 min, 4.47 min, and 4.09 min, respectively. The mothers required an average of three coaching sessions for modeling + mand-model (range = 2–4) and 3.5 for time delay (range = 3–4) to meet the intervention fidelity criteria. Across all three participants, coaching sessions lasted an average of 11.78 min (range = 2.96–28 min).

Parent Behavior

We used a single-case research design, specifically, within subject multiple-baseline design across strategies and replicated across three families. Parents were not asked to use a set number of teaching strategies in each session and, therefore, the rate of teaching strategies (i.e., number of strategies used divided by number of minutes) used in each session varied among the parents. Overall, visual inspection of the graphs revealed an increase in the level of the rate of NCT strategy use. Immediate changes in level and trend were observed across all three mothers especially following introduction of the coaching. Based on visual analyses regarding fidelity of RT and NCT strategy use, all three graphs revealed (a) immediacy of effect and a positive upward trend, (b) no overlapping data points between baseline and coaching phases, and (c) an increase in the level of fidelity percentages, suggesting a functional relation between the introduction of coaching and the DVs (See Figs. 2, 3, and 4).

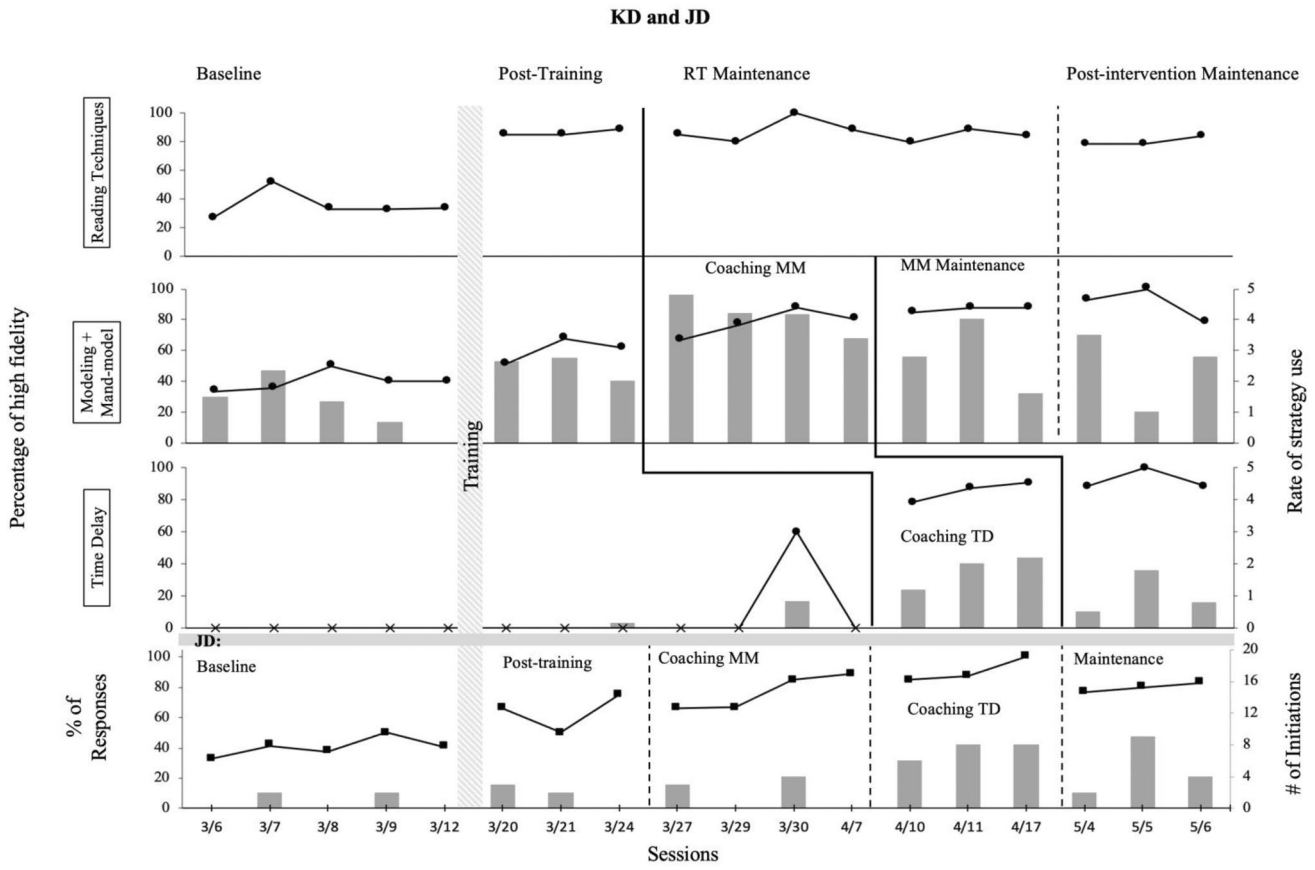

Fig. 2 KD and JD's performance. *MM* Modeling + mand-model, *RT* reading techniques, *TD* time delay. Coaching begins in MM and continues with TD. No coaching was provided for reading techniques since KD met the criteria during post-training. In Tier 1, the line graph represents KD's percentage of reading technique fidelity. In Tiers 2–3, line graphs represent KD's percentage of high-fidelity (Fidelity 4) strategy use; shaded bars reflect the rate. Bottom tier represents JD's communication behavior; line graph shows the percentage of child responses, and shaded bars reflect the number of times the child initiated

Fidelity on Reading Techniques

All three parents' fidelity score for RTs was lower than 80% across all baseline sessions, meaning they used only a few RTs. Some of the RTs the parents occasionally used during baseline included offering book choices, sitting in a consistent and comfortable area, asking questions (mand-model), presenting the book, and saying, "The end," or, "All done."

KD reached the performance criteria (80% and above) across the three post-training sessions, ending with an average fidelity of 87.6%. Training alone was sufficient to change her RT implementation and therefore, she did not need coaching on RTs. For RS, reading technique data displayed a slight increase in percentage of fidelity followed by a positive upward trend in level after training. She did not meet the fidelity criterion during the post-training phase. RS had an average of 58.33% fidelity during post-training. Therefore, RS needed coaching to reach the criterion and reached the 80% intervention fidelity criterion in coaching sessions. KJ's fidelity of implementation of RTs increased immediately in level following training and was relatively more stable during post-training. She demonstrated mastery criterion on RTs in the last post-training data point and her first coaching data point. Therefore, we moved onto modeling + mand-model coaching after only one RT coaching session. During the post-intervention maintenance phase, her implementation fidelity remained high in level, despite some slight variability.

Rate and Fidelity of NCT Strategy Use

KD used modeling + mand-model strategies relatively often (5 to 10 times). Visual analysis reveals that, following training on all strategies, changes in KD's implementation varied until coaching was introduced. A substantial increase in the rate at which she implemented modeling + mand-model coincided with coaching. KD's level of high-fidelity strategy use was particularly higher and showed a positive upward trend during the coaching phase. During maintenance (after coaching ended), KD continued to apply

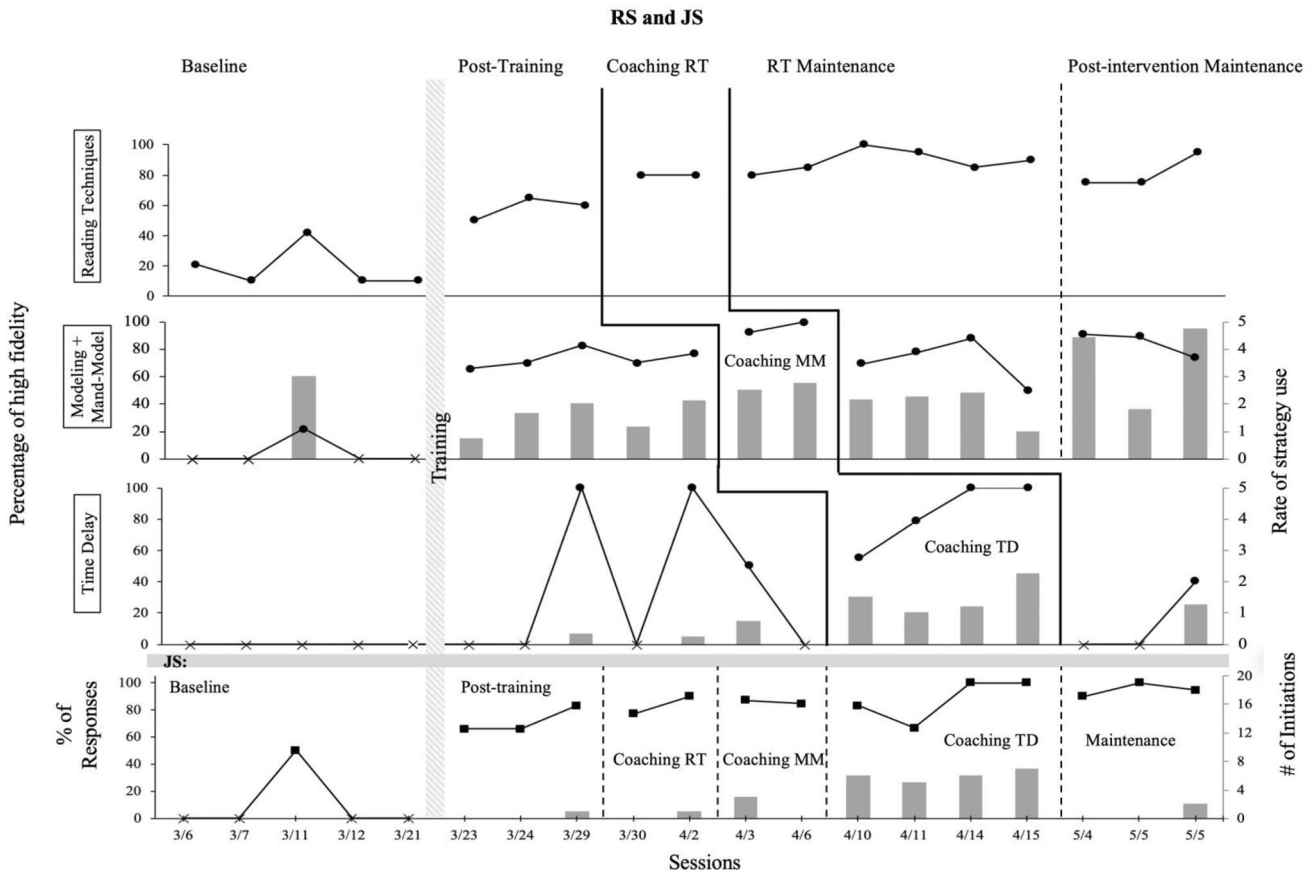

Fig. 3 RS and JS's performance. In Tier 1, the line graph represents RS's percentage of reading technique fidelity. In Tiers 2–3, line graphs represent RS's percentage of high-fidelity (Fidelity 4) strategy use; shaded bars reflect the rate at which RS used the strategy. Bottom tier represents JS's communication behavior; line graph shows the percentage of child responses, and shaded bars reflect the number of times the child initiated.

modeling + mand-model with high fidelity. RS did not use modeling + mand-model during baseline (aside from one exception). After receiving training, the rate at which RS used modeling + mand-model and the percentage of high-fidelity strategy use increased notably, but she did not achieve 80% and above for two consecutive sessions. After coaching on modeling + mand-model was introduced, RS's rate and level of high-fidelity strategy use increased substantially. During maintenance, RS used the strategies at lower rates than during coaching but maintained relatively high levels of fidelity implementation.

During baseline, KJ used modeling + mand-model strategies rarely (3–5 times) and never used time delay. During post-training, KJ's rate was notably higher for modeling + mand-model strategies. Her high-fidelity use of modeling + mand-model remained lower than 80% but was higher in level with notable variability during post-training. Coinciding with coaching, KJ's level of strategy use immediately increased for modeling + mand-model. Her high-fidelity use modeling + mand-model was more stable during coaching and she demonstrated mastery criterion on the last two coaching sessions.

None of the parents used the time delay teaching strategy often or with high fidelity during the baseline phase. Following training, all three parents' rate and high-fidelity use of time delay increased somewhat, with significant variability and they did not meet the mastery criterion. When coaching was introduced, rate and level of high-fidelity time delay use increased substantially for all three parents. However, during the maintenance phase, KJ and RS decreased their average use of the time delay teaching strategy while KD maintained a high-level use of time delay strategy. Overall, we can assume a functional relation between coaching and all three parents' use of RTs and NCT strategies.

Child behavior

Visual analysis of the bottom tier of each figure reveals an increase in level (percentage of opportunities) at which JD responded to his parent's strategy use after training was

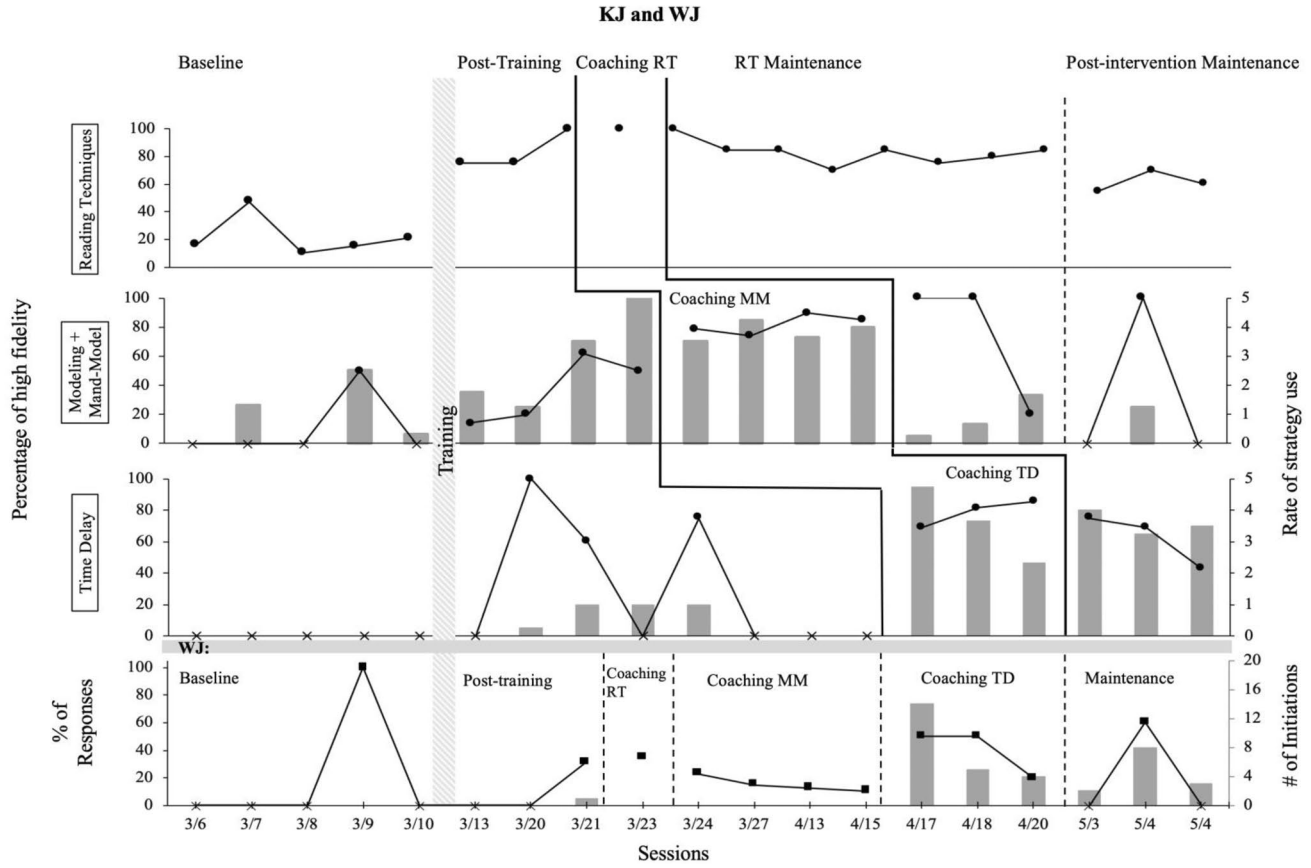

Fig. 4 KJ and WJ's performance. In Tier 1, the line graph represents KJ's percentage of reading technique fidelity. In Tiers 2–3, line graphs represent KJ's percentage of high-fidelity (Fidelity 4) strategy use; shaded bars reflect the rate at which KJ used the strategy. Bottom tier represents WJ's communication behavior; line graph shows the percentage of child responses, and shaded bars reflect the number of times the child initiated

introduced, that was maintained throughout the remainder of the study. While JD's responsiveness and initiations showed a slight variability, overall, there was an upward trend in his behaviors. JS's responsiveness and initiations data during after training was introduced were higher in level and relatively more stable compared to baseline. WJ's level of responsiveness was slightly higher after training was introduced and was maintained with notable variability for the remainder of the intervention. When coaching on time delay was introduced, all three children initiated communication more frequently. Finally, during maintenance, JD and JS's level of responses and frequency of initiations remained well above baseline levels, while WJ's level of responses was below baseline level and his frequency of initiations was above baseline level.

Social Validity

Preintervention and postintervention interviews provide qualitative data specific to the goals, procedures, and outcomes of the PiCSS intervention. The following sections highlight a summary of participating parents' responses.

Goals

Preintervention interviews demonstrated that all three parents reported challenges specific to their children's communication skills prior to participation in the PiCSS intervention. All three families noted that they wanted their children to be able to communicate wants and needs. For example, RS said, "My goal is to get him to say more sentences, be more engaged in story books, being more engaged in play time." KD note the following,

> I would love to see him engage more with books. I would love to see him expand, you know, with autism everything can be kind of narrow-focused. I would love to see him be able to expand that excitement to other books.

Procedures

All three parents reported high levels of satisfaction with the procedures of the intervention during their postintervention interviews. They shared that the NCT strategies and RTs were easy to use once they became familiar with them, and they all expressed that the bookmark served as a good reminder. For example, KD said, "…Seeing what we did broken down in line by line of what we had said and what we were doing or were not doing…that was so beneficial for me to see that kind of feedback broken down." KJ expressed her thoughts about collaboration as follows, "I guess the favorite part would be being able to work together for the common goal of helping W… It was a good collaboration."

Outcomes

All three parents reported that they noticed improvements in their children's communication and engagement during storybook reading. Overall, the participating parents expressed high levels of satisfaction in their postintervention interviews specific to the outcomes of the PiCSS intervention. KJ said the following, "…It exceeded goals and I feel like WJ is now meeting goals that I had not even put in place yet or set up for him because I didn't think he was ready yet." RS noted, "Just for him to be interested in a story, that was the real outcome, the true outcome. And for him to learn to communicate with me and me back with him."

Discussion

Shared storybook reading is a common activity among many American families, but more information is needed about embedding NCT strategies into shared reading. Overall, parents who participated in the study perceived the PiCSS program as effective, found the procedures feasible, and the outcomes acceptable. Furthermore, the three mothers stated they enjoyed the PiCSS program and will continue using strategies with their children in the future.

Fidelity of Implementation

Children with ASD tend to be distracted and have a lack of focus in shared reading (D'Agostino et al. 2020; Fleury and Schwartz 2017). In the current study, we adopted the RTs, such as attention getters and giving feedback, from Akamoglu and Meadan (2019) and we adopted the bookmark checklist and 80% criterion from Lorio and Woods (2020). Checklists help implementers self-monitor and support fidelity of implementation. Fixsen et al. (2005) stated that the effectiveness of intervention is highly associated with the fidelity with which it is implemented. Similar to the findings from Lorio and Woods (2020), the fidelity checklist (i.e., bookmark) helped all three mothers increase their reading fidelity following training, because each parent reviewed the bookmark right before each reading session.

All three children focused more on book reading, as revealed by their responses and initiations following their mothers' increases in fidelity and all three mothers' social validity reports. Previous studies have reported similar results in child engagement upon adults' use of systematic prompts with fidelity (Akamoglu and Meadan 2019; Golloher 2018; Lorio and Woods 2020). For example, Golloher (2018) reported that children's engagement increased upon parents' use of least-to-most prompting. Similarly, Lorio and Woods (2020) reported that following paraeducators' fidelity increase in book reading, children were more responsive to reading prompts.

Training and Coaching

For NCT strategies, training was mostly sufficient to increase rate and fidelity somewhat, but coaching was the factor that helped all three mothers improve and maintain their fidelity for two consecutive sessions. Other researchers have also reported that coaching supplemented the training and supported the implementation of the strategies in the naturalistic setting (Akamoglu and Meadan 2019; Lorio and Woods 2020; Meadan et al. 2016). Training alone, however, was sufficient for improving KD's RT fidelity. Although both RS and KJ increased their RT fidelity in post-training, they needed coaching to reach the 80% and above for two consecutive sessions. These findings support Lorio and Woods's (2020) investigation reporting the effectiveness of coaching in supporting paraeducators to meet 80% reading fidelity criterion.

Limitations and Directions for Future Research

This study had a number of limitations. First, this single-case design study included only three participants and the participating children did not have a research diagnostic confirmation (we relied on IEP reports), therefore, limiting its generalizability to other parents and children with ASD. Future research should conduct ASD diagnostic assessment and examine the effectiveness of this intervention with a greater number of families. Second, even though parents reported high satisfaction with the bookmarks, it is not always possible for parents to acquire such bookmarks or have easy access to a fidelity checklist. These materials in particular might be in conflict with the nature of naturalistic activities. Practitioners who work with families of children with ASD or other developmental disabilities, however, could possibly adapt such checklists and share them with families as needed. Third, modeling and mand-model were

combined, which did not allow the researcher to distinguish which form of strategy (i.e., modeling or mand-model) parents used more frequently and with high fidelity. Fourth, our intervention package consisted of training and coaching. Training on RTs and NCT strategies were delivered all at once and then delivered coaching in staggered fashion. Although coaching helped parents to reach the performance criterion, it is unclear which component of the intervention was responsible for behavior change. While interpreting the results of this study, the effects of training and coaching must be considered in combination. Future research should examine the contribution of training and coaching independently. Fifth, although we had an independent variable that affected the dependent variable (child communication outcomes), child growth in age and development might have contributed to their language and communication development with the 8-week period. Future research should conduct similar studies using randomized control trials (RCT) method to assert and confirm the effectiveness of the PiCSS program on children with ASD.

Implications for Practice

Shared storybook reading is a natural activity and with minor modifications to procedures, parents can use the RTs and embed NCT strategies to create participation and social interaction opportunities for their children with ASD and other developmental disabilities. In addition, practitioners who work with families should consider individualizing their coaching, provide performance-based feedback, and allow parents to reflect upon their practice. This can improve parents' ability to learn and apply the strategies to their everyday routines.

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