Journal of Autism and Developmental Disorders (2020) 50:3005–3017
https://doi.org/10.1007/s10803-020-04406-6

ORIGINAL PAPER

Shared Book Reading Behaviors of Parents and Their Verbal Preschoolers on the Autism Spectrum

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Published online: 17 February 2020

Abstract
Preschoolers on the autism spectrum are at risk of persistent language and literacy difficulties thus research into shared book reading (SBR) in this group is important. We observed 47 parents and their verbal preschoolers on the spectrum sharing two unfamiliar picture books and coded the interactions for parent and child behaviors. Parents were able to engage their child in SBR and demonstrated a range of print- and meaning-related SBR behaviors with no evidence of a focus on print. Multiple regressions showed direct effects of parents' explicit teaching of story structure and use of questions on their children's verbal participation. Further research is needed to unpack the potential transactional relationships between parent and child SBR behaviors to inform early intervention.

Keywords ASD · Preschool · Children · Shared book reading · Emergent literacy

Introduction

The importance of parent–child interactions in language development has long been emphasized in social constructivism theories (Vygotsky 1981). Shared book reading (SBR) is a key activity that fosters parent–child interactions and promotes children's early language and emergent literacy skills (Reese and Cox 1999; Whitehurst et al. 1988). It may be particularly valuable to young children on the autism spectrum[1] who are vulnerable to both persistent language (e.g., Magiati et al. 2014) and literacy difficulties (e.g., Nation et al. 2006). Only recently have studies started to address SBR practices with young children on the spectrum (Fleury et al. 2014; Mucchetti 2013; Tipton et al. 2017). However, these studies have mainly focused on educators as opposed to parents, which seems surprising, considering SBR is part of many family routines, particularly during the preschool years (Marquenie et al. 2011). To the authors' knowledge, only two published studies investigated the SBR practices of parents and young children on the spectrum and have focused on parent behaviors (Fleury and Hugh 2018; Tipton et al. 2017). The current study contributed to this scant evidence-base by recruiting parents of verbal preschoolers on the spectrum and observing both parent and child behaviors during an SBR session in the home environment. Research into this area has potential to inform early intervention practices aimed at facilitating early language and literacy skills in this at-risk population.

SBR and Early Language and Literacy Development

There are strong links between SBR practices and children's oral language and emergent literacy in typical development. Consistent with the Home Literacy Model (Sénéchal and LeFevre 2002), parent behaviors during SBR interactions may be categorized as *meaning*-related or *print*-related (Han and Neuharth-Pritchett 2015; Hindman et al. 2008). Meaning or oral language-related parent behaviors promote children's oral language skills by not only exposing the child to book-related vocabulary (e.g., labelling pictures, explaining word meanings, and linking

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[1] This choice of language is in line with stakeholder preferences across groups (Kenny et al. 2016).

words to everyday events), but also through explicit teaching of meaning-related skills related to the overall structure of the story (i.e., story grammar). Print-related SBR behaviors draw the child's attention to print-related features of the book and include explicit teaching of, for example, letter names and sounds, or explicitly discussing how to decode written words.

Research into SBR behaviors of parents with typically developing children has found that these two types of experiences (meaning-related and print-related) predict different aspects of children's oral language and literacy development. For example, significant correlations have been found between parents' use of meaning-related talk (e.g., defining novel words and encouraging children to make links between the text and real-life experiences) and their children's vocabulary development (Beck and McKeown 2007; Hargrave and Sénéchal 2000). In addition, Sénéchal et al. (1998) found that frequency of storybook exposure in the home was linked to stimulation of children's oral language skills (e.g., receptive vocabulary and listening comprehension) and led to better skills once children were at school. When parents explicitly focus on letters and print concepts during SBR, an improvement is seen in their children's early print-related skills such as letter name knowledge, print concepts, and early decoding skills (Sénéchal 2006). Taken together, these findings highlight that engaging children in shared book reading alone does not result in better print-related early literacy skills, and that parental print-related teaching may be required. However, Sénéchal et al. (1998) acknowledged the mediating effect of children's existing oral language and early literacy skills, and other variables such as child interest in books (Frijters et al. 2000) were not considered. In addition, the quality of parent–child interactions during SBR should be taken into consideration (Kaderavek et al. 2014).

Given SBR is a social activity, it is also important to consider child behaviors including their engagement with the book during SBR. Previous research with typically developing children has shown that a child's verbal participation may be linked to their parents' use of meaning-related behaviors (Luo and Tamis-LeMonda 2017; Sénéchal et al. 1995), although this association is less clear for children with identified language impairments (McGinty et al. 2012). In fact, the child's language ability as measured on a standardized language test may influence the SBR interactions and moderate the effects of SBR on future oral language and literacy development (Kaderavek and Sulzby 2000).

SBR with Children on the Autism Spectrum

Although literacy is not a core area of impairment associated with an autism diagnosis, numerous studies have confirmed that a significant number of children on the spectrum demonstrate reading difficulties at school (McIntyre et al. 2017; Nation et al. 2006). The most common reading profile is one of relative strength in word recognition in the presence of poor reading comprehension (Huemer and Mann 2010). Recent research has started to explore these uneven reading profiles by investigating the emergent literacy skills of preschoolers on the spectrum (see Westerveld et al. 2016, for a review). Results indicated early strengths in print-related skills (e.g., letter knowledge) were predictive of later word recognition ability and weaknesses in meaning related skills (e.g., story comprehension) were predictive of later reading comprehension difficulties. In a recent study, Westerveld et al. (2017) noted however, that most parents of children on the spectrum started reading to their child from an early age and many (66%) parents of preschool-aged children on the spectrum frequently read to their child. Thus, this uneven emergent literacy profile seems to occur even in the presence of a relatively rich home-literacy environment (Lanter et al. 2012; Westerveld et al. 2017). This highlights the importance of investigating the content and quality of the parent–child interactions during SBR activities, particularly because children diagnosed with autism often show challenges in both oral language development and in engaging in social interactions, and thus SBR may not be the most preferred activity by these children or their parents (Dynia et al. 2014; Westerveld and van Bysterveldt 2017).

Only two published studies have investigated the SBR behaviors of parents with their preschoolers on the spectrum (Fleury and Hugh 2018; Tipton et al. 2017). Tipton et al. asked parents of children (ages 4 to 7 years) on the spectrum ($n = 111$) to share four wordless picture books. Parent behaviors were coded for the use of language elicitation strategies and correlated with the children's social interaction skills (on the Child Communication Checklist-2 [CCC-2]), their IQ (Wechsler Preschool and Primary Scales of Intelligence [WPPSI]), and the children's behavior problems (based on a checklist). Parents of children on the spectrum in this study used a range of language elicitation techniques (e.g., asking questions, providing feedback, and teaching novel language skills). Children's social interaction skills were positively correlated with parents' use of clarification techniques, although the correlation was small ($r = 0.20$). In addition, parents' use of language elicitation techniques was negatively linked to their children's IQ ($r = -0.23$), with children with lower IQ receiving higher levels of parental input. Based on their findings and acknowledging that their non-experimental design could not confirm causality, Tipton et al. hypothesized that parental use of clarification techniques might facilitate children's social communication development and that children with lower IQ may require more

parental support during SBR. However, as recognized by Tipton et al. (2017), this study was conducted in a clinic setting, using wordless picture books, with children who were at different levels of schooling. It is thus not clear if the results would generalize to a more naturalistic setting, such as the child's home environment, using common picture books containing text, with children who have not yet started formal schooling. It should also be noted that the children's behaviors during the book reading activity were not observed.

More recently, Fleury and Hugh (2018) addressed some of the limitations identified in Tipton et al.'s (2017) study by observing the SBR sessions of parents and their preschool age children on the spectrum (ages 3 to 5; $n=17$) as well as a group of parents with TD preschoolers ($n=20$). Parents were seen in their home environment and asked to share a total of nine books with their child across three separate examiner video-taped sessions. Sessions were scored for adult book reading quality (drawing attention to text, promoting interactive reading, and using literacy strategies) and child engagement (active, passive, disruptive/unengaged). Children's verbal engagement was not reported. Children on the spectrum showed lower levels of passive engagement than their TD peers, whereas TD children showed lower rates of non-engagement than the children on the spectrum. Consistent with previous research investigating the links between the quality of SBR with TD children, the parents' reading quality was positively correlated with child engagement across both groups.

The Current Study

The current exploratory study examined the SBR behaviors of parents with verbal preschoolers on the autism spectrum and investigated how these behaviors correlated with their children's verbal behaviors during shared book reading as well as the children's performance on norm-referenced communication and standardized emergent literacy tasks. We asked parents of preschool-age children on the autism spectrum to videotape themselves sharing books with their child and analyzed these videos for parent- and child behaviors. We focused on parent meaning- and print-related SBR behaviors that are known to facilitate children's oral language and emergent literacy skills (Dickinson et al. 2012). As overviewed, parents' use of book-related language (e.g., labelling of pictures and introducing new words, explaining the meanings of words, and relating words to the child's own experiences) during SBR facilitates children's vocabulary skills (Bus et al. 1995). Further, adults' use of questions stimulates children's vocabulary development (Blake et al. 2006; Sénéchal et al. 1995). These two parent behaviors are often combined in studies investigating the effectiveness of SBR in promoting word learning in preschoolers (see Wasik et al. 2016); however, in the current study it was of interest what specific behaviors parents of children on the spectrum might display during SBR. A less-well researched parental meaning-related behavior is the explicit teaching of story grammar elements during SBR (Breit-Smith et al. 2017). Knowledge of story grammar elements is important for (future) reading comprehension as it provides the child with a mental model of the typical composition of a story. Considering children on the spectrum are at significant risk of reading comprehension difficulties, it is thus important to investigate if parents of preschoolers on the spectrum expose their children to story grammar elements. Finally, we wanted to investigate if parents demonstrated explicit teaching of print-related skills (e.g., print referencing, Justice and Ezell 2000).

Due to the interactive nature of SBR, we also considered children's participation. One way of measuring participation is by calculating the duration of the SBR session (Hindman et al. 2014). Acknowledging the potential impact children's verbal participation may have on the SBR interaction, we captured children's verbal participation by tallying the number of utterances and the number of different words they used, and investigated whether these were correlated with the parents' SBR behaviors as described above (i.e., parents' use of book-related language, explicit teaching of print-related skills, explicit teaching of story structure, and use of questions). Furthermore, we measured whether these parent behaviors during SBR correlated with their children's performance on norm-referenced language and communication measures and print-related emergent literacy skills of alphabet knowledge and print concept knowledge.

In summary, the following questions were asked:

1. What meaning- and print-related behaviors do parents of preschoolers on the spectrum demonstrate during a SBR activity?
2. What are the correlations between parent SBR behaviors and child verbal behaviors during SBR?
3. What are the correlations between parents' meaning-related SBR behaviors and children's communication assessed using direct child assessment and parent report?
4. What are the correlations between parents' print-related SBR behaviors and children's alphabet knowledge and print concept knowledge?

Method

Design

Participants were recruited for a longitudinal study investigating the emergent literacy skills of children with autism (Westerveld et al. 2017). Cross-sectional data from Time 1 were used to answer the research questions.

Participants

As described in detail in Westerveld et al. (2017), a total of 57 participants were recruited. All parents were asked to complete a home video of an SBR session using two different books and 51 families completed the video. Four families were excluded due to reading the same book on both occasions. Of the 47 families remaining, children (39 boys, 8 girls) were aged between 48 and 70 months ($M = 57.53$; $SD = 6.22$) and had not yet commenced formal schooling (i.e., Foundation Year of primary school education in Australia). All children had a confirmed ASD diagnosis, spoke in short phrases or sentences, and were capable of participating in preschool-like activities (e.g., pointing to pictures). Initial community diagnosis and Autism Diagnostic Observation Schedule (ADOS; Lord et al. 2012) results obtained from trained professionals were used to confirm autism diagnosis. For those children without existing ADOS results, the Social Communication Questionnaire (SCQ; Rutter et al. 2003) was administered using a cut-off score of 11 or higher (as per Eaves, Wingert, Ho and Mickelson 2006). Two children with borderline SCQ results were then administered the ADOS by a trained research assistant to verify diagnosis. Demographic information for the participants is summarized in Table 1, along with the parents' level of education. English was the main language spoken in the home for all participants.

Table 1 Participant characteristics ($N = 47$)

	n (%)	*M*	*SD*	Min–Max
Parent education				
High school	12 (25.5)			
Graduate degree	35 (74.5)			
Gender (child)				
Male	39 (83)			
Female	8 (17)			
Child age (months)		57.53	6.22	48–70
SCQ		16.20	0.90	5–32
PPVT-4 SS		92.69	2.38	66–127
Nonverbal ability (MSEL)		83.08	2.77	44.35–119.23
VABS-II				
Comm SS		85.11	11.90	57–110
Comm AE		36.52	1.58	17–69
Expressive AE		37.24	1.40	16–59
Receptive AE		35.80	2.15	12–90
PALS-PreK				
AK (%)		13.16 (50.61)	9.17 (35.26)	0–25.5 (0–98.08)
PWA (%)		5.66 (56.60)	3.02 (30.24)	0–10 (0–100)

SCQ Social Communication Questionnaire, *MSEL* Mullen Scales of Early Learning ability score, *PPVT SS* Peabody Picture Vocabulary Test Standard Score, *VABS-II* Communication scores presented as Standard Scores (SS) and age-equivalent (AE) scores (in months), *PALS-PreK* Phonological Awareness Literacy Screening for Preschool, *AK* Alphabet Knowledge, *max score* 26, *PWA* print and word awareness, *max score* 10

Procedure and Tasks

For the larger longitudinal study, all children were seen on two occasions by certified practising speech pathologists at the child's early childhood facility, in their home, or in the university clinic. Following the first assessment session, parents were asked to complete a home video of an SBR session with their child and asked to return the video before the next assessment session. Parents were asked if they wanted to borrow a video camera or were happy to use their own recording device (e.g., a phone). All parents were provided with a mini tripod.

Autism Traits

Performance on the *Social Communication Questionnaire* (SCQ; Rutter et al. 2003) was used as a measure of autism traits. Research has shown the SCQ to have good psychometric properties, with high sensitivity (0.88) and specificity (0.72) (Chandler et al. 2007), fair internal consistency (Snow and Lecavalier 2008), and convergent validity (Eaves et al. 2006).

Nonverbal Ability

Nonverbal cognitive ability was evaluated using the *Mullen Scales of Early Learning* (MSEL; Mullen 1995) and used for descriptive purposes. A nonverbal cognition score was calculated by dividing the child's age equivalent average across the Visual Reception and Fine Motor subscales by the child's chronological age in months, before multiplying it by 100, consistent with previous research with this population (e.g., Yang et al. 2016).

Receptive Vocabulary

The *Peabody Picture Vocabulary Test—4th Edition* (PPVT-4; Dunn and Dunn 2007) was administered to determine the

children's level of receptive vocabulary. This task required the children to point to a picture (from a set of four) that matches the word spoken by the examiner. As reported in the manual, the PPVT-4 has good reliability (test–retest = 0.93; split-half = 0.94). Furthermore, this test has been used extensively in research investigating language skills of children on the spectrum (e.g., Condouris et al. 2003). Standard scores were computed and used for analysis.

Communication Skills

The Communication domain of the *Vineland Adaptive Behavior Scales—2nd Edition* (VABS-II; Sparrow et al. 2005) was used to determine the children's communication skills. The Communication domain comprises three subdomains: receptive, expressive, and written. Test–retest reliability for ages 3–6 is excellent (Communication domain, $r = 0.90$; receptive, $r = 0.84$; expressive, $r = 0.84$; written, $r = 0.89$). Communication Domain standard scores are reported for descriptive purposes. Age equivalent scores were calculated for three subdomains as reported in the manual; the receptive, expressive, and written communication scores were analyzed separately. Age equivalent scores were chosen for analysis based on recommendations made for preschool-age children on the spectrum given potential for floor effects on standard scores in this population (Yang et al. 2016).

Print-Related Emergent Literacy Skills

The tasks contained in the *Phonological Awareness Literacy Screening for Preschool* (PALS-PreK; Invernizzi et al. 2004) were designed to be developmentally appropriate for 4-year-olds. The manual reports acceptable criterion-validity, predictive validity, internal consistency, and construct validity (Invernizzi et al. 2004). The following subtests from the PALS-PreK were used: (1) Alphabet knowledge. Alphabet knowledge comprised a composite score of two separate tasks: letter name knowledge and letter sound knowledge. For both tasks all 26 letters of the alphabet, printed upper case and shown in random order, were presented to children on a white sheet of paper. One line of letters was shown at a time. One point was allocated for each letter the child named correctly and the two tasks were summed and divided by two (max 26); (2) Print concept knowledge: Children's print-concept knowledge was assessed using the Print and Word Awareness (PWA) subtest. This task uses a small book and tests the child's knowledge of print concepts, such as identifying words on a page and reading from left to right, through a series of 10 items (max 10 points). This task was specifically developed for 4-year-olds and shows acceptable internal consistency (Cronbach's $\alpha = 0.75$). For both tasks, the composite alphabet knowledge and PWA raw scores were used for analysis.

SBR Task

Parents were provided with two books and asked to complete a video of themselves sharing these with their child, *Pip and Posy, the Big Balloon* (Scheffler 2012) and *Pop up Peekaboo. Woof! Woof!* (Sirret 2013). The first book is a story with a clear narrative structure, with short, simple sentences and colorful illustrations. The second book is an interactive text, with lift-the-flaps and pop-up animals, with bright, colorful illustrations and repetitive text. No instructions were provided to parents regarding the order in which books were to be read or whether the books were to be read in one sitting or separately. Parents were requested to read with their child 'as they typically would' and record information pertaining to the reading session on a short form provided. Information required included the time of day the session was completed, whether the child had seen the book before, and whether the parent believed the video reflected a typical reading session with their child. SBR videos were transcribed verbatim (parent and child utterances) and entered into the software program Systematic Analysis of Language Transcripts, New Zealand/Australia version 2018 (SALT-NZAU; Miller et al. 2017). Duration of reading time per book was also recorded from the video play time. The quality of all videos was sufficient for coding purposes.

Parent SBR Behaviors

The transcripts were hand-scored for three types of parent behaviors: (1) exposure to book vocabulary / language, coded as 'words' [W], (2) explicit teaching of print-related skills [EP], (3) explicit teaching of story structure [ESS], and (4) use of questions [Q]. The Appendix provides an overview of the parent SBR behaviors including detailed examples of coded behaviors. The total number of observations per behavior was used for analysis.

Child Verbal Behaviors

The following child behaviors were calculated automatically using SALT: (1) Total number of child utterances (communication units); and (2) number of different words (NDW).

Reliability

Twelve videos (12%) were randomly selected (using SPSS) and viewed by an independent researcher, a certified practising speech pathologist. First, the independent researcher viewed the videos and checked the transcripts for accuracy of transcription. Out of the total number of words (5871) across the

12 transcripts, there were 98 disagreements (1.6%). The independent researcher then coded all transcripts for the four parent behaviors. Intraclass reliability coefficients were calculated and showed good agreement between the two raters for all behaviors (Wtotal, $\alpha = 0.98$; EPtotal, $\alpha = 0.80$; and ESStotal, $\alpha = 0.98$).

Data Analysis

Both books were combined for analysis due to not counterbalancing the sequence in which the books were read by parents to their child. Parents varied greatly in the length of time they spent reading with their child, with session durations (across books/sittings) ranging from 199 s (3 min, 19 s) to 1116 s (18 min, 36 s), $M = 391$, $SD = 174$. Spearman's rho was used to assess whether differences in reading time duration were associated with individual child and parent characteristics. No significant associations were found between time spent reading and child age, SCQ score, nonverbal ability, receptive vocabulary (PPVT-SS), VABS-II communication domain age equivalent, and parent education level ($r = 0.04$ to 0.22, all $ps > 0.05$). To account for the variability in reading duration, both child and parent behaviors were divided by the time spent reading. Spearman's rho was used to explore the relationships between parent SBR behaviors and child verbal behaviors, parents' meaning-related SBR behaviors and children's receptive vocabulary and general communication skills, and parents' print-related SBR behaviors and children's alphabet knowledge and print concept knowledge. To further explore the unique contribution of each parent SBR behavior to child verbal behaviors, two multiple regression analyses were conducted post hoc to follow-up significant a priori zero order correlations that were conducted to address the research questions. For the first analysis, number of child utterances per minute was the dependent variable (DV); for the second analysis, child number of different words per minute was the DV. For both, predictors entered were parent behaviors: book related language total per minute (Wtotal/min), explicit teaching of story structure per minute (ESStotal/min), questions asked by parents total per minute (Qtotal/min), and explicit print-related teaching behaviors per minute (EPtotal/min). Due to the exploratory nature of the current study, increased risk of Type 1 errors was considered less of a concern than Type 2 errors. Although the design necessitated multiple analyses, which potentially increased the possibility of Familywise error, Bonferroni correction was deemed too conservative (Perneger 1998). Thus, a p-value of 0.05 was retained for all analyses. Cohen's (1988) recommendations for interpreting effect sizes for correlation analyses (small: 0.1; moderate: 0.3; large: 0.5) were applied.

Results

Data Screening

Missing value analysis showed < 5%, missing completely at random, Little's MCAR test $\chi^2(141) = 0.00$, $p = 1.00$. Thus, data were deleted listwise by analysis as acceptable under these conditions (Tabachnick and Fidell 2007). Some underlying distributions showed violations of normality (Shapiro–Wilk's test, $p > 0.05$), however these were deemed satisfactory due to the robust nature of the analyses conducted. Outliers were detected using z-scores per outcome ($n = 3$; cut-off > 3.29); however, upon further inspection these were found to have no influence on outcomes of analyses and were thus retained. Data were screened for assumptions of multiple regression including independence of residuals, linearity, homoscedasticity, multicollinearity, outliers (all studentized deleted residuals < 3.29) and influential datapoints, and normality of residuals. No major violations were observed, however one influential data point was detected, but further inspection confirmed this was a genuine data point and it was thus retained for analysis.

Parent SBR Behaviors

We first described the meaning- and print-related behaviors of the parents during the SBR activity. As shown in Table 2, there was wide variability across all parent behaviors, particularly the number of times they used book-related language and the number of questions they asked their child. There were relatively few instances of explicit teaching of story structure or print-related skills. When considering the percentage of parents using specific meaning-related SBR behaviors it was found that more than 90% of parents used book-related language or asked questions at least once during the session; in contrast 64% of parents demonstrated at least one instance of explicit teaching of story structure; 72% showed explicit teaching of print on at least one occasion.

Correlations Between Parent SBR Behaviors and Child Verbal Behaviors

As shown in Table 2, considerable variability was found in the amount of verbal behavior children exhibited across the two book readings, with total number of utterances ranging from 1 to 104 (from 0.28 to 15.43 utterances per minute) and the number of different words used by children ranging from 1 to 168 (0.28–15.07 per minute). As shown in Table 3, moderate significant associations ($r = 0.32$ to 0.57) were found between the children's verbal behaviors (per minute) and parents' meaning-related SBR behaviors, except for

Table 2 Parent and child behaviors during shared book reading across books ($N=47$)

	M (*SD*)	Min–Max	% of parents using technique at least once
Reading duration (seconds)	391.30 (173.90)	199–1116	
Wtotal	19.45 (2.45)	0–64	95.7
Wtotal/min	2.77 (2.28)	0–11.96	
ESStotal	2.34 (0.46)	0–12	63.8
ESStotal/min	0.33 (0.46)	0–2.12	
Qtotal	24.32 (3.12)	0–91	93.6
Qtotal/min	3.34 (2.31)	0–8.5	
EPtotal	2.66 (0.43)	0–13	72.3
EPtotal/min	0.39 (0.43)	0–1.94	
Child utterances	32.43 (3.81)	1–104	
Child utterances/min	4.61 (2.79)	0.28–15.43	
Child-NDW	47.70 (5.84)	1–168	
Child-NDW/min	6.63 (3.55)	0.28–15.07	

Wtotal SBR book-related vocabulary/language total, *ESStotal* explicit story structure-related teaching behaviors total, *C-NDW* child number of different words, *Qtotal* questions total, *EPtotal* explicit print-related teaching behaviors total, */min* per minute of shared book reading.

Table 3 Spearman's rho correlations between parent SBR behaviors and child verbal behaviors when correcting for duration

	1	2	3	4	5	6
1. C-UTT/min	–	0.87**	0.35*	0.32*	0.57**	0.24
2. C-NDW/min		–	0.19	0.34*	0.40**	0.29*
3. Wtotal/min			–	0.32*	0.63**	0.17
4. ESStotal/min				–	0.38**	0.02
5. Qtotal/min					–	0.24
6. EPtotal/min						–

C-UTT/min number of child utterances per minute, *C-NDW/min* child number of different words per minute, *Wtotal/min* SBR book-related vocabulary/language total per minute, *ESStotal/min* explicit story structure-related teaching behaviors total per minute, *Qtotal/min* questions total per minute, *EPtotal/min* explicit print-related teaching behaviors total per minute

*$p<0.05$; **$p<0.001$

parents' use of book-related vocabulary per minute and children's number of different words per minute. Associations between parents' use of explicit teaching of print-related skills and their child's verbal behaviors were small to moderate ($r=0.24$–0.29) and only reached significance for Child NDW and parents' use of print-related teaching.

Multiple Regressions: Child Verbal Behaviors Predicted by Parent SBR Behaviors

Two multiple regressions were conducted to predict number of child utterances and child number of different words (per minute) from parent behaviors (per minute): book related vocabulary/language (Wtotal/min), explicit story structure (ESStotal/min), questions asked (Qtotal/min), and explicit print-related teaching behaviors (EPtotal/min). Parent behaviors taken together significantly predicted the number of child utterances per minute, $F(4, 42)=7.98$, $p<0.001$. The overall model predicted 43.2% (R^2) of the variance in number of child utterances, with an adjusted R^2 of 37.8%, indicating a moderate effect. However, only parents' explicit teaching of story structure added a significant unique contribution to the prediction of number of child utterances, accounting for 9% of the variance, see Table 4. In contrast, parent behaviors (book related vocabulary/language, explicit story structure, questions, print-related teaching) taken together did not predict number of different words used by the child ($p=0.071$) with the overall model predicting 18.2% (R^2) of the variance in number of different words per minute, with an adjusted R^2 of 10.4% indicating a small effect. However, questions asked (Qtotal/min) contributed a unique proportion of the variance accounting for 9%, see Table 4.

Table 4 Summary of multiple regression analysis of parent behaviors on child utterances and number of different words per minute

Dependent variable	*B* (*SE*)	*β*	*t*	*p*	sr^2
Number of child utterances/minute					
Constant	2.12 (0.63)		3.37	0.002	
Wtotal/min	0.25 (0.18)	0.20	0.1.37	0.18	0.03
ESStotal/min	2.09 (0.81)	0.34	2.58	0.01	0.09
Qtotal/min	0.34 (0.18)	0.28	1.93	0.06	0.05
EPtotal/min	−0.06 (0.79)	−0.009	−0.08	0.94	< 0.001
Number of different words/minute					
Constant	4.69 (0.96)		4.89	< 0.001	
Wtotal/min	−0.22 (0.28)	−0.14	−0.80	0.43	0.01
ESStotal/min	1.59 (1.23)	0.21	1.29	0.20	0.03
Qtota/min	0.58 (0.27)	0.38	2.13	0.04	0.09
EPtotal/min	0.23 (1.20)	0.03	0.20	0.85	0.001

B unstandardized coefficient, *SE* standard error, *β* standardized coefficient, *t t* value, *p p* value, sr^2 squared semi-partial correlation

Correlations Between Parent Meaning-Related SBR Behaviors and Child Receptive Vocabulary and General Communication Skills

We explored the relationships between parents' meaning-related SBR behaviors and children's performance on two norm-referenced communication measures: the PPVT-4 and the VABS-II receptive and expressive communication subdomains. As shown in Table 5, no significant associations were found (r's < 0.19) between parent meaning-related SBR behaviors observed and children's performance on these two norm-referenced measures.

Correlations Between Parents' Print-Related SBR Behaviors and Children's Print-Related Emergent Literacy Skills

Next, we explored the relationships between parents' print-related SBR behaviors, and children's performance on alphabet knowledge and print concept knowledge on the PALS-PreK and parent-reported performance on the VABS-II Written Communication subdomain. A moderate significant correlation was found between parents' use of print-related SBR behaviors and their child's performance on the VABS-II written subdomain ($r = 0.35$). In contrast, mild non-significant associations were found between parent SBR behaviors related to explicitly teaching their child print-related skills and children's alphabet knowledge ($r = 0.27$), and between children's print concept knowledge and parent print-related teaching behaviors ($r = 0.28$). Table 5 shows the correlations.

Discussion

Previous research has shown that as a group, children on the autism spectrum often demonstrate strengths in print-related and weaknesses in meaning-related emergent literacy skills (see Westerveld et al. 2016). To provide insight into whether these emergent literacy profiles may be linked to

Table 5 Spearman's rho correlations between parent SBR behaviors and child language and literacy measures, correcting for duration

	1	2	3	4	5	6	7	8	9	10
1. Wtotal/min	–	0.32*	0.63**	0.17	−0.08	−0.009	0.15	−0.04	0.14	−0.05
2. ESStotal/min		–	0.38**	0.02	0.15	−0.15	−0.19	−0.09	−0.001	−0.08
3. Qtotal/min			–	0.24	−0.05	−0.03	0.11	−0.13	0.11	−0.09
4. EPtotal/min				–	0.03	0.06	0.35*	0.19	0.27	0.28
5. VABS Rec					–	0.61**	0.15	0.46**	−0.11	0.17
6. VABS Exp						–	0.29	0.49**	0.03	0.31*
7 VABS Writ							–	0.34*	0.79**	0.46**
8. PPVT SS								–	0.23	0.51**
9 AK									–	0.42**
10 PWA										–

Wtotal SBR book language total, *ESStotal* explicit teaching of story structure total, *Qtotal* questions total, *VABS Rec* VABS-II Receptive Language Subscale—age equivalent, *VABS Exp* VABS-II Expressive Language Subscale—age equivalent, *VABS Writ* VABS-II Written Language Subscale—age equivalent, *PPVT* peabody picture vocabulary test standard, *EPtotal* explicit print-related teaching behaviors total, *AK* alphabet knowledge, *PWA* print and word awareness, */min* per minute

*p < 0.05; **p < 0.001 Score; *p < 0.05; **p < 0.001

children's SBR experiences in the home, we investigated parent- and child-behaviors during SBR interactions. The time parents spent sharing the two books ranged from 3 to 18 min ($M = 6$ min). Interestingly the duration of the reading sessions was not significantly related to the children's age, autism characteristics, nonverbal cognitive ability, receptive vocabulary, or communication skills, nor to the parents' level of education.

Parents demonstrated wide variability in SBR behaviors, consistent with previous research with typically developing preschoolers (Price et al. 2009; Tompkins et al. 2017). Furthermore, parents demonstrated a range of SBR behaviors, most frequently the use of book-related vocabulary/language and asking questions, both known to promote children's oral language skills. Although there were far fewer instances of explicit teaching of story structure and print-related skills, at least 62% (story structure) and 72% (print-related teaching) of parents demonstrated those behaviors at least once during the book reading sessions. These results appear higher than those reported in a recent investigation into families' book-related talk within a large representative sample ($n \sim 800$) in the US (Hindman et al. 2014). Although a different coding system was used, Hindman et al. observed that 16% of parents recalled/summarized the story during or after the book reading (roughly equivalent to our coding of explicit teaching of story structure); only 1% of families pointed out sounds or letters during the SBR. In contrast, Breit-Smith et al. (2017) observed that 100% of the parents participating in their study ($n = 23$) included at least one extra-textual exposure to a story structure element when sharing a book with their typically developing preschooler.

Next, we investigated the relationship between parent SBR behaviors and child verbal behaviors during SBR, while controlling for reading duration. Moderate to strong significant correlations were found between the children's verbal behaviors (number of utterances and the number of different words) and most of their parents' use of SBR behaviors. These results are in line with the significant correlations found between parent and child verbal behaviors during SBR in previous studies with typically developing preschoolers (Luo and Tamis-LeMonda 2017). The correlations between the parents' use of questions and their child's verbal behaviors (number of utterances and NDW) were moderate to strong ($r = 0.57$ and 0.40, respectively).

Although multiple regression indicated parents' use of meaning-related behaviors predicted their children's verbal participation, the only unique individual predictor was the explicit teaching of story structure for child utterances per minute, and parents' use of questions was the only individual predictor for their children's number of different words per minute. Taken together, the results indicate that the parents' use of meaning-related strategies encouraged their children to verbally participate in the SBR session. We also noticed strong correlations between parents' use of questions, their use of book-related language ($r = 0.63$), and their explicit teaching of story structure ($r = 0.38$) indicating that these three types of meaning-related SBR behaviors were linked. This may explain why only one of the SBR behaviors predicted only 9% of the children's verbal behaviors (explicit teaching of story structure for number of child utterances), while taken together parents' SBR behaviors predicted 43% of the children's verbal behavior in number of utterances with a moderate effect. Although we did not significantly predict the children's number of different words per minute, number of questions asked per minute was a significant individual predictor, predicting 9% of the variance. Further detailed analysis of parent and child verbal behaviors is now needed to investigate how parent SBR behaviors may influence children's verbal participation and vice versa and to unpack the potential transactional relationship (e.g., see Luo and Tamis-LeMonda 2017; McGinty et al. 2012).

Our third question investigated the correlations between parents' meaning-related SBR behaviors and children's performance on two norm-referenced communication measures. Contrary to expectations, there were no significant correlations between any of the parents' SBR behaviors and their children's performance on these tests. As our design was correlational, not experimental, directional explanations cannot be drawn; however, we tentatively suggest that parents' perceptions of their children's communication skills (as measured on the parent-reported VABS) did not influence their meaning-related SBR behaviors during SBR. Furthermore, the children's level of receptive vocabulary (PPVT-4) did not seem to be correlated with the parents' meaning-related behaviors, which is surprising considering the strong links between word learning and SBR interactions (Flack et al. 2018). It may be possible that parents, regardless of their child's language ability, use these SBR behaviors that may have been taught in early intervention services, to facilitate their child's engagement in the SBR activity as observed in the children's number of utterances per minute.

We found a mild positive, but non-significant association between parental SBR behaviors related to explicitly teaching their child print-related skills and children's alphabet knowledge and print concept knowledge. However, a significant strong correlation was found between children's performance on parent-reported written skills (VABS) and their alphabet knowledge and print and word awareness. These results are consistent with those investigating typical populations (e.g., Sénéchal 2006), and with those reported on preschool children with language impairment (Sawyer et al. 2014) which found that parental literacy teaching (based on a parent questionnaire) was not associated with children's print knowledge ($r = .09$). A plausible explanation for the stronger correlations between parents' print-related SBR behaviors and their children's print skills in the current

study is that parents of preschoolers on the autism spectrum may demonstrate these behaviors in response to their child's specific interest in letters and sounds. Considering the correlational nature of this study, we cannot comment on the direction of the associations, nor did we incorporate a measure of child interest in print.

Limitations and Future Directions

This study investigated and described the SBR behaviors of a group of parents and their verbal preschoolers on the spectrum. As such, it is not known if the results would generalize to preschoolers who are minimally verbal, who comprise approximately 30% of preschool children on the spectrum who exit early intervention programs (Rose et al. 2016). This will be worth investigating in future. Further, we did not include a control group that may have provided us with additional insights into the potential differences in SBR behaviors across groups. However, the choice of a control group is not straightforward (Tager-Flusberg 2004). Choosing a control group of children matched for language ability would result in a much younger control group; matching the participants to a group of typically developing children matched on chronological age would include children with more advanced oral language skills. Thus, due to the importance of age (i.e., years of exposure to story books) and oral language proficiency to the SBR process, we chose to investigate these SBR behaviors within a group of children on the spectrum (as suggested by Tager-Flusberg 2004). The parents who participated in this research all showed an interest in literacy by signing up for the study, which may have influenced our findings. Finally, we asked parents to share two unfamiliar books in their home environment and did not control for order, nor did we ask parents to read both books in one session. Although we combined the two books in our analyses to control for a practice effect, recent research has suggested that familiarity with the book may influence the engagement of children on the spectrum (Fleury and Hugh 2018). It is therefore not known if our findings would generalize to parents and children sharing familiar picture books.

Conclusion

SBR during the preschool years is known to stimulate oral language and emergent literacy skills in typically developing preschoolers. The results from our study showed that parents were able to engage their preschool children on the autism spectrum in an SBR activity, using unfamiliar story books. Parents used a range of strategies known to promote both print-related and meaning-related emergent literacy skills. Results from our exploratory study do not suggest parents focus on print rather than meaning when engaging their preschooler on the spectrum in SBR. Further research is clearly needed to better understand why this group of children often shows uneven reading profiles from a very young age.

Acknowledgements The authors wish to thank the parents for sharing their home-recorded SBR videos.

Funding This study received financial support from the Cooperative Research Centre for Living with Autism (Autism CRC), established and supported under the Australian Government's Cooperative Research Centres Program.

Compliance with Ethical Standards

Conflict of interest The first author has a financial relationship with SALT Software, LLC. SALT Software, LLC, did not participate in the design, execution, or analysis/interpretation of the project/project data nor did it review the article before submission. The authors declare they have no other conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional research committee (Griffith University ethics committee, AHS/13/14/HREC) and the Sydney Children's Hospitals Network ethics committee (HREC/14/SCHN/270) and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

Appendix

Coding Guidelines for Shared Book Reading Videos

Start time: Once the book has been selected and when the book related discussion begins. Do not code video footage preceding this time (e.g., parent setting up the camera).
End time: Once the book related discussion has ceased. DO code post-book discussions about the story, questions about the story structure, child retells, summarizations, second readings, and time spent looking at/discussing pages (including the back cover).
Please note: Story book related behaviors should only be coded if they are directed towards the target child. Any questions, answers or comments directed to anyone else in the video should not be included.

Behavior: Words Words Words: Exposure to book language [W]

- W1: Labelling/describing pictures using words or gestures.
  Examples: Points to pictures while reading word (labelling).
  Look at the little dog (while pointing to picture).
  Does NOT include imitations of the child's utterance.

- W2: Linking words to another object or event related to the child's own experience.
  Examples: *This puppy looks like (child's dog's name) doesn't he*?
  That's why mummy makes sure she ties your balloon to your wrist.
  It popped, just like your balloon!
- W3: Explaining word meanings and associations in a way the child can understand.
  Examples: May include a definition: *A kennel is a house for doggies*.
  Associations: *It's a bucket, it's like a box; A pony is like a small horse.*
- W4: Emphasizing low frequency words, not encountered in everyday discourse.
  Examples: Ferocious, aquarium, kennel, author, illustrator, shop keeper, grinned, dashed, fox, crow, badger.

Behavior: Explicit Teaching of Print-Related Skills [EP]

- EP1: Parent points to text.
  Examples: While parent or child is reading, parent points to specific words (often to highlight).
  Parent points out words on the pages and comments about them (e.g., *This says…*)
- EP2: Parent talks about print features.
  Examples: *The title of this book is "Pop Up Peekaboo, Woof Woof*!"
  It was illustrated by …. (Note: count the words 'author' and 'illustrator' as low frequency words [W4])
- EP3: Parent talks about letter names and sounds.
  Parent identifies a letter on the page and makes link to the letter sound: *That is the letter S, it makes a sssss sound!; P says…?*

Behavior: Explicit Teaching of Story-Structure [ESS]

- ESS1: Parent talks about the main character/s outside of the text.
  Examples: *This story is about Pip and Posy and a big balloon/a puppy dog…*
  Who do you think this story will be about?
  Who were the characters in the story?
- ESS2: Parent asks questions and/or makes comments about what happens next in the story to encourage the child to make predictions.
  Examples: *What do you think will happen next?*
  What do you think he will do?
  Note: Include questions which prompt the child to make a prediction in order to answer e.g., *What should she do now? What do you think her great idea is?*
- ESS3: Parent comments about or summarizes the story, referring to the characters, setting, problem, events, and/or ending.
  Examples: Parent makes connections: *Pip is sad because his balloon popped*! (if discussed at the end of the book)
  He needs a new balloon because his one burst!
  Oh no! His balloon burst! That's a big problem!

Behavior: Asking Questions [Q]

- Q1: Parent asks the child open ended questions related to the story or book e.g., who, what, where, when, why, how.
  Examples: *Who is this story about?*
  What will happen next?
  Where are they going?
  Note: does not include requests to label e.g., *What is this?*
  What is he doing?
- Q2: Parent requests that the child label a picture/action, imitate a word/phrase, and/or asks a sentence completion question related to the story or book.
  Examples: *What's this?*
  What is he doing?
  Pip has a…
  And then…
- Q3: Parent asks the child closed ended questions related to the story or book (e.g., yes/no, forced-choice questions, requests to point).
  Examples: *Is this his balloon?*
  Is he happy or sad?
  Should he play bubbles or go home?
- Q4: Parent asks the child tag questions related to the story or the book.
  Examples: *He's happy now, isn't he?*
  Balloons are supposed to pop, aren't they?
  You can see it in the picture, can't you?

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