Preferences for Tactile and Narrative Counting Books Across Parents with Different Education Levels

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Abstract

Counting books are a potential source of input for children's learning of early mathematics concepts. However, little is known about the factors that affect the counting books parents choose for their children. Parents (N = 696) of preschoolers (ages 2;6-4;11) were surveyed about their preferences for two specific counting book features, tactility and narrative quality. These two features were studied both covertly, by experimentally manipulating the types of books parents saw and asking parents why they would choose particular books, and explicitly, by asking parents to rate the importance of various factors when choosing counting books for their children. The a priori hypotheses were that parents would prefer tactile over non-tactile counting books for boys and narrative over non-narrative counting books for girls and that education level would be positively associated with counting book reading. Results did not support these hypotheses. Instead, parents' preferences for the features depended on their education level. Higher education levels were generally associated with decreased preference for tactility and increased preference for narrative quality. Results raise the question of whether the books parents choose for their children may be one way parent education shapes children's early learning environments.

Keywords: counting books; mathematics; preschool; parent education; tactile; narrative

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The activities parents choose for their children have the potential to affect children's early academic skills. For example, playing math-related board games (e.g., Ramani & Siegler, 2008), playing with objects that promote one-to-one correspondence (Mix, Moore, & Holcomb, 2011), and hearing mathematics-related language during shared book reading (Purpura, Napoli, Wehrspann, & Gold, 2017) all help children construct mathematical knowledge. Children's exposure to such activities likely depends on how parents view those activities. In the present study, we focused on how parents view different types of counting books with and without specific features (described later).

Shared book reading, including shared counting book reading, provides opportunities for interactions that are authentic, meaningful, and interesting for both parents and children (Dexter & Stacks, 2014). It also offers parents the opportunity to introduce and teach mathematics to children (Ginsburg, 2016; Mix, Sandhofer, Moore, & Russell, 2012; Purpura et al., 2017; Shapiro, Anderson, & Anderson, 1997) and, thus, may improve young children's understanding of mathematics (van den Heuvel-Panhuizen, Elia, & Robitzsch, 2016).

One foundational early mathematics concept that may be taught through shared counting book reading is cardinality. This concept involves understanding that the last word stated when counting a set refers to the size of that set (Wynn, 1992). Mix et al. (2012) examined how picture books could be used to promote such an understanding. They found that the most effective input for three-and-a-half-year-old children is to both label the overall set size and count that same set. Other studies have also shown benefits of this type of input (O'Rear & McNeil, 2017; Paliwal & Baroody, 2017; Petersen et al., 2014). Unfortunately, parents provide this type of input less than

2% of the time during counting book reading and, instead, tend to only identify the overall set size or encourage the child to do so (Mix et al., 2012).

The ways parents use counting books may depend on the particular counting books they use. Thus, it is important to understand how parents determine which books to use. The counting books available on the market vary greatly (e.g., Powell & Nurnberger-Haag, 2015). Powell and Nurnberger-Haag (2015) examined 160 counting books and found that there was wide variation in how number was represented within counting books (with a numeral, a word, a picture, or a combination of the three). Ward and colleagues (2017) found that many books contained extra images and features that could be distracting. Furthermore, less than one percent of the books had an explicit emphasis on cardinality. Ward et al. argued that given the wide variability in how counting books are designed, more research is needed to determine which factors are important for learning. We agree and are currently conducting experiments to test the effects of different features on children's understanding of early mathematics concepts and skills. However, we also need research into the features that affect parents' preferences for different types of counting books because parents' preferences likely affect which books children are exposed to at home.

Little is known about the factors that affect the counting books parents choose for their children. There have been previous studies of the factors that affect parents' general picture book preferences (Anderson, Anderson, Shapiro, & Lynch, 2001; Wagner, 2017). In one study, parents preferred books that were familiar (versus unfamiliar), and parents of boys had a greater preference for informational books (over narrative books) than parents of girls (Anderson et al., 2001). In another study, parents preferred books that were older and had won awards and disliked those with female protagonists (Wagner, 2017).

We focused on parents' preferences for different types of counting books. We were specifically interested in two features that may influence which books parents choose for their children: (1) the presence or absence of tactile features (e.g., touch-and-feel objects, textures, pop-ups) and (2) the presence or absence of a narrative story. Our a priori hypothesis was that preferences for these features would depend on child gender (explained below). We also thought parent education might play a role because research has shown strong effects of parent education on the home literacy environment (e.g., DeFlorio & Beliakoff, 2015), education-related expectations (DeBaryshe, 1995), and the general structuring of children's learning environments (Bradley, Corwyn, McAdoo, & García-Coll, 2001; Kaushal, Magnuson, & Waldfogel, 2011; Stipek, Milburn, Clements, & Daniels, 1992). Prior work did not suggest how education level might be associated with preferences for tactile or narrative features in counting books, so we included parent education level as a factor in our design, but we did not make specific predictions about its relation with our outcomes of interest, other than expecting parent education to be positively associated with frequency of book reading (Bracken & Fischel, 2008; DeBaryshe, 1995) and counting book reading (DeFlorio & Beliakoff, 2015).

Tactile counting books. Tactile counting books involve parts or textures on the pages that a child can touch and feel. These features can be three-dimensional objects attached to the page, textures, or push buttons. How exactly tactility within counting books influences children's learning is unknown. Tactility may hinder learning because the features distract children from the target concept (Chiong & DeLoache, 2013; Petersen et al., 2014). Children tested by Petersen et al. had five weekly sessions with a tutor wherein they practiced counting with either physical objects (e.g., small animals, toy cars, fruits) or picture books containing images of those same objects on a plain white background. Only children who practiced counting with picture books

improved their understanding of cardinality. An analysis of the videos of the counting practice revealed that children who practiced with the objects displayed more off-task behaviors and were more distracted during the practice sessions (e.g., pretending the toy animal was moving across the table instead of counting the set of objects) than were children who practiced with the picture books. Although this study suggests that tactile features may be distracting, free physical objects are not the same as tactile features within a book, so it remains an open question.

Chiong and DeLoache (2013) examined tactile and manipulative features within picture books and found that children who are learning to identify letters benefit more from traditional books than from those with manipulative features (e.g., lift-the-flap books). However, they found no difference between traditional and nontraditional book types in a follow-up study where the flaps were removed and replaced with tactile letters (e.g., the letter "F" was made out of sandpaper). Thus, when tactile features are used in a way that reinforces children's representation of the to-be-learned information, they may not hinder learning. Tactility may even be helpful to learning in some cases like counting where a kinesthetic representation may help children link words to the objects and concepts they represent (Alibali & DiRusso, 1999; Glenberg, Gutierrez, Levin, Japuntich, & Kaschak, 2004).

Despite the mixed evidence for the benefits of tactility in picture books, some counting books on the market contain tactile features. A search on Amazon.com for counting books with "touch-and-feel" or "pop up & lift the flap" features provides over 150 results (April, 2018). Some of these tactile books may even be accessible to parents and children through libraries, despite the challenges of wear and tear that come with library use. In a review of some of the most commonly used counting books available in Minneapolis area libraries, Ward et al. (2017) found that roughly 10% had some physical feature (e.g., tactile or manipulative) within the book.

A full list of the tactile and non-tactile counting books used in the present study are presented in the supplementary materials. Tactile books contain features that the reader can touch and feel, typically for each object they are counting (e.g., push three pop-up buttons on the page when counting to three, or feel the raised figures of five plastic ducklings when counting to five). Non-tactile books do not contain tactile features and are printed with traditional two-dimensional images. In traditional books, there is no feature that the child can physically feel or manipulate while they count (other than pointing to the objects on the page).

We hypothesized that parents of boys would be more likely than parents of girls to choose books with tactile versus non-tactile features. This hypothesis was based on research on boys' activity levels. One meta-analysis revealed gender differences in children's activity levels and physical aggression (Hyde & Linn, 2006). These differences in activity level between boys and girls are apparent in infancy and continue through childhood (Eaton & Enns, 1986), and they may affect the types of activities that are regarded as beneficial for boys versus girls. Indeed, some educators have used differences in activity level along with differences in spatial abilities to argue that boys benefit when the learning environment includes more spatial-kinesthetic tasks (King & Gurian, 2006). Parents also may assume that boys have "spatial-kinesthetic strengths" and may consider tactile counting books, which include touching, feeling, lifting flaps, and the like, to be well suited to such strengths.

As mentioned above, we did not have specific hypotheses about how parent education might be associated with preferences for tactile versus non-tactile features. There is some evidence to suggest that education level may be associated with the type of instruction that parents think is best. Specifically, mothers with lower levels of education are more likely to endorse using direct instruction to teach early skills whereas mothers with higher levels of

education report being more likely to integrate learning opportunities in informal, constructivist activities (e.g., Stipek, Milburn, Clements, & Daniels, 1992). If tactile features are viewed as more informal or constructivist, then preference for this feature may increase with parent education. At the same time, however, if parent education levels are negatively associated with acceptance of traditional gender stereotypes (Katz-Wise, Priess, & Hyde, 2010), and our prediction about gender differences holds, then there could be more complex interactions among the presence of tactile features, parent education level, and child gender.

Narrative counting books. A full list of the narrative and non-narrative counting books used in the present study are presented in the supplementary materials. Narrative counting books are books that involve a storyline and oftentimes a main character who, for example, may go on an adventure or seek to complete a specific task. Narrative counting books make up a sizeable majority of the books on the market (e.g., Ward et al., 2017). The counting element of these narrative books is interwoven with the story. In contrast, non-narrative books simply provide a number of objects on each page with a corresponding set size to count. These objects may relate to each other in theme, and there may be a short sentence describing the objects, but there is not a cohesive story across the pages.

How narrative features influence the effectiveness of counting books remains unknown, but it may depend on the opportunities for parents to count and discuss number in the books. For example, picture books that contain no text lead to more parental and child speech than books with simple sentences (Sénéchal, Cornell, & Broda, 1995). It is possible that embedding the mathematics within a specific story may limit the discussion and elaboration that occurs. However, embedding mathematics within larger passages followed by specific questions

improves children's mathematics achievement (Berkowitz et al., 2015; Purpura et al., 2017). Thus, it is unclear whether narrative features help or hinder understanding of mathematics.

We hypothesized that parents of girls would be more likely than parents of boys to choose books that embed counting in a narrative story. This hypothesis is based on the idea that parents of preschoolers have a greater preference for informational books (over narrative books) for boys than they do for girls (Anderson et al., 2001). Chapman, Filipenko, McTavish, and Shapiro (2007) showed that these gender-related beliefs about book choice are present in first-grade children. Given a set of gender-neutral books that were categorized as narrative or informational, children were asked to choose between the books and then decide what choices they thought different boys and girls would make. On a forced-choice question, girls showed a strong preference for narrative books but boys did not show a strong preference for narrative or informational books. When children were selecting books for another girl, both boys and girls tended to select narrative books. However, when children were selecting books for another boy, they tended to select informational books.

We again did not have specific hypotheses about how parent education might be associated with preferences for narrative versus non-narrative counting books. In the classic Stipek et al. (1992) study mentioned above, parents with lower levels of education preferred more formal learning activities like flashcards or workbooks, whereas parents with higher education preferred less formal activities like talking about letters and numbers during the course of everyday interactions. It is possible that narrative counting books are perceived to be a less formal way to introduce counting to children compared to non-narrative counting books. If so, then this might suggest that parents' preference for narrative books would increase with parent education level. However, we know of no data to suggest that narrative counting books are

viewed in this way, and at the time of designing our survey, we had not made this link, so the hypothesis with regard to the association between parent education level and preference for narrative versus non-narrative counting books was left open.

Method

Participants

A total of 702 participants completed a survey designed for parents of preschoolers (ages three and four years old). Five participants were excluded because they did not provide either a boy or girl response for the child gender question, and one participant did not report a level of education. Thus, the final sample included 696 participants (657 mothers, 34 fathers, and 5 participants who preferred not to answer; conclusions are unchanged if we limit the sample to the 657 mothers). Participants with more than one child in the age range were told to "fill out the survey for whichever child is closest in age to 3." If they had more than one child with the same birthday, then they were told to choose one for the entire survey. Three hundred and fifty-nine reported on their daughters and 337 reported on their sons. The average child age was three years and nine months (SD = 7 months). For self-reported race/ethnicity, 91.5% of parents reported themselves as White, 2.5% reported Asian, 1.6% reported Black or African American, 3.1% "Other," and 1.3% preferred not to answer. Responses for all possible education levels were collapsed into the following three education groups to be reflective of those most often used in summaries of election polls and major public opinion polls: less than a bachelor's degree (58 parents; 8.3%), bachelor's degree (142 parents; 20.4%), and at least some post graduate education (496 parents; 71.3%). Of those who reported less than a bachelor's degree, no parents reported less than high school diploma or equivalent (GED), 9 parents (15.5%) reported having a high school diploma or GED, 32 parents (55.2%) reported completing at least some college, and

17 parents (29.3%) reported obtaining an associate's degree. Of those who reported at least some post graduate education, 27 parents (5.4%) reported having completed some postgraduate education, 119 parents (24.0%) reported having a master's degree, and 350 parents (70.6%) reported having a Ph.D., law, or medical degree. Of those who also reported annual household income (n = 661), the median income range was between $100,000 to $149,999. All income ranges were represented in all three education groups, but there was a significant positive correlation between household income and parent education level, $r(659) = .37$, $p < .001$. Parent education level was not associated with the other demographic variables, including the percentage of respondents who identified as white, $\chi^2(2, N = 696) = 0.27$, $p = .87$, and child gender, $\chi^2(2, N = 696) = 0.95$, $p = .62$.

Procedure

Participants were invited to complete the roughly 10-minute Qualtrics-based survey through the authors' research lab's email list, which reaches thousands of parents and educators from across the United States, several education group listservs, and social media. Lab members also shared the invitation with family or friends who had preschoolers. The invitation was also placed on a large Facebook group for academic mothers that has well over 10,000 members from across the world. The group includes academic mothers of all races, ethnicities, sexualities, and income levels, with overrepresentation of members in the United States. Many of the women have graduate degrees, but some are just starting graduate education. Many work in academia, but others work as K-12 teachers, in industry, or as homemakers. Parents who participated were encouraged to share the survey with "anyone who might be interested." The survey was anonymous and any parent with a child in the specified age range could participate. The survey

invitation was specifically addressed to parents of children ages "three and four years old," so any data reported on children younger than 2;6 and older than 4;11 were discarded.

Measures

The survey included questions to gauge how often parents and children read books with an emphasis on counting books. First, parents' preferences for tactile versus non-tactile books and narrative versus non-narrative books were established covertly by asking parents to rate and select their preferred books (labeled Book A, Book B, Book C, Book D so as not to highlight the factors of interest). Here the factors of interest were varied using a within-subjects experimental design (described below). Next, parents were explicitly asked to rate the importance of challenge, enjoyment, tactility, and narrative qualities when selecting counting books to read with their children. The topics of many of the questions in this survey were inspired by the topics of questions in an extensive survey conducted by Scholastic (2013).

Book reading behaviors. The first four questions of the survey asked how often parents read to their children and how often their children read by themselves. The questions were: (1) "How often do either you or your partner read books to your child? (2) How often do either you or your partner read **counting** books to your child? (3) When your child is engaged in free time, how often does he or she choose to read a book? (4) When your child chooses to read a book, how often does he or she choose to read a **counting** book?" The second and fourth questions had the word, "counting," in bold font to help participants identify the difference in what these two questions were asking compared to the more general questions in questions one and three. These four questions used a 5-point Likert scale (almost always, often, sometimes, rarely, and never for the questions concerning how often their child reads; every day, almost every day, a few times a

week, a few times a month, rarely or never for the questions about how often the parent reads to the child).

Preferences by category. The next section of the survey focused on parents' views of four different categories of counting books: Tactile, Non-tactile, Narrative, and Non-narrative. Tactile counting books were defined as books containing features that could be touched, felt, or manipulated whereas non-tactile counting books only included two-dimensional images and text. Narrative counting books included mathematics that was embedded in a narrative story whereas non-narrative counting books included primarily numbers and images with minimal text. Parents were not explicitly informed of these categories, but were instead asked to rate "Book A," "Book B," and so on, so as not to highlight the factors of interest. The survey was set up so that all parents first made comparisons between randomly selected tactile and non-tactile books and later made comparisons between randomly selected narrative and non-narrative books. There were ten example counting books included in each category from which the random selection was made for a given participant, and each book appeared in only one of the four categories for a total of 40 counting books involved in the survey across participants. These counting books were compiled using the counting books list on Amazon, starting with the tactile books and then matching them to non-tactile books based on number of pages, Amazon rating, highest number in book, and whether or not it contained recognizable characters, and then doing the same for narrative and non-narrative books (see the supplementary materials for information on all 40 books).

One book from each of the four categories (tactile, non-tactile, narrative, and non-narrative) was randomly selected for each participant to view. Thus, any given participant only saw one book from each category, and the survey evenly presented the ten counting books in each category across participants. Participants were given the following prompt: "Below are

pictures and descriptions of counting books. Please look at the pictures and read each description carefully before deciding how likely you would be to choose the book for your child." Then participants were shown the book title, cover page, a description of the book, and an example page. Each example page was selected based on how well it represented its respective category and the specific number shown on the page so that the averages of the example page numbers across each of the four book categories were matched. The descriptions were based off of the Amazon book description and were edited to be similar in length and to remove any mention of awards. Participants were asked, "How likely are you to choose this book for your child?" A 5-point Likert scale was used: extremely likely, likely, neutral, unlikely, and extremely unlikely.

Forced-choice category comparison. In the next portion of the survey, participants were asked to choose between the books that they had previously seen in the tactile and non-tactile categories and then choose between the books they had previously seen in the narrative and non-narrative categories. Participants were prompted, "Below are pictures of two of the counting books you read about in the last section. Please look at the pictures and decide which book you would be more likely to choose for your child." They were asked, "Which book are you more likely to choose for your child?" Underneath this question, the example pages from the tactile and non-tactile books from the previous questions (i.e., Book A and Book B) were shown and labeled. Participants selected one of these two books. Participants were then asked, "Why would you be more likely to choose that book for your child?" and explained their reasoning in a text box. On the next page, participants received the same prompt and questions for the narrative and non-narrative books they had previously been shown (i.e., Book C and Book D).

Importance ratings of book qualities. The next four questions focused on the explicit ratings of importance of a counting book's challenge, enjoyment, tactility, and narrative qualities

in a parents' selection of that counting book for their child. These questions asked, "When selecting a counting book for your child, how important is it that (1) the book has math content that challenges your child? (2) the book has content that is fun and enjoyable for your child? (3) the book has countable objects to touch, feel, or manipulate? (4) the book has a story with a narrative and a main character or characters?" A 5-point Likert scale was used: extremely important, very important, moderately important, slightly important, and not important.

Familiarity with counting books. The final section of the survey asked participants to report which of the 40 counting books involved in the full survey they had read to their child. All participants saw all 40 counting books and were asked to check the box next to the titles that they had read or to check the box for "none of the above."

Coding

Participants' responses to questions with a 5-point Likert scale were converted to a numeric value (1-5), with 5 representing the most frequent or most positive option. Participants' selection on the forced choice between the tactile and non-tactile books (i.e., Book A and Book B) was coded as tactile = 1, non-tactile = 0. Similarly, their selection on the forced choice between the narrative and non-narrative books (i.e., Book C and Book D) was coded as narrative = 1, non-narrative = 0. After participants made their selection, they were asked why they chose the book they did, and responses were coded according to whether they mentioned the target feature in a positive way or not (again recall that participants were not told what the features of interest were). For example, after choosing between the tactile and non-tactile book, responses such as "3D printing makes for more sensory involvement" or "he would love popping the buttons to count" were given a score of 1 for mentioning tactility in a positive way, and all other responses were given a score of 0 (e.g., "pop-up books get torn and damaged too easily," "I like

water/aquatic themes"). Similarly, after choosing between the narrative and non-narrative book, responses such as "more of a story is included instead of just a counting exercise" or "I like the narrative better" were given a score of 1 for mentioning the narrative quality in a positive way, and all other responses were given a score of 0 (e.g., "counting books with more complicated storylines aren't as useful for teaching counting," "animal illustrations are easier to follow"). Inter-rater reliability was established with a second person coding a random sample of 20% of responses. Agreement was 97.9% for whether or not participants mentioned tactility in a positive way and 98.6% for whether or not participants mentioned the narrative quality in a positive way.

For the familiarity with counting books question, participants received one point for every listed book they reported having read to their child. Thus, for each of the four book types (tactile, non-tactile, narrative, non-narrative), scores could range from 0-10.

Results

Book Reading Behaviors

Parents reported how often they read books to their child, how often they read counting books to their child, how often their child chose to read a book, and how often their child chose to read a counting book. Responses to these four questions were analyzed as separate dependent variables in ANCOVAs with child gender (girl or boy) and parent education (less than bachelor's degree, bachelor's degree, graduate education) as the independent variables and the child age (in months) as the covariate. Due to the unequal *n* across the three education levels, we paid special attention to violations of the homogeneity of variance assumption (reported below). When found, we re-analyzed the relevant data as comparisons of means using the Welch test.

When considering how often parents read books to their child, there was a significant main effect of parent education, $F(2, 689) = 30.43$, $p < .001$, $\eta_p^2 = .08$. Parents with graduate

education reported that they read books to their child the most (M = 4.76, SD = 0.67) followed by parents with a bachelor's degree (M = 4.49, SD = 0.67) and parents with less than a bachelor's degree (M = 4.11, SD = 0.67). The linear contrast for this effect was statistically significant ($\hat{\varphi}$ = 0.46, SE = 0.07, $p < .001$; d = .40 for the difference between graduate education and bachelor's degree; d = .57 for the difference between bachelor's degree and less than a bachelor's degree). The effects of child age and child gender, as well as the interaction between child gender and education were not significant (all p-values > .10). Levene's test revealed that the null hypothesis of equal error variance should be rejected, $F(5, 690) = 15.294$, $p < .001$, but the Welch tests were consistent with the results above: comparing the three means for education level, $F(2, 120.048) = 17.58$, $p < .001$; comparing the six means in the 2x3 design, $F(5, 117.79) = 7.14$, $p < .001$.

When considering how often parents read counting books to their child, there was a significant effect of child age, $F(1, 689) = 12.29$, $p < .001$, $\eta_p^2 = .02$. As the child's age increased, the frequency of parents' reading of counting books decreased. The main effects of parent education and child gender, as well as the interaction between child gender and parent education were not significant (all p-values > .10). There was no evidence of violations in homogeneity of variance (p = .750).

When considering how often the child chose to read a book during free time, there was a significant main effect of child gender, $F(1, 689) = 7.80$, p = .005, η_p^2 = .01, Cohen's d = .22. Parents reported that girls chose to read a book during free time more often (M = 3.54, SD = 1.08) than boys (M = 3.31, SD = 1.02). The effects of child age and parent education, as well as the interaction between child gender and parent education were not significant (all p-values > .10). There was no evidence of violations in homogeneity of variance (p = .281).

When considering how often the child chose to read a counting book when reading, there was a significant effect of child age, $F(1, 689) = 7.93$, $p = .005$, $\eta_p^2 = .01$. As the child's age increased, the frequency of their reading of counting books decreased. There was an additional main effect of parent education, $F(2, 689) = 4.12$, $p = .02$, $\eta_p^2 = .01$. The linear contrast for this effect was significant ($\hat{\varphi} = -0.15$, $SE = 0.07$, $p = .04$), but was due largely to parents with graduate education reporting that their child read counting books less frequently than parents in the other two groups (Cohen's $d = .23$). The main effect of child gender, as well as the interaction between child gender and parent education was not significant (all p-values > .10). There was no evidence of violations in homogeneity of variance ($p = .520$)

Factors Influencing Parents' Ratings of Counting Books

Recall that parents read descriptions and viewed example pages of four counting books (presented one at a time and labeled Book A, B, C, D). After reading the description of each book, they rated the likelihood that they would choose the given book for their child (1 = extremely unlikely, 5 = extremely likely). Every parent rated one randomly chosen exemplar from each of the four book types (tactile, non-tactile, narrative, and non-narrative). Parents' ratings were analyzed using a mixed-factor ANCOVA with child gender and parent education as between-subjects independent variables, book type (tactile, non-tactile, narrative, non-narrative) as the within-subjects independent variable, and child age as the covariate. The Greenhouse-Geisser adjustment was used to correct for violations of sphericity. There were not statistically significant main effects of book type or child gender, or an association with child age (all p-values > .10). However, there was a significant interaction between book type and child age, $F(2.96, 2036.33) = 2.78$, $p = .04$, $\eta_p^2 = .004$. This interaction was not immediately interpretable, but after closer inspection of the data, the general pattern was for parents to prefer narrative

books over non-narrative books as child's age increased, but there was no systematic preference between tactile and non-tactile books as child's age increased. This pattern is displayed in Figure 1 using age bins created based on half birthdays (2;6-2;11, 3;0-3;5, 3;6-3;11, 4;0-4;5, 4;6-4;11) for illustrative purposes.

There was also a significant main effect of parent education, $F(2, 689) = 13.22$, $p < .001$, $\eta_p^2 = .04$. Parents with graduate education rated the likelihood that they would choose a given book ($M = 3.33$, $SD = 0.69$) as lower than parents with a bachelor's degree ($M = 3.65$, SD = 0.58, Cohen's $d = .50$) and parents with less than a bachelor's degree ($M = 3.60$, $SD = 0.71$, Cohen's $d = .39$). However, this main effect was qualified by a significant interaction between book type and parent education, $F(5.91, 2036.33) = 2.14$, $p = .047$, $\eta_p^2 = .006$. Tests of the simple effects showed an effect of parent education on every book type (all p-values < .05). However, follow-up Helmert contrasts using the Bonferroni-corrected alpha level of .0125 (.05 divided by the 4 unplanned follow-up Helmert contrasts) revealed that the specific pattern of the main effect shown above was present for every book type (all p-values < .01) except narrative ($p = .29$). The three-way interaction between book type, parent education, and child gender was not significant ($p > .10$). Note that the patterns above held if we included dummy variables to control for exemplars 1-10 for each of the book types as additional covariates in our analyses. Box's test showed no evidence of violations in the equality of the covariance matrices ($p = .31$), and Levene's tests conducted separately on each level of the repeated measure showed no evidence of violations in homogeneity of variance (all p-values > .05).

Preference for Tactile Counting Books

The forced choice between a tactile and non-tactile book was designed to further investigate parents' preferences for tactile counting books. After parents rated the four books

individually, they were presented with the tactile counting book they had rated side-by-side with the non-tactile book they had rated (labeled Book A and Book B) and were asked which one they would be more likely to choose and then to provide their reasoning. Parents' likelihood of choosing the tactile book (tactile = 1, non-tactile = 0) was analyzed with a logistic regression with child gender, parent education, and child age as the independent variables. There was a significant effect of parent education on parents' likelihood of selecting a tactile counting book, with higher education levels being associated with a decreased likelihood of choosing the tactile counting book, $\hat{\beta}$ = -0.31, *Wald* (1, *N* = 696) = 6.37, *OR* = 0.73, *p* = .01. Table 1 displays the percentage of parents at each education level who chose the tactile book. The effects of gender and child age were not statistically significant (both *p*-values > .10).

Parents' book choice explanations were analyzed for whether they mentioned tactility positively. Recall that parents were unaware that tactility was the factor of interest when they selected the counting books. Parents' likelihood of mentioning tactility as a positive reason for having selected their chosen book (e.g., "pop-up books hold my child's attention better") was analyzed with a logistic regression with child gender, parent education, and child age as the independent variables. There was a significant negative effect of parent education on the presence of positive responses regarding tactile elements in counting books, $\hat{\beta}$ = -0.32, *Wald* (1, *N* = 696) = 6.18, *OR* = 0.73, *p* = .01. As parents' education increased, the likelihood of mentioning the tactile elements as a positive reason for selecting their chosen book decreased. The odds that a parent with less than a bachelor's degree mentioned tactile features as a positive reason were 1.45 times those of a parent with graduate education. No other effects were statistically significant (all *p*-values > .10). Note that all of the patterns reported above for the forced choice and reasoning analyses involving tactility held if we included dummy variables to

control for exemplars 1-10 for the tactile and non-tactile book types as additional independent variables in our analyses.

Table 1

Parents' Preferences for Tactility Versus Non-Tactility and Narrative Versus Non-Narrative on the Forced-Choice Questions by Parent Education

Education Level	% Chose tactile over non-tactile	% Mentioned tactile positively	% Chose narrative over non-narrative	% Mentioned narrative positively
Less than a bachelor's degree (n = 58)	62.1	31.0	44.8	3.4
Bachelor's degree (n = 142)	58.5	38.7	65.5	9.2
Graduate education (n = 496)	48.8	24.8	64.9	14.1

Preference for Narrative Counting Books

A separate forced choice question was included to investigate parents' preferences for narrative versus non-narrative counting books. Similar to the approach for the tactile books above, parents were presented with the narrative and non-narrative counting books they had rated (labeled Book C and Book D) and asked which one they would be more likely to choose and then provide their reasoning. Parents' likelihood of choosing the narrative book (narrative = 1, non-narrative = 0) was analyzed with a logistic regression with child gender, parent education, and child age as the independent variables. There was a significant effect of parent education such that higher education levels were associated with an increased likelihood of selecting a narrative counting book, $\hat{\beta} = 0.27$, *Wald* (1, $N = 696$) = 4.89, $OR = 1.31$, $p = .03$. Table 1

displays the percentage of parents at each education level who chose the narrative book. Child age was not statistically significant ($p = .07$). There was also a significant effect of child gender with parents of boys being more likely to choose narrative counting books than parents of girls, $\hat{\beta} = 0.32$, *Wald* $(1, N = 696) = 3.95$, $OR = 1.37$, $p = .047$. Note, however, that controlling for exemplars did matter for this gender effect. When we included dummy variables to control for exemplars 1-10 for the narrative and non-narrative book types as independent variables in our analyses, the gender effect was no longer statistically significant ($p = .13$). The significant effect of parent education and the non-significant effect of child age were unchanged.

Parents' book choice explanations were analyzed for whether they mentioned the narrative qualities of the book as a positive feature. Recall that parents were unaware that narrative qualities were the factor of interest when they selected the counting books. Parents' likelihood of mentioning narrative qualities as a positive reason for having selected their chosen book (e.g., "[the narrative book] has a story line, which makes it more engaging and the counting is just a byproduct") was analyzed with a logistic regression with child gender, parent education, and child age as the independent variables. There was a significant positive effect of parent education on the presence of positive responses regarding narrative elements in counting books, $\hat{\beta} = 0.62$, *Wald* $(1, N = 696) = 6.80$, $OR = 1.86$, $p = .009$. As education level increased, the likelihood of mentioning the narrative elements as a positive reason for selecting their chosen book also increased. The odds that a parent with a graduate degree mentioned the narrative elements as a positive reason were 3.72 times higher than those of a parent without a bachelor's degree. No other effects were statistically significant (all p-values $> .10$). The same pattern held when we included dummy variables to control for exemplars 1-10 for the narrative and non-narrative book types as additional independent variables in our analyses.

Factors Parents Say Are Important When Selecting Counting Books

Parents explicitly rated how important four different book factors were when deciding on a counting book for their child. The four considered factors were challenge, enjoyment, tactility, and narrative qualities. Results are illustrated in Figure 2. Parents' ratings of each of these four factors were analyzed in a mixed-factor ANCOVA with child gender and parent education as the between-subjects independent variables, the four book factors as the within-subjects independent variable, and child age as the covariate. The Greenhouse-Geisser adjustment was used to correct for violations of sphericity. There was a significant effect of child age, $F(1, 689) = 5.14$, $p = .02$, $\eta_p^2 = 007$. As the child's age increased, parents' importance ratings increased. There was also a significant main effect of the book factor, $F(2.69, 1854.38) = 20.13$, $p < .001$, $\eta_p^2 = .03$. Enjoyment ($M = 4.56$, $SD = 0.87$) was rated as the most important factor, followed by narrative qualities ($M = 3.31$, $SD = 1.69$), tactility ($M = 3.07$, $SD = 1.66$), and challenge ($M = 2.79$, $SD = 1.53$). These effects were qualified by an interaction between the book factors and child age, $F(2.69, 1854.38) = 3.99$, $p = .01$, $\eta_p^2 = .006$. The general pattern of this interaction was that the importance of narrative qualities increased as child age increased, but the importance of other qualities remained roughly the same as child age increased.

The main effect of the book factor was also qualified by an interaction between the book factor and parent education, $F(5.38, 1854.38) = 6.81$, $p < .001$, $\eta_p^2 = .02$. Tests of the simple effects revealed an effect of parent education on the importance ratings for challenge, $F(2, 689) = 3.13$, $p = .04$, $\eta_p^2 = .01$, and tactility, $F(2, 689) = 12.91$, $p < .001$, $\eta_p^2 = .04$, but not for the enjoyment or narrative factors (both p-values > .10). A closer examination of the challenge factor revealed that parents with less than a bachelor's degree rated challenge as less important ($M = 2.55$, $SD = 1.08$) than those with a bachelor's degree ($M = 2.97$, $SD = 1.06$) and those with

graduate education (M = 2.86, SD = 1.07); d = .39 for the difference between parents with less than a bachelor's degree and those with a bachelor's degree; d = .29 for the difference between parents with less than a bachelor's degree and those with graduate education. The Helmert contrast for this effect was significant using a Bonferroni-corrected alpha level of .025 (.05 divided by 2 unplanned contrasts on the significant simple effects), $\hat{\varphi}$ = -0.36, SE = 0.15, p = .02. A closer examination of the tactility factor revealed that parents with graduate education rated tactility as less important (M = 2.79, SD = 1.16) than those with a bachelor's degree (M = 3.33, SD = 1.16) and those with less than a bachelor's degree (M = 3.08, SD = 1.17); d = .47 for the difference between parents with a graduate education and those with a bachelor's degree; d = .25 for the difference between parents with a graduate education and those with less than a bachelor's degree. The Helmert contrast for this effect was also statistically significant using a Bonferroni-corrected alpha level of .025, $\hat{\varphi}$ = -0.42, SE = 0.11, p < .001. There were no significant effects involving child gender (all p-values > .10). Box's test showed evidence of violations in the equality of the covariance matrices (p = .001), but Levene's tests conducted separately on each level of the repeated measure showed no evidence of violations in homogeneity of variance (all p-values > .05).

Counting Books Parents Have Read to Their Child

Finally, parents indicated the counting books they had read to their child. The options on the list were the 10 tactile, 10 non-tactile, 10 narrative, and 10 non-narrative books that had been used in the study (see supplementary materials). The results are illustrated in Figure 3. The number of books read (out of 10) was analyzed with a mixed-factor ANCOVA with child gender and parent education as the two between-subjects independent variables, book type (tactile, non-tactile, narrative, non-narrative) as the within-subjects independent variable, and child age as the

covariate. There were not statistically significant effects of book type, child gender, or child age (all *p*-values > .05). There was a significant main effect of parent education, $F(2, 689) = 7.12$, $p = .001$, $\eta_p^2 = .02$. Parents with less than a bachelor's degree reported reading more counting books on average ($M = 1.41$, $SD = 0.81$) than parents with a bachelor's degree ($M = 1.15$, $SD = 0.79$), who reported more than parents with graduate education ($M = 1.02$, $SD = 0.80$); $d = .32$ for the difference between parents with less than a bachelor's degree and those with a bachelor's degree; $d = .48$ for the difference between parents with less than a bachelor's degree and those with graduate education. The linear contrast for this effect was negative and statistically significant ($\hat{\varphi} = -0.28$, $SE = 0.08$, $p < .001$). This effect was qualified by an interaction between parent education and child gender, $F(2, 689) = 5.85$, $p = .003$, $\eta_p^2 = .02$. Tests of the simple effects showed that the significant effect of parent education held for parents of boys, $F(2, 333) = 10.00$, $p < .001$, $\eta_p^2 = .06$, but not for parents of girls, $F(2, 355) = 1.59$, $p = .21$, $\eta_p^2 = .009$.

The main effect of parent education was also qualified by an interaction between parent education and book type, $F(5.70, 1963.10) = 4.07$, $p = .001$, $\eta_p^2 = .01$. Tests of the simple effects showed that the effect of parent education held for tactile books and non-tactile books, but not for narrative and non-narrative books. Follow-up polynomial contrasts using the Bonferroni-corrected alpha level of .008 (.05 divided by 6 [4 unplanned polynomial contrasts here plus the 2 unplanned polynomial comparisons below]) revealed that the negative linear effect held for tactile ($p < .001$) but not non-tactile ($p = .009$), narrative ($p = .22$), or non-narrative ($p = .24$). A related pattern displayed in Figure 3 is that the difference between the number of tactile and non-tactile books read significantly decreased with parent education level (polynomial contrast $p = .003$), but the difference between the number of narrative versus non-narrative books read did not (polynomial contrast $p = .92$). There was not a significant three-way interaction among book

type, parent education, and child gender ($p > .10$). Box's test showed no evidence of violations in the equality of the covariance matrices ($p = .55$), and Levene's tests conducted separately on each level of the repeated measure showed no evidence of violations in homogeneity of variance (all p-values > .05).

Discussion

Despite the role parents play in preschoolers' exposure to counting books, this study is the first to provide information about the factors influencing parents' counting book preferences for their children. We hypothesized that parent education would be positively associated with counting book reading and that child gender would be associated with parent preferences for specific features within counting books. Results did not support these hypotheses. Instead, parent education was negatively associated with counting book reading, and child gender was generally not associated with parent preferences for specific features. Parent education and child age, however, were associated with preferences for specific counting book features.

Although we replicated the well-established positive association between parent education and frequency of book reading (Foster, Lambert, Abbott-Shim, McCarty, & Franz, 2005; Hartas, 2011; Phillips & Lonigan, 2009), that positive association did not extend to counting books. If anything, higher parent education was associated with less counting book reading (when measured by the number of specific counting books used in this study that parents had previously read to their child). This finding counters DeFlorio and Beliakoff's (2015) finding that children from middle socioeconomic status (SES) homes are more likely than those from lower-SES homes to be exposed to books with mathematics content. It is worth noting that SES in the Deflorio and Beliakoff study was determined based on household income and not parental education level, though parents from higher-SES households did report having more years of

education. One possibility is that different aspects of SES may relate differently to educational outcomes (cf. Davis-Kean, 2005). However, it is also possible that parents with higher education levels are more likely than those with lower education levels to view counting books as below the skill level of their child. Indeed, frequency of counting book reading was negatively associated with child age. Together these results may reflect the developmental progression of children learning how to count. Children of parents with higher education levels and older children might not read counting books as often as those with parents with lower education levels and younger children because they may already have mastered the counting concepts and skills supported by counting book reading and, therefore, may view these books as less interesting. Note that parents (at least those in middle-SES samples) often overestimate their child's understanding of counting because they assume that correctly reciting the count list indicates understanding of cardinality (Fluck, Linnell, & Holgate, 2005).

Our primary goal was to examine the effects of both tactility and narrative quality on parents' counting book preferences. We predicted that parents' preferences for each of these factors would depend on child gender; however, results generally did not support this hypothesis. Instead, preferences differed by parent education and child age. Parents with graduate education exhibited less preference for tactile versus non-tactile books, but more preference for narrative versus non-narrative books, than did those with less than a bachelor's degree. Parents' preferences for narrative counting books also increased with child age.

Preferences for Narrative Quality

Parental education has previously been shown to influence preferences for how to structure early learning environments (e.g., Stipek et al., 1992). Highly educated parents seem to value more progressive, reform-based learning opportunities for their children (e.g., Brantlinger

& Majd-Jabbari, 1998; Petrilli, 2017), and mothers with higher levels of education tend to prefer embedding education within everyday tasks (e.g., Stipek et al.). These preferences may extend to their preferences about the books and learning materials they select for their home. Parents with graduate education may not be interested in counting books without a narrative story because such books seem to be more in line with a traditional skills-based, direct instruction approach. They may prefer narrative counting books because they embed counting within the context of a more meaningful, "joy-filled" activity.

A second possibility is that variations in parent preferences by education level reflect underlying differences in children's mathematics knowledge. Family socioeconomic status, of which parental education is an important facet, is positively associated with early mathematics understanding (e.g., Jordan, Huttenlocher, & Levine, 1992; LeFevre et al., 2009; Saxe, Guberman, & Gearhart, 1987; Starkey, Klein, & Wakeley, 2004). Parents with higher education levels may choose the narrative books because the non-narrative counting books are viewed as too simplistic and too far below their child's current knowledge level. A related point is that parents with higher education levels may view narrative counting books as more challenging and enriching than non-narrative counting books because they involve both reading and counting practice for children. Narrative books may be seen as a way to help children learn vocabulary, storytelling skills, and mathematics concepts. Given the positive effects that book reading has on children's language abilities and literacy skills, parents may view narrative counting books as an opportunity to merge reading and counting practice (Saracho & Spodek, 2010) and build mathematical language skills (Purpura et al., 2017). Recall that parents with less than a bachelor's degree rated challenge as the least important factor when choosing a counting book, which aligns with this speculation. Perhaps parents with lower education levels were less likely

to select narrative counting books because the challenge of these books was not as important to them as other factors such as enjoyment. Still another possibility is that the differences in preferences for narrative books over non-narrative books may reflect differences in perceived challenge for the parent themselves. If the parents with lower education levels also had lower levels of literacy, then it may be that they wanted to refrain from selecting books that contained more text.

Preferences for Tactility

Parents in our sample with lower levels of education had a higher preference for tactile over non-tactile features. This was shown in the parent ratings of the importance of tactile features, the number of the tactile books that parents reported having read with their child, and the forced choice selection between a book with or without tactile features. This finding, though unexpected, may be related to educational differences in knowledge of child development. Several studies have shown that parent education level is positively associated with knowledge of child development (Bornstein, Cote, Haynes, Hahn, & Park, 2010; Hess, Teti, & Hussey-Gardner, 2004). Thus, it is possible that parents with higher education levels may have more awareness of how their child's behavior would be affected by tactile features. They may view tactile features as too distracting for the limited cognitive resources of preschool children. A common belief about tactility is that it can make activities more entertaining and engaging for children (e.g., Moyer, 2001), but more engaging does not always translate to greater understanding or deeper learning (DeLoache, 2002; Petersen et al., 2014). In fact, more engaging tactile materials may sometimes lead children to exhibit more distraction and off-task behaviors during learning tasks (Petersen et al., 2014). Parents with graduate education may be aware of these potential downsides of using tactile books. Some of the reasons parents with graduate

education gave for why they chose the non-tactile book over the tactile book support this idea (e.g., "the buttons distract from actual counting," "my child would be more interested in just pushing the dots and not really care about counting," and "[the tactile book] might be distracting...").

Preferences for Other Factors

Regardless of education level, parents by far reported child enjoyment as the most important factor in selecting a counting book to read with their child. This finding is noteworthy because it identifies a common preference across all education levels—parents want to use counting books that their children find enjoyable. At times there may be tension between books that are most effective for teaching particular concepts and those that are most engaging. The results of the present study suggest that instructional designers and marketers benefit from prioritizing children's enjoyment. Still, parents across the education levels may have different ideas about what their child will find enjoyable, and each child's preferences may or may not line up with their parents'. The heterogeneity in parental preferences for the presence of different design features (e.g., tactility, narrative quality) suggests that there is not one option that appeals to everyone. Future work should focus on determining the best ways to maximize children's enjoyment during counting book reading, while at the same time incorporating features that facilitate learning and do not detract from the concepts and skills to be learned. It is also important for future research to consider this question in the context of e-books given their increasing prevalence. The use of tablets as a platform for counting books offers the possibility of introducing many interactive and engaging features, but similar to the exemplars of tactile books in the present study, the educational effectiveness of such features requires future study.

Limitations and Future Directions

There were limitations to this study that may limit generalizability. First, a random sampling method was not used for recruitment. Instead, we used convenience and snowball sampling which resulted in the majority of the survey participants (60%) being White women who held more than a bachelor's degree. Only 8.3% of the sample had less than a bachelor's degree, and only 1.6% were African American or Black. The overrepresentation of parents from the highest education level makes it difficult to generalize the findings related to age and gender that are averaged across education level. Thus, the fact that we did not find support for our original hypotheses related to children's gender should be interpreted cautiously because gender differences may be found in a sample that is more representative of the U.S. population. People with higher education levels may be less likely to hold gender stereotypes (Katz-Wise et al., 2010). Indeed, a Pew Research Center survey (2017) showed that people in the United States with a bachelor's degree or higher are more likely than those with less than a bachelor's degree to see societal benefits to changing gender roles. Future research should also recruit a more racially and ethnically diverse sample, as the gender-related attitudes of White women may not be representative of the gender-related attitudes of Black or Hispanic women (Kane, 2000).

Fortunately, our unequal *n* is less problematic for interpreting the differences we found across education levels. Given that the homogeneity of variance assumption was not systematically violated, the main consequence of our unequal *n* is a reduction in power for detecting the effect of education level. However, as mentioned above, our convenience sampling does affect generalization, and it is important to keep in mind that the group with the lowest education level did not include parents who had not graduated from high school and likely did not include people living in poverty without easy internet access. Thus, the findings involving this group may not generalize to parents without a high school degree.

Second, we included only a subset of the available counting books on the market. We identified all of the books through an Amazon search and tried to equate tactile and non-tactile books and narrative and non-narrative books in terms of a few obvious factors. However, parents may have rated a book highly or selected a book if they had read it in the past (see Anderson et al., 2001). Many parents reported familiarity with a book as part of their reason for selecting the books during the forced choice section of the survey (e.g., "I am familiar with this author," "I'm familiar with this book and would love to share it with my son."). However, the associations between education level and the two factors of interest remained the same when the specific book exemplars that parents viewed were controlled for, suggesting that this cannot fully account for the results. Future research may identify the importance of these factors by creating novel stimuli that differ only in the factor of interest.

Third, we studied parents' preferences with a survey. It is an open question whether parents actually draw on these preferences when making decisions in their everyday lives. It is possible that different factors come into play when parents are shopping for counting books among hundreds of books choices online, choosing which books to check out of a public library, or selecting which book in their home library to read or re-read with their child. Moreover, as mentioned above, parents' preferences may or may not be correlated with their child's preferences, and children's preferences may dictate in large part which books children read and re-read. To fully understand the benefits and disadvantages of including tactile features and narrative quality in counting books, we need to study how these features affect parents' preferences, parents' behaviors, children's preferences, and children's behaviors. Future research will also need to determine how the tactility and narrative quality of counting books affects the knowledge children construct from shared book reading.

Although the current study linked parental education with parental preferences for counting books, more research is needed to determine whether this effect is unique to education or indicative of SES more broadly. That is, socioeconomic status is meant to be a marker of just how rich (or sparse) a developmental environment is. To measure this "amorphous concept" researchers will oftentimes use parental education, family income, occupational status, marital status, or some composite of the components (Duncan & Magnuson, 2003). However, these different components of SES do not perfectly overlap and may differentially influence developmental outcomes.

Results indicate that parent education level may play a role in the types of counting books that children read. However, the effect sizes were mostly in the small or small to medium range (Cohen, 1992). Small effect sizes are not uncommon in the domain of education, and these effect sizes should not be strictly interpreted or compared to other effect sizes because it is unclear what a small to medium effect on parent preferences for counting books actually means (Valentine & Cooper, 2003). Indeed, even a small effect size in education could be a worthwhile improvement if it is low cost and cumulative over time (Coe, 2002). One example of this is the readability of text in learning materials. When participants study information and then later have to recall that information, their memory performance is a little better if the studied material was written in a difficult-to-read font than if it was written in an easy-to-read font (Diemand-Yauman, Oppenheimer, & Vaughan, 2011). This relatively small effect on recall performance can cumulate over weeks to affect high school students' performance on a unit test if the font modification is made to all of the worksheets and PowerPoint slides a teacher uses when teaching that unit (Diemand-Yauman et al.). In a similar way, the small effect sizes in parent preferences for book types seen in the present study may cascade into larger effects if parents'

book preferences affect the actual book choices parents make when putting together a child's home library. If one home library includes more challenging, narrative, non-tactile counting books, and another home library includes more non-challenging, non-narrative, tactile counting books, then those two children's cumulative experience with counting books will be substantially different. At the same time, however, it is theoretically possible for even large effects on parents' book preferences to be substantively meaningless if they do not ultimately affect the books children are exposed to or the children's own book preferences.

Implications

By combining research on the factors that support learning from shared counting book reading with research on the factors that affect the counting books parents select for their children, we may discover ways parents' choices may contribute to differences in children's early mathematics knowledge. At a minimum, results of the present study suggest that counting books are one early learning resource that parents with lower education levels are relying on as much as, if not more than, parents with higher education levels. If designed effectively, counting books may be uniquely positioned to improve the early mathematics skills of children who have parents with lower education levels. Research should continue to investigate how different features of counting books affect book choices, book reading behaviors, and children's learning and development. Ultimately, such research could help guide the recommendations pediatricians and educators make to parents about the types of books they can choose to support children's early mathematics development.

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