Children Simultaneously Learn Multiple Dimensions of Information during Shared Book Reading

Elise Breitfeld, Christine E. Potter & Casey Lew-Williams

Published online: 28 Jun 2021.

Submit your article to this journal

Article views: 188

View related articles

View Crossmark data

Routledge
Taylor & Francis Group

Check for updates

Children Simultaneously Learn Multiple Dimensions of Information during Shared Book Reading

Elise Breitfeld[a], Christine E. Potter[b], and Casey Lew-Williams[c]

[a]Princeton University, University of Wisconsin-Madison; [b]Princeton University, University of Texas at El Paso; [c]Princeton University

ABSTRACT
Picture books inherently contain many parallel dimensions of information and serve as a rich source of input for children. However, studies of children's learning from picture books tend to focus on a single type of information (e.g., novel words). To better understand the learning-related potential of shared book reading, we examined 4.5- to 5.5-year-old children's simultaneous learning of novel words, moral lessons, and story details from a reading interaction with a parent. Results showed that children successfully learned new words, extracted a moral lesson, and recalled story details from the picture book. Contrary to expectations, children's learning was equally strong regardless of whether or not parents were prompted to focus on learning as the key purpose of book reading. This research demonstrates that children learn diverse information presented across different time scales from picture books.

Introduction

Interactions with caregivers form the basis of early experience, and caregivers' language input is thought to be an important information source for young children's learning (Snow & Ferguson, 1977; Vygotsky, 1978; Weisleder & Fernald, 2013). In many cultures and communities, picture books are a particularly common source of this language input. Some parents report reading to their young children at least once a day (Deckner, Adamson, & Bakeman, 2006; Raikes et al., 2006; Young, Davis, Schoen, & Parker, 1998). Given this frequency, it is estimated that picture books could constitute up to 10% of a child's daily linguistic input (Montag, Jones, & Smith, 2015). Furthermore, research suggests that the activity of shared reading contributes positively to children's future success. For example, independent of parents' education, occupation, and social class, children who grow up with access to many books in their homes complete three more years of education, on average, than children who grow up in homes without books (Evans, Kelley, Sikora, & Treiman, 2010). Shared reading has also been found to be positively associated with children's factual knowledge, such as science and math (Ganea, Ma, & DeLoache, 2011; Hong, 1996; van den Heuvel-Panhuizen et al., 2016; Venkadasalam & Ganea, 2018), social skills (Curenton & Craig, 2011; Farver, Xu, Eppe, & Lonigan, 2006), and vocabulary size (Farrant & Zubrick, 2012; Sénéchal & Lefevre, 2002), all of which are

correlated with children's future academic achievement (Cooper, Moore, Powers, Cleveland, & Greenberg, 2014; Morgan, Farkas, Hillemeier, Hammer, & Maczuga, 2015). Thus, engaging in shared reading can support children's cognitive, social, and language development. In the current study, we examined children's ability to simultaneously learn story details, moral lessons, and new words from a picture book.

Story recall from shared reading

The contents of picture books present diverse types of information that children can learn, providing the potential to support a wide range of educational benefits. At the most basic level, picture books include a variety of factual details and story events. Previous research has shown that children as young as two years old begin to demonstrate memory for story events using implicit measures such as eye-tracking, but may fail to express the same knowledge through explicit measures such pointing (Kaefer, Pinkham, & Neuman, 2017). Children's free recall and recognition of story details continue to improve between ages three and five (Richter & Courage, 2017) and can be strengthened with repeated readings (Cornell, Sénéchal, & Broda, 1988). Additionally, the more parents discuss and provide extra-textual elaborations about events in the story with preschool children, the better they remember story events (Greenhoot, Beyer, & Curtis, 2014).

Learning moral lessons from shared reading

Often, picture books contain an overarching lesson or 'moral' of the story woven into the events of the book. Suprawati, Anggoro, and Bukatko (2014) investigated the content of a sample of picture books from the United States, Indonesia, and Japan and found that across these cultures, in the majority of books, the main character is presented with a challenge that is resolved in some way by the end of the story. Research has found that embedding positive messages within these story arcs has the potential to influence children's behavior. For example, in one study, 4- to 6-year-old children increased their carrot consumption after reading a picture book about a character who was only able to help his friend after eating carrots to make him strong (De Droog, Buijzen, & Valkenburg, 2014). These messages can also teach children prosocial values and improve their social skills. For example, after reading a book about the importance of sharing, preschoolers were more likely to behave altruistically in a sharing task (Larsen, Lee, & Ganea, 2018).

However, while children may change their behavior to match that of characters in picture books, it has also been shown that children have difficulty explicitly articulating or identifying the lessons presented in books and often fail to demonstrate moral comprehension. Even children in the latter years of elementary school (3rd to 5th grade in the United States) struggle to extract the main idea from narratives and to identify moral themes (Narvaez, Bentley, Gleason, & Samuels, 1998; Taylor, 1986). Specifically, children tend to be distracted by surface-level details of the story. In one study, when children were asked to select a description that matched the moral lesson of a story, they often selected distractors that shared superficial similarities with the original story, rather than selecting the response that matched the moral lesson; third graders only selected the correct vignette 11% of the time (Narvaez, Gleason, Mitchell, & Bentley, 1999). Research on kindergartners' comprehension of moral lessons from TV programs yields similar results. After watching a television

episode meant to promote inclusivity and tolerance, the majority of children failed to generate the correct lesson in response to an open-ended question, and when given three possible choices, children choose either an irrelevant lesson or a literal summary of the plot rather than the correct moral lesson (Mares & Acosta, 2008).

However, recent research reveals that children are more capable of extracting moral lessons from picture books and other narrative media when they are provided with scaffolding. Peebles, Bonus, and Mares (2018) found that compared to watching a normal television episode that focused on the importance of being honest, watching the episode with embedded questions and answers about key emotional content improved preschool children's ability identify the correct moral lesson; however, children in both groups still failed to identify the moral lesson above chance. Similarly, Walker and Lombrozo (2017) found that six-year-old children were able to successfully identify a vignette matching the moral of a story from a picture book, but only if they were asked during the reading of the book to explain why certain events happened. Children in a control group, who were not asked to provide explanations during reading, failed to identify the correct vignette. Thus, similar to story details, elaboration improves children's ability to identify moral lessons, but not necessarily to demonstrate explicit learning of moral lessons.

Learning words from shared reading

In addition to story details and moral lessons, picture books contain many words that children have the chance to learn. Picture books contain more unique word tokens and present them in more diverse contexts than everyday conversation (Montag et al., 2015), meaning that picture books provide particularly valuable opportunities for children to encounter new vocabulary. A meta-analysis of studies investigating children's ability to learn new words from picture books found that overall, children successfully learned 46% of the target words to which they were exposed (Flack, Field, & Horst, 2018). A variety of factors have been shown to influence their ability to do so. For example, 3-year-olds' word learning improves if they are exposed to a target word multiple times within the same context (i.e., repeated exposures within the same story; Horst, Parsons, & Bryan, 2011) and if the target word appears near the end of a page (Evans, Reynolds, Shaw, & Pursoo, 2011).

Children's word learning can also be influenced by the nature of the reader's extra-textual contributions relating to target words during shared reading interactions. Preschool children learn words better when they are provided with an explanation of the definition of a target word (Penno, Wilkinson, & Moore, 2002) or asked a question about a target word (Blewitt, Rump, Shealy, & Cook, 2009). When these types of dialogic reading styles are used, children learn more words than from non-dialogic shared reading interactions (Flack et al., 2018). Importantly, in many of these dialogic reading studies, the explanations and questions are specifically scripted by experimenters to highlight target words during shared reading. But, a study of naturalistic shared reading interactions between kindergartners and their parents revealed that only 4% of unusual words encountered in picture books were spontaneously discussed (Evans et al., 2011). Therefore, the manner in which parents and children interact during shared reading may play an important role in supporting children's learning of words found in picture books.

Beyond the content of a book or a book-reading episode, children's ability to learn is in part shaped by their vocabulary knowledge. Studies with 4- to 6-year-old children have

shown that children with larger vocabularies tend to show better comprehension and learning of new words presented in storybooks, compared to children who know fewer words (Robbins & Ehri, 1994; Sénéchal, Thomas, & Monker, 1995). Preschool children with stronger vocabulary skills are also better able to take advantage of scaffolding techniques, such as being provided with definitions and explanations of target word meanings or being asked extratextual questions (Blewitt et al., 2009; Ewers & Brownson, 1999; Penno et al., 2002). These studies suggest that across different types of interactions, the size of children's vocabulary affects their ability to take advantage of the opportunity to learn new words.

Children's concurrent learning of multiple types of information

As reviewed above, prior research demonstrates that children are capable of learning story details, moral lessons, and new words from picture books, with varying levels of success depending on the support they receive during shared reading. But critically, picture books always contain many dimensions of information, including some combination of familiar and unfamiliar words, moral lessons, character information, narratives, objects, background scenes, and much more. However, children's learning of words, moral lessons, and other types of information from picture books has typically been studied separately and these studies often include scripts specifically designed to highlight the specific information of interest (Flevares & Schiff, 2014; Ganea, Canfield, Simons-Ghafari, & Chou, 2014; Houston-Price, Howe, & Lintern, 2014; Nhundu, 2007). Children's ability to concurrently learn multiple different types of information from shared reading remains unexplored.

Might children find it difficult to engage in multiple different types of learning from picture books? Previous research has suggested that picture books can induce a large cognitive load that limits children's ability to learn due to memory constraints. Children's working memory capacity was found to correlate with their ability to learn words from picture books when the definitions of target words were provided during shared reading, but not if definitions were provided before or after the reading (Jimenez & Saylor, 2017), suggesting that children's working memory may be taxed by larger amounts of information presented at one time. Similarly, Flack and Horst (2018) found that children learned significantly fewer words from a picture book with two illustrations per page spread compared to a picture book with just one illustration per page spread. Children's word learning was hindered by the presentation of cluttered visual information, presumably due to demands on attention and memory, which are lessened when extraneous perceptual information is removed. For older children as well, cluttered visual input disrupts attention and comprehension during reading. First and second graders' learning from a picture book was found to be hindered by the inclusion of extraneous illustrations (Eng, Godwin, & Fisher, 2020). Thus, given that picture books may introduce high cognitive load and large amounts of perceptual input, it may be difficult for children to learn multiple types of information during a shared reading interaction.

Research in other domains of cognition also provides evidence that children may struggle to extract multiple types of information simultaneously. For instance, attending to and learning about one feature of a stimulus can interfere with learning of other features (Navon, 1977; Gómez, 2002; Wendelken et la., 2012). However, other studies suggest that children can attend to multiple types of information at the same time. For example, children are capable of sorting objects into multiple different types of categories simultaneously

based on a variety of features, e.g., classifying objects by both type and color, or by type and material (Bigler & Liben, 1992; Kalish & Gelman, 1992). In addition, children have been shown to simultaneously learn about individual words (i.e., mappings between objects and labels) and abstract category rules (i.e., features shared by objects with the same labels; Yuan, Perfors, Tenenbaum, & Xu, 2011). These results indicate that children are at least sometimes able to encode and remember more than one type of information from a single event or experience. In the current study, we tested whether or not children would be able to successfully learn at multiple levels during shared reading.

Parents' influence on children's learning from shared reading

In addition to cognitive factors that may influence children's ability to learn from shared reading, interactions with their parents may also affect the information that children extract. Children's learning of words, morals, and story details from picture books differs based on caregivers' extra-textual contributions (e.g., Aram, Deitcher, Sabag Shoshan, & Ziv, 2017; Gonzalez et al., 2014; Greenhoot et al., 2014), and the information emphasized in pedagogical interactions has been shown to limit the scope of children's learning (Bonawitz et al., 2011). Therefore, parents' attention and behaviors may be important for shaping children's learning of multiple types of information from shared reading interactions.

One factor that has been demonstrated to play a role in shaping caregivers' behavior during shared reading is the caregiver's expectations about the value of reading (e.g., Bojczyk, Davis, & Rana, 2016; Curenton & Justice, 2008; Lynch, Anderson, Anderson, & Shapiro, 2006). For example, caregivers who value reading as a source of learning are more likely to engage in behaviors that support learning, including asking questions and providing extra-textual information. Moreover, caregivers who endorse the view that reading should be fun are more likely to engage in behaviors with a positive emotional tone, such as offering praise and encouragement (Meagher, Arnold, Doctoroff, & Baker, 2008). Thus, the focus of caregivers' attention appears to shape shared reading interactions, and changing the information that they prioritize could in turn influence the information that children are likely to uncover. Indeed, previous research suggests that brief, parent-focused interventions can be successful in increasing parents' use of particular behaviors and strategies (e.g., Robinson et al., 2018). For instance, parents who were shown a 5-minute video that called their attention to pointing as an important part of children's language development subsequently increased their pointing compared to a control group (Rowe & Leech, 2019). However, links between parents' expectations about reading and children's learning remain under-explored.

The current study

The current study extends previous research on children's learning from picture books by examining whether or not children can learn multiple dimensions of information during shared reading with their parent. Specifically, we asked whether children are able to simultaneously learn words, a moral lesson, and specific story details from a single reading of a picture book. To do so, we created an original children's book about a gardening project at an elementary school that included exposure to four low-frequency English words, a moral lesson about the importance of sharing, and a variety of visual and auditory details. Our primary goal was to test whether children could learn at multiple levels simultaneously.

We also examined potential differences in children's learning from the book based on a manipulation of parents' attention to certain aspects of the book.

To understand how parents' focus during shared reading may affect children's learning, we primed parents to attend to different goals of reading, and evaluated the potential impact on children's learning of different types of information. Parents' attention to the book's content was manipulated prior to reading with their child. Half of the parents were primed to focus on the idea that reading promotes children's vocabulary growth (Word Learning condition). We chose to emphasize word learning because children vary substantially in how successfully they learn new words from a brief reading interaction (Flack et al., 2018), and parents seem to spontaneously discuss only a minority of unfamiliar vocabulary encountered in picture books (Evans et al., 2011), suggesting that we could feasibly influence performance. In addition, because picture books are widely viewed as source of new vocabulary (Weigel, Martin, & Bennett, 2006), we thought it was likely that parents would be successfully persuaded to increase attention to new words, and in doing so, support children's encoding of them. The other half of parents were primed to focus on the idea that reading promotes parent-child bonding (Control condition), as a way of providing similar emphasis on the value of reading without highlighting any particular target for learning.

To evaluate whether or not children can learn multiple types of information from storybooks, we used forced-choice tasks that tested children's ability to learn new words, story details, and a moral lesson. The main prediction was that children would successfully learn different types of information in parallel during a shared reading interaction. Although prior work on shared reading has pointed to high cognitive load as a reason why children may *not* be able to engage in this type of simultaneous learning (Flack & Horst, 2018; Jimenez & Saylor, 2017), research in other domains, such as category learning, has suggested that children are in fact capable of extracting multiple pieces of information from a single stimulus (Bigler & Liben, 1992; Kalish & Gelman, 1992; Yuan et al., 2011).

We also evaluated two secondary predictions about potential differences in children's learning. One was that parents would emphasize information about new words if they had been primed to do so, which in turn would shape children's learning. Specifically, we expected that parents in the Word Learning condition would provide extra verbal and nonverbal references to target words. We predicted that this added emphasis would boost children's word learning above levels observed in the Control condition, but would not improve learning of others information in the book. The other secondary prediction was that, across conditions, individual differences in children's vocabulary knowledge would affect their ability to learn from the reading interaction. Specifically, we expected that children with larger vocabularies would show more successful learning across all measures of learning, relative to children with smaller vocabularies.

Method

Participants

Our final sample included 39 parent-child dyads with children between 4.5 and 5.5 years of age (M = 59.2 months, SD = 3.0, range = 54.1–65.2; 18 girls; 37 mothers). The majority of dyads included children and their mothers (37 mothers, 2 fathers). One additional dyad was excluded from analysis because the child was reported to have known all of the target

words prior to participating. We chose to focus on this age group given the important links between preschool and kindergarten experiences and school success (e.g., Cooper et al., 2014). Participants were recruited in Princeton, New Jersey, USA and surrounding areas. All children were monolingual English speakers, and all parents were native speakers of English. All children were full-term, had no history of developmental delays, hearing loss, or vision loss. Dyads were randomly assigned to the experimental Word Learning condition ($N = 19$) or the Control condition ($N = 20$). We confirmed that, based on random assignment, there were no significant differences between conditions in children's age, children's vocabulary size, or parents' reported home literacy behaviors (all ps > .05).

Materials

Picture book

An original picture book, "Max Plants a Garden," was written and illustrated for this study. The picture book consisted of 22 pages of text and each page included an illustration corresponding to the text on the page (see Supplementary Materials). The narrative of the story incorporated a pro-social moral lesson about the importance of sharing. Embedded in the narrative were four uncommon, low-frequency target nouns that children were unlikely to hear or produce on a regular basis, if at all: *archway, gazebo, trowel*, and *spigot*. These nouns were selected based on their very low occurrence in North American English corpora on the Child Language Data Exchange System for children between 0 and 5.5 years of age (archway = 0 occurrences, gazebo = 1, spigot = 10, trowel = 6, out of 5,787,898 total words; MacWhinney, 2000). Each target noun appeared in the text once, accompanied by a depiction of its referent in the corresponding illustration (see Figure 1 for example). The referent of each target noun also appeared once more in a later illustration. All four nouns occurred in the text of the first half of the book, and the second instance of the referent appeared in the second half. Following the experiment, parents were asked to report whether or not they believed their child knew each target noun prior to the study to ensure that we only included unfamiliar words in our analyses.

Parent questionnaires

To test the effects of the attentional manipulation and assess individual differences in home literacy behaviors, parents completed two short questionnaires after reading the picture book with their child. The Parent Reading Belief Inventory (PRBI) was used to assess parents' views about teaching literacy and about the role of reading in supporting language development (DeBaryshe & Binder, 1994). The PBRI asks parents to report the extent to which they agree with statements such as: "Children learn new words, colors, names, etc. from books" and "My child knows the names of many things he or she has seen in books." An adapted version of the Home Literacy Environment Questionnaire was used to determine the types of literacy activities that parents and children engaged in at home (Van Steensel, 2006). No further analyses are reported about this questionnaire because there were no significant differences in home literacy activities between conditions and no interpretable or meaningful relations with other variables (all ps > .05). After reading the book, parents also completed a short checklist in which they were asked if their child already knew any of the four target nouns included in the picture book prior to participating in the study.

Figure 1. Sample page from a custom picture book used for this study, "Max Plants a Garden." On this page, the target word archway is introduced both in the text and in the illustration.

Vocabulary

The Peabody Picture Vocabulary Test (PPVT; Dunn & Dunn, 2007) was used to assess children's receptive vocabulary. Children's raw scores were used in the analyses as a measure of their current vocabulary knowledge.

Procedure

The study included three phases: a brief manipulation of parents' attention to different goals of reading, a shared reading interaction, and a testing phase. First, prior to reading the picture book, the experimenter explained to each parent that they would read a book to their child. In a between-subjects manipulation, the experimenter then emphasized that reading is valuable because children get to learn new words (*Word Learning condition*) or because reading promotes parent-child bonding (*Control condition*). We emphasized parent-child bonding in the Control condition to provide the same interest to parents and draw attention to the importance of engaging in shared reading without directing parents' attention specifically to any type of content in the book. The scripts for both conditions were developed to be as similar as possible with regard to length, level of detail, and scientific validity (see Supplementary Materials).

Following this manipulation, dyads were escorted to a separate room to read the picture book together. The parent was instructed to read with their child as they would at home. The experimenter left the room, and the reading interaction was video recorded.

When each dyad finished the book, the experimenter reentered the room for the testing phase. Children's learning of words, the moral lesson, and miscellaneous story details was evaluated via forced-choice tasks on an iPad. Half of children were randomly assigned to be tested first for learning of the words and then tested on story details and the moral lesson, while the other half were tested in the opposite order. The story details and moral lesson tasks were tested in a fixed order to avoid the possibility that children might become confused about the plot of the storybook after hearing a series of novel vignettes in the moral lesson task. While the experimenter interacted with the child, the parent responded to questionnaires. After completion of all of the experimental tasks, children's vocabulary was measured with the PPVT.

Word learning task

The word learning task consisted of one practice trial and 12 experimental trials in a four-alternative forced-choice task, modeled after the PPVT. On each trial, children were presented with a grid of four images on the iPad and asked to select the image depicting one of the four target nouns from the picture book. Children were not given any feedback after making their selection on each trial. Of the four images in each trial, one depicted the target noun (e.g., *archway*), one depicted one of the other three target nouns from the book (e.g., *gazebo*), and two depicted distractor referents that appeared in the illustrations of the book but were never directly labeled (e.g., a garden plot and a fountain; see Figure 2). To assess children's ability to generalize the target words from the picture book to new contexts, the task included three blocks: a "familiar token" block using the identical cartoon images that appeared in the picture book, a "near transfer" block using novel cartoon
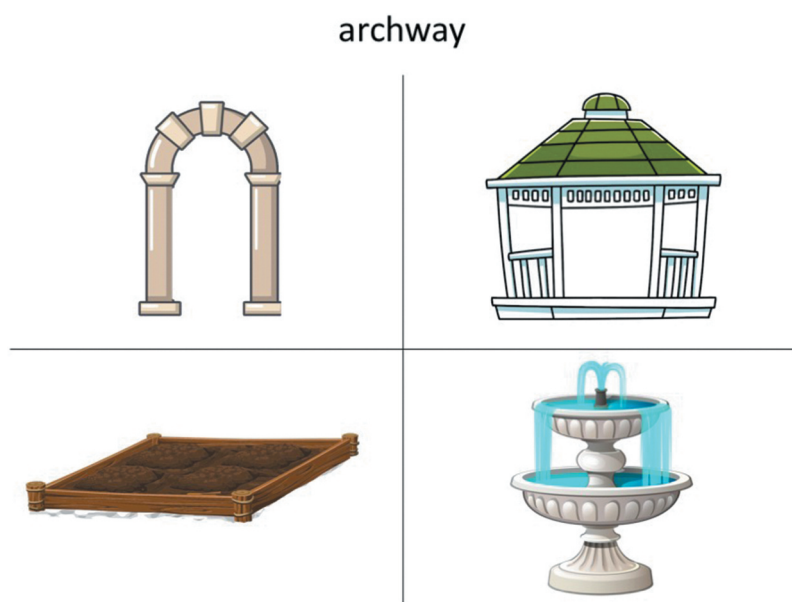
archway

Figure 2. Sample word learning test trial. Each 4AFC trial included an image of the target word (in this case archway), an image of another target word from the book (gazebo), and two images of objects that appeared in the book but were not labeled.

images of the items, and a "far transfer" block using novel real-world images of the items. Each target noun was tested once in each block and the blocks were tested in a fixed order: familiar token, near transfer, far transfer. The position of the target items and distractors on the screen and the order of items were randomized.

Story details task

The story details task included two practice trials and six experimental trials (see Supplementary Materials). Before completing the practice trials, the experimenter explained the task to the child using exact wording used by Walker and Lombrozo (2017), as follows: "Some of the things I say will be right, and some of the things I say will not be right. I want you to press the green button for the things that are right, and the red button for the things that are not right." Each trial consisted of a two-alternative forced-choice yes/no question about something that happened in the story (e.g., "In the story, does Max plant apples?"). Children selected a green button with a checkmark to respond "yes" and a red button with an X to respond "no." The order of the six questions was randomized.

Moral learning task

The moral learning task was closely based on the paradigm used by Walker and Lombrozo (2017), but adapted for younger children. Full materials can be found in the Supplementary Materials. Before completing the moral learning task, the experimenter provided children with a short explanation of what a moral lesson is. The experimenter explained to the child, "I want to talk about what a lesson is. Some stories have a lesson. A lesson is what we can learn about what we are supposed to do." Then, the child was given a free-response prompt, "Max's story had a lesson about what he was supposed to do. Let's think about the lesson in Max's story. What lesson did you learn from Max's story?" The child's response was recorded and coded as (1) lesson-based if it referred to sharing, (2) content-based if it referred to surface-level content like watering plants, growing vegetables, etc., or (3) irrelevant. A lack of a response or a response that did not answer the prompt was considered irrelevant.

Following the free-response, children were given instructions to complete a two-alternative forced-choice matching task to assess their learning of the moral lesson from the story. The experimenter explained, "In this game, we will think about the lesson that Max learned. You will see two pictures on the screen. I am going to tell you a short story about each picture. One story will have the same lesson as Max's story and one will have a lesson that is different from Max's story. After I tell you both stories, I want you to point to the picture with the same lesson as Max's story." On each of the four trials, children were presented with two novel vignettes in a different setting than the original story (e.g., the original story took place in a garden, and one pair of vignettes took place in a sandbox, see Figure 3). One of the two vignettes included a moral lesson about the importance of sharing that matched the moral from the original story; the other always had a non-matching moral about the importance of apologizing. One vignette appeared on each side of the screen, and the location of the matching and non-matching vignette was randomized across trials. On each trial, the experimenter first read the story associated with the vignette that appeared on the left side of the screen, while the image of the vignette on the right side was grayed out (see Figure 3). Then, the left vignette was grayed out while the experimenter read the story
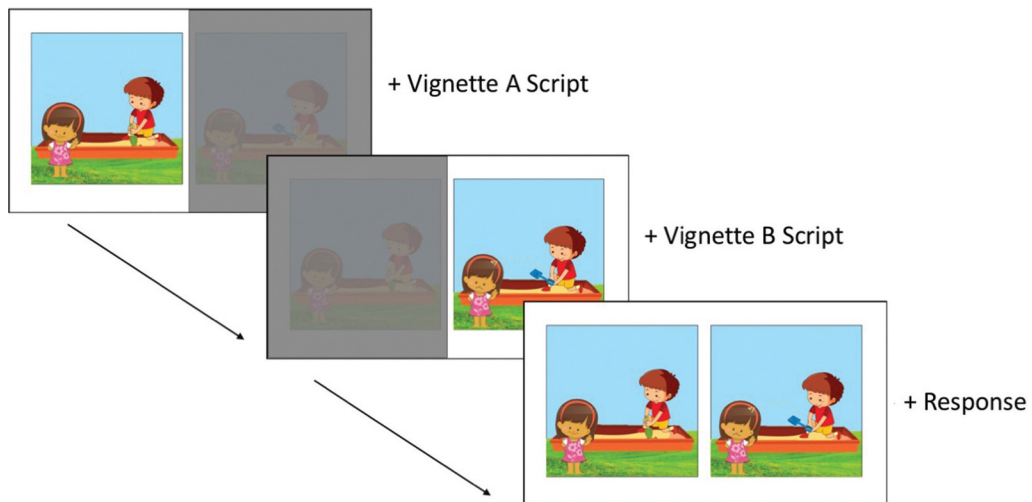
Figure 3. Schematic of moral learning matching task. On each trial, children heard two novel vignettes read by the experimenter (labeled Vignettes A and B, see Supplementary Materials for details) that were each associated with a picture on the screen. The child was then asked to select which vignette contained a moral lesson matching the one in the picture book.

for the vignette on the right. After hearing both vignettes and seeing both images, the child made their selection by touching one of the pictures.

Coding

Recordings of each parent-child reading interaction were coded for explicit references to target nouns and the moral lesson. Parents' target noun references were coded as either (1) a point to the target word referent in the illustration, (2) a repeated label of the target noun not included in the text of the story, or (3) a description of the target noun referent. References to the moral lesson of the story included any extra-textual elaboration about sharing. All of the videos of the reading interaction were coded by a single coder and a second coder who was blind to the conditions and hypotheses of the study recoded 20% of the videos, resulting in 88% inter-rater reliability (89% agreement for references to target words and 87% agreement for references to the moral). Discrepancies were resolved by discussion between the two coders.

Results

To measure children's learning from the shared reading interaction, we first calculated each child's performance on the three learning tasks (word learning, moral learning, and story details) by determining the proportion of trials for which the child provided the correct response. This enabled us to address our primary research question: were children able to simultaneously learn multiple types of information from the storybook? Below we articulate statistical tests for each task alone and for the three tasks combined. We then explored our secondary questions about the factors that might explain differences in children's learning.

Specifically, we asked: (1) were parents' behaviors during shared reading and/or children's learning affected by our priming manipulation? and (2) did individual differences in children's vocabulary size relate to differences in their learning?

Word learning

To ensure that we captured new learning in our measure of children's word learning, we excluded any target nouns that children were reported to know before reading the picture book (14 children knew one word; 11 knew two words, and three knew three words). A two-tailed single-sample t-test revealed that children exceeded chance (.25) in identifying the correct image for the target nouns, $M = .62$, $SD = 0.27$, $t(38) = 8.40$, $p < .001$, $d = 1.35$, demonstrating that as a group, children were able to successfully learn new words from the picture book.[1] Results of a one-way ANOVA showed no significant main effect of block (familiar token vs. near transfer vs. far transfer), $F(2, 76) = 0.017$, $p = .98$, $\eta_p^2 = .0004$. This lack of differences suggests that children's word learning was stable (with no evidence of learning during the test phase) and robust across the different images used to represent the target nouns.

Moral learning

To assess children's moral learning, we analyzed their responses to the moral lesson matching task and the free-response prompt. A two-tailed single-sample t-test revealed that in the matching task, children selected the vignette with the matching moral lesson about sharing significantly above chance (.5), $M = .69$, $SD = 0.36$, $t(38) = 3.21$, $p = .003$, $d = 0.51$, revealing that they were able to successfully identify the moral lesson from the picture book. As a second analysis, we sought to understand relations between children's performance on the matching task and their free-response answers. Twenty-one out of 39 children provided a lesson-based response (53.8%), another 12 provided content-based responses (30.8%), and 6 children either did not respond or provided an irrelevant response (15.4%). Children who provided a lesson-based response performed numerically better on the matching task ($M = .74$, $SD = .35$) than children who provided a content-based or irrelevant response ($M = .62$, $SD = .38$), but this difference was not statistically significant, $t(37) = 0.97$, $p = .34$, $d = 0.32$.

Story details

In addition to children's above-chance performance on the word and moral learning tasks, a two-tailed single-sample t-test revealed that children also exceeded chance (.5) in selecting the correct responses about story details, $M = .89$, $SD = 0.14$, $t(38) = 17.40$, $p < .001$, $d = 2.79$. Thus, as a group, children successfully demonstrated learning of new words, an understanding of the moral lesson, and memory for details from the story. See Table 1.

---

[1]An alternative analytic approach that uses ANCOVA to control for children's prior knowledge yields the same pattern of results and is included in the Supplemental Materials.

Table 1. Children's performance on each of the three learning tasks (word learning, moral learning, and story details) within each condition (Word Learning and Control) and collapsed across conditions. Asterices denoting statistical significance report overall means compared to chance performance.

Measure	Word Learning	Moral Learning	Story Details
Word Learning Condition	0.64	0.74	0.90
Control Condition	0.65	0.64	0.88
Overall Mean	0.62 ***	0.69 **	0.89 ***
Standard deviation	0.27	0.36	0.14
Chance level	0.25	0.50	0.50

* $p < .05$, ** $p < .01$, *** $p < .001$

Simultaneous learning of words, moral lessons, and story details

To ensure that individual children were in fact learning these different types of information simultaneously, we analyzed each participant's performance across all three tasks. Thirty-five out of 39 children (89.7%) showed above-chance learning for two or more of the types of information tested; 21 out of 39 (53.8%) showed above-chance learning for all three types. Furthermore, exploratory analyses revealed no significant associations between children's performance on each of the three learning tasks (all $ps > 0.05$), suggesting that learning of words, the moral lesson, and other details may be independent of each other. These results suggest that children are capable of simultaneously learning multiple types of information from a picture book, and that learning one type of information neither improved nor impeded children's learning of other features of the story.

Parents' behaviors during shared reading

To understand parents' influence on children's learning, we first asked whether our manipulation (a brief introduction about the importance of reading for vocabulary development in the Word Learning condition versus bonding in the Control condition) led to differences in parents' reported attitudes between conditions. We assessed parents' views on the value of reading with the PBRI, which measures the extent to which parents endorse shared reading as a teaching opportunity to support their child's language development. Parents in the Word Learning condition had significantly higher scores on the PRBI ($M = 157.4$, $SD = 5.79$; possible scores range from 42–168) than parents in the bonding Control condition ($M = 151.3$, $SD = 9.22$), $t(37) = 2.43$, $p = .02$, $d = 0.80$. After hearing the experimenter describe reading as a chance to learn new vocabulary, parents endorsed the importance of book reading as an opportunity to support their child's language development more highly than parents who heard about reading as an opportunity for bonding. This suggests that the experimenter's description prior to the reading interaction affected parents' tendency to focus on language-related benefits of shared reading.

We then examined whether these differences in reported views on reading affected parents' behavior during shared reading. Across the sample, parents varied greatly in the number of times they referred to target words (including labels, points, and descriptions: 0–29, $M = 6.69$, $SD = 5.44$), the number of times they mentioned the moral lesson (0–8, $M = 1.00$, $SD = 1.70$), and the duration of the reading interaction (3.62–11.37 minutes, $M = 6.13$, $SD = 1.72$). We expected that parents in the Word Learning condition would make more references to target words than parents in the Control condition. While parents

in the Word Learning condition did make a numerically greater number of references to target words ($M = 7.89$, $SD = 6.24$) compared to parents in the Control condition ($M = 5.55$, $SD = 4.42$), this difference was not statistically significant, $t(37) = 1.36$, $p = .18$. There were also no significant condition differences in the number of moral lesson references or reading duration (all ps > 0.05). Thus, while our manipulation appeared to successfully change parents' focus, it did not yield reliable differences in their behavior.

Finally, we investigated whether children's performance on each of the three learning tasks differed by condition. Contrary to our hypothesis, we found no significant differences in performance for children in the Word Learning condition vs. the Control condition for word learning, $t(37) = 0.81$, $p = .42$, moral learning, $t(37) = 0.86$, $p = .40$, or the learning of story details, $t(37) = 0.63$, $p = .53$ (see Table 1). This lack of difference suggests that children can successfully attend to multiple dimensions of information, independent of their parents' focus. Additional analyses of parent behaviors can be found in Supplementary Materials.

Vocabulary size and learning

Finally, in a series of exploratory analyses, we tested whether individual differences in children's ability to learn different types of information from the picture book might be related to their vocabulary size. First, we calculated an average learning score for each child. Since the three measures had different chance levels, for each child, we calculated a z-score for each of the three learning tasks and then averaged the z-scores to get a single composite measure of learning. Then, we ran a series of simple regression models predicting the composite learning scores, word learning accuracy, story detail accuracy, and moral learning accuracy from PPVT scores. We verified that all models satisfied the assumptions of the general linear model framework. We found that children's scores on the PPVT significantly predicted their composite learning score, $F(1, 37) = 16.81$, $p < .001$, suggesting that their overall learning from the book was positively related to their vocabulary size. We also tested whether this relation between vocabulary size and learning differed by task. We found that children's PPVT scores significantly predicted their performance on both the word learning task, $F(1, 37) = 5.57$, $p = .024$, and the story details task, $F(1, 37) = 13.17$, $p < .001$, but not on the moral lesson task, $F(1, 37) = 1.28$, $p = .27$ (see Supplementary Materials for bivariate plots). While children with larger vocabularies learned new words and remembered story details more easily, they were not better at extracting the moral lesson relative to children with smaller vocabularies. Thus, more advanced language skills may support children's learning of some types of information from books, but it is not the case that children with better knowledge of language learn all features of a story more easily. Based on the small sample size, these exploratory associations should be interpreted with caution (Schönbrodt & Perugini, 2013). However, they tentatively suggest that learning different types of information from books may be partially driven by children's existing knowledge of words.

Discussion

This study examined the range and complexity of information that young children can extract concurrently from a single shared reading interaction with a parent. Specifically, we found that 4- and 5-year-olds are capable of simultaneously retaining novel vocabulary words, a moral lesson about the importance of sharing, and factual story details from

a picture book. In addition, we found that children's learning was robust to our manipulation of parents' attention to different aspects of the book, and that individual differences in vocabulary size were related to children's learning of words and story details, although not to the moral lesson. These results extend what is known about how picture books offer children opportunities to learn across a variety of domains, and reveal individual differences in how easily children are able to do so.

The main contribution of this research is its highlighting of children's ability to extract multiple dimensions of information simultaneously from naturalistic shared reading interactions with a parent. Previous research has primarily investigated children's learning of just one type of information and has often used specifically scripted dialogic reading techniques to underscore a particular element of the story. For example, in studies testing word learning, an experimenter might ask children questions about target words (e.g., Blewitt et al., 2009; Ewers & Brownson, 1999; Walsh & Blewitt, 2006), and in a study testing children's learning of a moral lesson, an experimenter asked children questions about the cause of events in the story (Walker & Lombrozo, 2017). The results of the current study extend these findings and demonstrate that children are capable of learning words, moral lessons, and story details concurrently from a picture book.

In addition to this main finding, these results provide the first evidence for successful explicit moral lesson comprehension without scaffolding questions in young children (Walker & Lombrozo, 2017). The majority of children in our study demonstrated moral comprehension not only in the forced-choice matching task, but also spontaneously in their answers to a free-response prompt. One potential explanation for these findings is that our task avoided a demand shown in previous research to be difficult for children. Namely, our matching task did not require children to ignore response choices with surface-level similarities to the original story in order to select the correct answer (see Narvaez et al., 1999). Although some children did provide free-response answers focusing on the surface-level details of the story (e.g., about gardening) rather than the moral lesson, 4- and 5-year-old children were generally able to identify the moral lesson in the story.

Contrary to evidence suggesting that picture books induce high cognitive load, children did not appear to find it challenging to engage in many different types of learning from shared reading; instead, children demonstrated the ability to flexibly consider multiple dimensions of the picture book simultaneously. They were even able to show evidence of generalizing their learning of new words to novel tokens. It should, however, be noted that the "far transfer" tokens appeared later in the test phase, introducing the possibility that some learning may have occurred during testing, rather than during reading. Nevertheless, children's learning was unexpectedly flexible. Research on infants' processing of spoken language suggests that they are able to attend to multiple features of language, such as transitional probabilities both within and between words, and learn in the presence of multiple cues, including speaker and language characteristics (e.g., Johnson, Westrek, Nazzi, & Cutler, 2011; Potter & Lew-Williams, 2019; Saffran & Wilson, 2003; Sahni, Seidenberg, & Saffran, 2010). Here, we observed comparable performance in the domain of written language and demonstrated that children are similarly capable of learning from multidimensional language input during shared reading.

Furthermore, children's learning was similar regardless of whether or not we drew parents' attention to word learning. Following this manipulation, parents' reported views on the value of reading did differ by experimental group, but these differences did not lead

to significant differences in parents' behavior during reading nor to differences in children's learning. Children in both conditions demonstrated successful simultaneous learning of multiple different types of information, and this learning was not related to any of the parent behaviors that were coded during shared reading. This reveals the robustness of children's ability to learn multiple dimensions of information concurrently – a pattern of results that may have emerged for several reasons.

First, our manipulation may not have been strong enough to change parents' habitual shared reading behaviors and their reading-related beliefs. Although parents' reported beliefs differed by condition, there were no significant differences in parents' behaviors between conditions. This finding is consistent with previous research demonstrating that parenting attitudes and behaviors are largely unchanging across time (e.g., Dallaire & Weinraub, 2005; McNally, Eisenberg, & Harris, 1991; Roberts, Block, & Block, 1984). It should be noted that parents' PBRI were scores were close to the top of the scale in both groups, thus ceiling effects could have masked the potential contribution of parents' reported beliefs on their behaviors. It is also possible that, due to demand characteristics following the manipulation, parents could infer what the experimenter wanted them to report and/or how they wanted them to behave, resulting in a condition difference in reported beliefs and a slight (but not statistically robust) difference in target word references. Therefore, our results suggest that directing parents' attention to particular learning targets for shared reading produced at least temporary differences in parents' explicit beliefs about the importance of reading, but did not affect their behavior in a significant way.

It is important to acknowledge that our manipulation only investigated the effects of drawing parents' attention to word learning, and did not manipulate attention to the moral lesson or to other story details. We targeted words for several reasons: word learning is quite variable, word learning is known to be influenced by parents' behaviors, and there is documented variability in how much parents prioritize the vocabulary content of books (Evans et al., 2011; Tamis-LeMonda, Custode, Kuchirko, Escobar, & Lo, 2019; Weigel et al., 2006; Weisleder & Fernald, 2013). There may be less variability in how parents convey moral lessons. Prior research suggests that a moral or core message is the most common feature that parents look for in picture books (Aram & Aviram, 2009; Bergman Deitcher, Aram, & Adar, 2019), and we thought it might be more difficult to increase parents' attention to the book's moral than to increase their attention to words. However, future studies could explore whether directing parents' attention to other aspects of picture books, such as morals, might change children's learning, and thereby provide a more complete picture of how parents' behaviors and beliefs affect their children.

Secondly, it is possible that we did not observe relations between parents' attention and children's learning because the picture book was created specifically for this study and therefore may have been particularly well-designed to allow for children's learning of both words and a moral lesson. A variety of book features have been shown to positively influence children's learning from picture books including the placement of target words at the end of a page (Evans et al., 2011), the consistency of context (Horst et al., 2011), and the presence of human characters (Kotaman & Balcı, 2017; Larsen et al., 2018), all of which were included in the picture book designed for this study. Therefore, it could be that children would find it harder to learn new information from books that introduce novel information in less supportive ways and/or push the narrative forward in non-optimized ways. In such cases, parents' attention might have an effect on children's learning. However,

further research is needed to uncover the features and structures of picture books that are more or less likely to yield learning of complex, multidimensional information, including words and overall lessons.

Thirdly, it is possible that previous research has overstated the parents' influence on children's learning during shared reading. Meta-analyses investigating the effects of shared reading on children's language development have reported medium effect sizes regarding the association between parents' reading techniques and children's ability to learn new words from picture books (Flack et al., 2018; Mol, Bus, De Jong, & Smeets, 2008). However, many of the studies included in the meta-analyses did not contain control groups. Interventions that did include appropriate control groups have revealed near-zero or small effects of shared reading (Noble et al., 2019). Thus, it is possible that other factors, such as children's vocabulary size or specific book features, may have a similar or even larger effect on children's learning than parents' attention during shared reading.

An additional possibility is that our small sample may have been underpowered to detect relations between parents' reading beliefs and children's learning as well as more nuanced individual differences. Although there was no association between parents' beliefs (following our manipulation) and children's learning, it is possible that our manipulation disguised associations between parents' naturally-occurring beliefs and children's learning. Without additional baseline measures of parents' preexisting beliefs or children's working memory capacity, it is difficult to pin down whether the finding that children successfully retained multiple types of information from the book might be due to child characteristics, parent reading techniques, or some combination of the two.

Although the parent beliefs that we measured in the current study were not related to children's learning, exploratory analyses suggested that individual differences in children's vocabulary knowledge did predict their ability to learn from shared reading. Interestingly, this correlation was not consistent across all types of learning. Vocabulary size predicted children's learning of words and their memory of story details, but did not predict their understanding of the moral lesson. While it is important not to over-interpret correlations obtained from a small sample, these associations are consistent with previous work demonstrating that children's existing vocabulary knowledge predicts word learning (Bion, Borovsky, & Fernald, 2013; Law & Edwards, 2015; Samuelson & Smith, 1999) and basic comprehension (Duff, Reen, Plunkett, & Nation, 2015; Lee, 2011), but suggest that children's moral learning may benefit both from language knowledge and from additional skills, such as children's theory of mind and emotional understanding (Ball, Smetana, & Sturge-Apple, 2017; Lane, Wellman, Olson, LaBounty, & Kerr, 2010). It is also possible that children who are better at learning from shared reading have larger vocabularies (Sénéchal, Pagan, Lever, & Ouellette, 2008; Sénéchal et al., 1995), causing more accelerated language growth for some children compared to others.

Our findings raise questions about how to structure book-reading activities that support children's concurrent learning of many types of information. Research with older, autonomous readers (7–11 years old) has revealed that measures of children's cognitive flexibility to attend to multidimensional input are related to their reading comprehension skills (Cartwright, 2002), suggesting children's ability to simultaneously encode different types of information may be a foundational skill for early literacy. Studies with preschool and kindergarten children have similarly found executive function to be related to school readiness including early literacy measures, social-emotional competencies, and math skills

(Bierman, Nix, Greenberg, Blair, & Domitrovich, 2008; Miller, Müller, Giesbrecht, Carpendale, & Kerns, 2013; Willoughby, Piper, Oyanga, & Merseth King, 2019). Thus, book-reading interventions may benefit from in part focusing on supporting children's broader cognitive development. While many interventions have focused on promoting children's language development (Dickinson, Griffith, Golinkoff, & Hirsh-Pasek, 2012; Dowdall et al., 2019; Noble et al., 2019), few have specifically targeted children's ability to extract multiple types of information from their input. Future research should continue to explore correlates of children's multidimensional learning from picture books in order to design effective interventions that optimize the range of benefits of shared reading.

In summary, children in this study were able to simultaneously and flexibly learn multiple types of information presented at different time scales during shared book-reading with a parent, even without substantial scaffolding. In subsequent research, it will be important to determine how variation in this ability may be related to the development of other skills, such as vocabulary learning, working memory, and early literacy. Picture books often present diverse information across time scales, and children who can most effectively detect and remember this information may be best equipped to thrive in early academic settings.

Acknowledgments

Disclosure of potential conflicts of interest

No potential competing interest was reported by the authors. The authors confirm that the data supporting the findings of this study are available within its supplementary materials. All supplementary materials can be found at: https://osf.io/qydc8/?view_only=65c4602098124db9af3f945ae3f13e82

Funding

References

Aram, D., & Aviram, S. (2009). Mothers' storybook reading and kindergartners' socioemotional and literacy development. *Reading Psychology*, *30*(2), 175–194. doi:10.1080/02702710802275348

Aram, D., Deitcher, D. B., Sabag Shoshan, T., & Ziv, M. (2017). Shared book reading interactions within families From low socioeconomic backgrounds and children's social understanding and prosocial behavior. *Journal of Cognitive Education and Psychology*, *16*(2), 157–177. doi:10.1891/1945-8959.16.2.157

Ball, C. L., Smetana, J. G., & Sturge-Apple, M. L. (2017). Following my head and my heart: Integrating preschoolers' empathy, theory of mind, and moral judgments. *Child Development*, *88*(2), 597–611. doi:10.1111/cdev.12605

Bergman Deitcher, D., Aram, D., & Adar, G. (2019). Book selection for shared reading: Parents' considerations and researchers' views. *Journal of Early Childhood Literacy*, *19*(3), 291–315. doi:10.1177/1468798417718236

Bierman, K. L., Nix, R. L., Greenberg, M. T., Blair, C., & Domitrovich, C. E. (2008). Executive functions and school readiness intervention: Impact, moderation, and mediation in the Head Start REDI program. *Development and Psychopathology*, *20*(3), 821–843. doi:10.1017/S0954579408000394

Bigler, R. S., & Liben, L. S. (1992). Cognitive mechanisms in children's gender stereotyping: Theoretical and educational implications of a cognitive-based intervention. *Child Development*, *63*(6), 1351–1363. doi:10.1111/j.1467-8624.1992.tb01700.x

Bion, R., Borovsky, A., & Fernald, A. (2013). Fast mapping, slow learning: Disambiguation of novel word-object mappings in relation to vocabulary learning at 18, 24, and 30months. *Cognition*, *126* (1), 39–53. doi:10.1016/j.cognition.2012.08.008

Blewitt, P., Rump, K. M., Shealy, S. E., & Cook, S. A. (2009). Shared book reading: When and how questions affect young children's word learning. *Journal of Educational Psychology*, *101*(2), 294–304. doi:10.1037/a0013844

Bojczyk, K. E., Davis, A. E., & Rana, V. (2016). Mother-child interaction quality in shared book reading: Relation to child vocabulary and readiness to read. *Early Childhood Research Quarterly*, *36*, 404–414. doi:10.1016/j.ecresq.2016.01.006

Bonawitz, E., Shafto, P., Gweon, H., Goodman, N., Spelke, E., & Schulz, L. (2011). The double-edged sword of pedagogy: Instruction limits spontaneous exploration and discovery. *Cognition*, *120*(3), 322–330. doi:10.1016/j.cognition.2010.10.001

Cartwright, K. B. (2002). Cognitive development and reading: The relation of reading-specific multiple classification skill to reading comprehension in elementary school children. *Journal of Educational Psychology*, *94*(1), 56–63. doi:10.1037/0022-0663.94.1.56

Cooper, B. R., Moore, J. E., Powers, C. J., Cleveland, M., & Greenberg, M. T. (2014). Patterns of early reading and social skills associated with academic success in elementary school. *Early Education and Development*, *25*(8), 1248–1264. doi:10.1080/10409289.2014.932236

Cornell, E. H., Sénéchal, M., & Broda, L. S. (1988). Recall of picture books by 3-year-old children: Testing and repetition effects in joint reading activities. *Journal of Educational Psychology*, *80*(4), 537–542. doi:10.1037/0022-0663.80.4.537

Curenton, S. M., & Craig, M. J. (2011). Shared-reading versus oral storytelling: Associations with preschoolers' prosocial skills and problem behaviours. *Early Child Development and Care*, *181*(1), 123–146. doi:10.1080/03004430903292208

Curenton, S. M., & Justice, L. M. (2008). Children's preliteracy skills: Influence of mothers' education and beliefs about shared-reading interactions. *Early Education and Development*, *19*(2), 261–283. doi:10.1080/10409280801963939

Dallaire, D. H., & Weinraub, M. (2005). The stability of parenting behaviors over the first 6 years of life. *Early Childhood Research Quarterly*, *20*(2), 201–219. doi:10.1016/j.ecresq.2005.04.008

De Droog, S. M., Buijzen, M., & Valkenburg, P. M. (2014). Enhancing children's vegetable consumption using vegetable-promoting picture books. The impact of interactive shared reading and character-product congruence. *Appetite*, *73*, 73–80. doi:10.1016/j.appet.2013.10.018

DeBaryshe, B. D., & Binder, J. C. (1994). Development of an instrument for measuring parental beliefs about reading aloud to young children. *Perceptual and Motor Skills*, *78*(3_suppl), 1303–1311. doi:10.2466/pms.1994.78.3c.1303

Deckner, D. F., Adamson, L. B., & Bakeman, R. (2006). Child and maternal contributions to shared reading: Effects on language and literacy development. *Journal of Applied Developmental Psychology*, *27*(1), 31–41. doi:10.1016/j.appdev.2005.12.001

Dickinson, D. K., Griffith, J. A., Golinkoff, R. M., & Hirsh-Pasek, K. (2012). How reading books fosters language development around the world. *Child Development Research*, *2012*, 1–15. doi:10.1155/2012/602807

Dowdall, N., Melendez-Torres, G. J., Murray, L., Gardner, F., Hartford, L., & Cooper, P. J. (2019). Shared picture book reading interventions for child language development: A systematic review and meta-analysis. *Child Development*, 1–17. doi:10.1111/cdev.13225

Duff, F. J., Reen, G., Plunkett, K., & Nation, K. (2015). Do infant vocabulary skills predict school-age language and literacy outcomes? *Journal of Child Psychology and Psychiatry and Allied Disciplines*, *56*(8), 848–856. doi:10.1111/jcpp.12378

Dunn, L. M., & Dunn, D. M. (2007). *PPVT-4: Peabody picture vocabulary test* (Peabody picture vocabulary test).

Eng, C. M., Godwin, K. E., & Fisher, A. V. (2020). Keep it simple: Streamlining book illustrations improves attention and comprehension in beginning readers. *Npj Science of Learning*, *5*(1). doi:10.1038/s41539-020-00073-5

Evans, M. A., Reynolds, K., Shaw, D., & Pursoo, T. (2011). Parental explanations of vocabulary during shared book reading: A missed opportunity. *First Language*, *31*(2), 195–213. doi:10.1177/0142723710393795

Evans, M. D. R., Kelley, J., Sikora, J., & Treiman, D. J. (2010). Family scholarly culture and educational success: Books and schooling in 27 nations. *Research in Social Stratification and Mobility*, *28*(2), 171–197. doi:10.1016/j.rssm.2010.01.002

Ewers, C. A., & Brownson, S. M. (1999). Kindergarteners' vocabulary acquisition as a function of active vs. passive storybook reading, prior vocabulary, and working memory. *Reading Psychology*, *20*(1), 11–20. doi:10.1080/027027199278484

Farrant, B. M., & Zubrick, S. R. (2012). Early vocabulary development: The importance of joint attention and parent-child book reading. *First Language*, *32*(3), 343–364. doi:10.1177/0142723711422626

Farver, J. A. M., Xu, Y., Eppe, S., & Lonigan, C. J. (2006). Home environments and young Latino children's school readiness. *Early Childhood Research Quarterly*, *21*(2), 196–212. doi:10.1016/j.ecresq.2006.04.008

Flack, Z. M., Field, A. P., & Horst, J. S. (2018). The effects of shared storybook reading on word learning: A meta-analysis. *Developmental Psychology*, *54*(7), 1334–1346. doi:10.1037/dev0000512

Flack, Z. M., & Horst, J. S. (2018). Children learn words better from one storybook page at a time. *Infant and Child Development*, *27*, 2007–2012. doi:10.1002/icd.2047

Flevares, L. M., & Schiff, J. R. (2014). Learning mathematics in two dimensions: A review and look ahead at teaching and learning early childhood mathematics with children's literature. *Frontiers in Psychology*, *5*, 459. doi:10.3389/fpsyg.2014.00459

Ganea, P. A., Canfield, C. F., Simons-Ghafari, K., & Chou, T. (2014). Do cavies talk? The effect of anthropomorphic picture books on children's knowledge about animals. *Frontiers in Psychology*, *5*, 283. doi:10.3389/fpsyg.2014.00283

Ganea, P. A., Ma, L., & DeLoache, J. S. (2011). Young children's learning and transfer of biological information from picture books to real animals. *Child Development*, *82*(5), 1421–1433. doi:10.1111/j.1467-8624.2011.01612.x

Gómez, R. L. (2002). Variability and detection of invariant structure. *Psychological Science*, *13*(5), 431–436. https://doi.org/10.1111/1467-9280.00476

Gonzalez, J. E., Pollard-Durodola, S., Simmons, D. C., Taylor, A. B., Davis, M. J., Fogarty, M., & Simmons, L. (2014). Enhancing preschool children's vocabulary: Effects of teacher talk before, during and after shared reading. *Early Childhood Research Quarterly*, *29*(2), 214–226. doi:10.1016/j.ecresq.2013.11.001

Greenhoot, A. F., Beyer, A. M., & Curtis, J. (2014). More than pretty pictures? How illustrations affect parent-child story reading and children's story recall. *Frontiers in Psychology*, *5*(JUL), 1–10. doi:10.3389/fpsyg.2014.00738

Hong, H. (1996). Effects of mathematics learning through children's literature on math achievement and dispositional outcomes. *EarlyChildhood Research Quarterly*. https://doi.org/10.1016/S0885-2006(96)90018-6

Horst, J. S., Parsons, K. L., & Bryan, N. M. (2011). Get the story straight: Contextual repetition promotes word learning from storybooks. *Frontiers in Psychology*, *2*(17), 1–11. doi:10.3389/fpsyg.2011.00017

Houston-Price, C., Howe, J. A., & Lintern, N. J. (2014). Once upon a time, there was a fabulous funambulist.: What children learn about the "high-level" vocabulary they encounter while listening to stories. *Frontiers in Psychology*, *5*, 75. doi:10.3389/fpsyg.2014.00075

Jimenez, S. R., & Saylor, M. M. (2017). Preschoolers' word learning and story comprehension during shared book reading. *Cognitive Development*, *44*(May), 57–68. doi:10.1016/j.cogdev.2017.08.011

Johnson, E. K., Westrek, E., Nazzi, T., & Cutler, A. (2011). Infant ability to tell voices apart rests on language experience. *Developmental Science*, *14*(5), 1002–1011. doi:10.1111/j.1467-7687.2011.01052.x

Kaefer, T., Pinkham, A. M., & Neuman, S. B. (2017). Seeing and knowing: Attention to illustrations during storybook reading and narrative comprehension in 2-year-olds. *Infant and Child Development*, *26*(5), e2018. doi:10.1002/icd.2018

Kalish, C. W., & Gelman, S. A. (1992). On wooden pillows: Multiple classification and children's category-based inductions. *Child Development*, *63*(6), 1536–1557. doi:10.2307/1131574

Kotaman, H., & Balcı, A. (2017). Impact of storybook type on kindergarteners' storybook comprehension. *Early Child Development and Care*, *187*(11), 1771–1781. doi:10.1080/03004430.2016.1188297

Lane, J. D., Wellman, H. M., Olson, S. L., LaBounty, J., & Kerr, D. C. R. (2010). Theory of mind and emotion understanding predict moral development in early childhood. *British Journal of Developmental Psychology*, *28*(4), 871–889. doi:10.1348/026151009X483056

Larsen, N. E., Lee, K., & Ganea, P. A. (2018). Do storybooks with anthropomorphized animal characters promote prosocial behaviors in young children? *Developmental Science*, *21*(3), 3. doi:10.1111/desc.12590

Law, F., & Edwards, J. R. (2015). Effects of vocabulary size on online lexical processing by preschoolers. *Language Learning and Development*, *11*(4), 331–355. doi:10.1080/15475441.2014.961066

Lee, J. (2011). Size matters: Early vocabulary as a predictor of language and literacy competence. *Applied Psycholinguistics*, *32*(1), 69–92. doi:10.1017/S0142716410000299

Lynch, J., Anderson, J., Anderson, A., & Shapiro, J. (2006). Parents' beliefs about young children's literacy development and parents' literacy behaviors. *Reading Psychology*, *27*(1), 1–20. doi:10.1080/02702710500468708

MacWhinney, B. (2000). The CHILDES project: Tools for analyzing talk (third edition): Volume I: Transcription format and programs, Volume II: The database. *Computational Linguistics*, *26*(4), 657. doi:10.1162/coli.2000.26.4.657

Mares, M. L., & Acosta, E. E. (2008). Be kind to three-legged dogs: Children's literal interpretations of TV's moral lessons. *Media Psychology*, *11*(3), 377–399. doi:10.1080/15213260802204355

McNally, S., Eisenberg, N., & Harris, J. D. (1991). Consistency and change in maternal child-rearing practices and values: A longitudinal study. *Child Development*, *62*(1), 190–198. doi:10.1111/j.1467-8624.1991.tb01524.x

Meagher, S. M., Arnold, D. H., Doctoroff, G. L., & Baker, C. N. (2008). The relationship between maternal beliefs and behavior during shared reading. *Early Education and Development*, *19*(1), 138–160. doi:10.1080/10409280701839221

Miller, M. R., Müller, U., Giesbrecht, G. F., Carpendale, J. I., & Kerns, K. A. (2013). The contribution of executive function and social understanding to preschoolers' letter and math skills. *Cognitive Development*, *28*(4), 331–349. doi:10.1016/j.cogdev.2012.10.005

Mol, S. E., Bus, A. G., De Jong, M. T., & Smeets, D. J. H. (2008). Added value of dialogic parent-child book readings: A meta-analysis. *Early Education and Development*, *19*(1), 7–26. doi:10.1080/10409280701838603

Montag, J. L., Jones, M. N., & Smith, L. B. (2015). The words children hear: Picture books and the statistics for language learning. *Psychological Science*, *26*(9), 1489–1496. doi:10.1177/0956797615594361

Morgan, P. L., Farkas, G., Hillemeier, M. M., Hammer, C. S., & Maczuga, S. (2015). 24-Month-Old children with larger oral vocabularies display greater academic and behavioral functioning at kindergarten entry. *Child Development*, *86*(5), 1351–1370. doi:10.1111/cdev.12398

Narvaez, D., Bentley, J., Gleason, T., & Samuels, J. (1998). Moral theme comprehension in third graders, fifth graders, and college students. *Reading Psychology*, *19*(2), 127–241. doi:10.1080/0270271980190203

Narvaez, D., Gleason, T., Mitchell, C., & Bentley, J. (1999). Moral theme comprehension in children. *Journal of Educational Psychology*, *91*(3), 477–487. doi:10.1037/0022-0663.91.3.477

Navon, D. (1977). Forest before trees: The precedence of global features in visual perception. *Cognitive Psychology*,*9*(3), 353–383. https://doi.org/10.1016/0010-0285(77)90012-3

Nhundu, T. J. (2007). Mitigating gender-typed occupational preferences of Zimbabwean primary school children: The use of biographical sketches and portrayals of female role models. *Sex Roles*, *56*(9–10), 639–649. doi:10.1007/s11199-007-9204-6

Noble, C., Sala, G., Peter, M., Lingwood, J., Rowland, C., Gobet, F., & Pine, J. (2019). The impact of shared book reading on children's language skills: A meta-analysis. *Educational Research Review*, *28*, 100290. doi:10.1016/j.edurev.2019.100290

Peebles, A., Bonus, J. A., & Mares, M. L. (2018). Questions + answers + agency: Interactive touchscreens and Children's learning from a socio-emotional TV story. *Computers in Human Behavior*, *85*, 339–348. doi:10.1016/j.chb.2018.03.039

Penno, J. F., Wilkinson, I. A. G., & Moore, D. W. (2002). Vocabulary acquisition from teacher explanation and repeated listening to stories: Do they overcome the Matthew effect? *Journal of Educational Psychology*, *94*(1), 23–33. doi:10.1037/0022-0663.94.1.23

Potter, C. E., & Lew-Williams, C. (2019). Infants' selective use of reliable cues in multidimensional language input. *Developmental Psychology*, *55*(1), 1–8. doi:10.1037/dev0000610

Raikes, H., Luze, G., Brooks-Gunn, J., Raikes, H. A., Pan, B. A., Tamis-LeMonda, C. S., . . . Rodriguez, E. T. (2006). Mother-child bookreading in low-income families: Correlates and outcomes during the first three years of life. *Child Development*, *77*(4), 924–953. doi:10.1111/j.1467-8624.2006.00911.x

Richter, A., & Courage, M. L. (2017). Comparing electronic and paper storybooks for preschoolers: Attention, engagement, and recall. *Journal of Applied Developmental Psychology*, *48*, 92–102. doi:10.1016/j.appdev.2017.01.002

Robbins, C. & Ehri, L. C. (1994). Reading storybooks to kindergartners helps them learn new vocabulary words. *Journal of Educational Psychology*,*86*(1), 54–64. https://doi.org/10.1037/0022-0663.86.1.54

Roberts, G. C., Block, J. H., & Block, J. (1984). Continuity and change in parents' child-rearing practices. *Child Development*, *55*(2), 586–597. doi:10.2307/1129970

Robinson, C. D., Lee, M. G., Dearing, E. & Rogers, T. (2018). Reducing student absenteeism in the early grades by targeting parental beliefs. American Educational Research Journal. https://doi.org/10.3102/0002831218772274

Rowe, M. L. & Leech, K. A. (2019). A parent intervention with a growth mindset approach improves children's early gesture and vocabulary development. Developmental Science. https://doi.org/10.1111/desc.12792

Saffran, J. R., & Wilson, D. P. (2003). From syllables to syntax: Multilevel statistical learning by 12-month-old infants. *Infancy*, *4*(2), 273–284. doi:10.1207/S15327078IN0402_07

Sahni, S. D., Seidenberg, M. S., & Saffran, J. R. (2010). Connecting cues: Overlapping regularities support cue discovery in infancy. *Child Development*, *81*(3), 727–736. doi:10.1111/j.1467-8624.2010.01430.x

Samuelson, L. K., & Smith, L. B. (1999). Early noun vocabularies: Do ontology, category structure and syntax correspond? *Cognition*, *73*(1), 1–33. doi:10.1016/S0010-0277(99)00034-7

Schönbrodt, F. D., & Perugini, M. (2013). At what sample size do correlations stabilize? *Journal of Research in Personality*, *47*, 5. doi:10.1016/j.jrp.2013.05.009

Sénéchal, M., & Lefevre, J. (2002). Parental involvement in the development of children's reading skill : A five-year Longitudinal study. *Child Development*, *73*(2), 445–460. doi:10.1111/1467-8624.00417

Sénéchal, M., Pagan, S., Lever, R., & Ouellette, G. P. (2008). Relations among the frequency of shared reading and 4-year-old children's vocabulary, morphological and syntax comprehension, and narrative skills. *Early Education and Development*, *19*(1), 27–44. doi:10.1080/10409280701838710

Sénéchal, M., Thomas, E., & Monker, J. A. (1995). Individual differences in 4-year-old children's acquisition of vocabulary during storybook reading. *Journal of Educational Psychology*, *87*(2), 218–229. doi:10.1037/0022-0663.87.2.218

Snow, C. E., & Ferguson, C. A. (1977). *Talking to Children: Language input and acquisition*. Cambridge: Cambridge University Press.

Suprawati, M., Anggoro, F. K., & Bukatko, D. (2014). "I think I can": Achievement-oriented themes in storybooks from Indonesia, Japan, and the United States. *Frontiers in Psychology*, 5, 167. doi:10.3389/fpsyg.2014.00167

Tamis-LeMonda, C. S., Custode, S., Kuchirko, Y., Escobar, K., & Lo, T. (2019). Routine language: Speech directed to infants during home activities. *Child Development*, 90, 6. doi:10.1111/cdev.13089

Taylor, K. K. (1986). Summary writing by young children. *Reading Research Quarterly*, 21(2), 193–208. doi:10.2307/747845

van den Heuvel-Panhuizen, M., Elia, I. & Robitzsch, A. (2016). *Effects of reading picture books on kindergartners' mathematics performance*. Educational Psychology. https://doi.org/10.1080/01443410.2014.963029

Van Steensel, R. (2006). Relations between socio-cultural factors, the home literacy environment and children's literacy development in the first years of primary education. *Journal of Research in Reading*, 29(4), 367–382. doi:10.1111/j.1467-9817.2006.00301.x

Venkadasalam, V. P., & Ganea, P. A. (2018). Do objects of different weight fall at the same time? Updating naive beliefs about free-falling objects from fictional and informational books in young children. *Journal of Cognition and Development*, 19(2), 165–181. doi:10.1080/15248372.2018.1436058

Vygotsky, L. (1978). Interaction between learning and development. In M. Cole, V. John-Steiner, S. Scribner, & E. Soubeman (Eds.), *Mind in society: The development of higher psychological processes* (pp. 79–91). Cambridge: Harvard University Press.

Walker, C. M., & Lombrozo, T. (2017). Explaining the moral of the story. *Cognition*, 167, 266–281. doi:10.1016/j.cognition.2016.11.007

Walsh, B. A., & Blewitt, P. (2006). The effect of questioning style during storybook reading on novel vocabulary acquisition of preschoolers. *Early Childhood Education Journal*, 33(4), 273–278. doi:10.1007/s10643-005-0052-0

Weigel, D. J., Martin, S. S., & Bennett, K. K. (2006). Mothers' literacy beliefs: Connections with the home literacy environment and pre-school children's literacy development. *Journal of Early Childhood Literacy*, 6(2), 191–211. doi:10.1177/1468798406066444

Weisleder, A., & Fernald, A. (2013). Talking to children matters: Early language experience strengthens processing and builds vocabulary. *Psychological Science*, 24(11), 2143–2152. doi:10.1177/0956797613488145

Wendelken, C., Munakata, Y., Baym, C., Souza, M. & Bunge, S. A. (2012). Flexible rule use: Common neural substrates in children and adults. *Developmental Cognitive Neuroscience*, 2(3), 329–339. https://doi.org/10.1016/j.dcn.2012.02.001

Willoughby, M. T., Piper, B., Oyanga, A., & Merseth King, K. (2019). Measuring executive function skills in young children in Kenya: Associations with school readiness. *Developmental Science*, e12818. doi:10.1111/desc.12818

Young, K. T., Davis, K., Schoen, C., & Parker, S. (1998). Listening to parents: A national survey of parents with young children. *Archives of Pediatrics and Adolescent Medicine*, 152(3), 255–262. doi:10.1001/archpedi.152.3.255

Yuan, S., Perfors, A., Tenenbaum, J. B., & Xu, F. (2011). Learning individual words and learning about words simultaneously. In *Proceedings of the 30th Annual Conference of the Cognitive Science Society*. Boston, MA.