MIND, BRAIN, AND EDUCATION

Building Vocabulary Knowledge in Preschoolers Through Shared Book Reading and Gameplay

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ABSTRACT— This study moves beyond previous investigations to examine whether an educational intervention combining shared book reading with a vocabulary game increases children's vocabulary knowledge. Four-year-olds ($N = 44$) were randomly assigned to dyads in either an intervention (shared book reading plus vocabulary review game) or comparison condition (shared book reading, after-reading vocabulary review, and game that did not teach vocabulary). After two 30-min sessions, results demonstrated that the intervention condition outperformed the comparison condition on measures of receptive and expressive knowledge of taught vocabulary words. Children in the intervention group who scored the lowest at pretest on the receptive measure saw the most gains in taught word knowledge. Findings suggest that combining vocabulary gameplay with shared book reading improved children's learning of the vocabulary words in comparison to a comparison group.

Imagine a child encountering this sentence: "The cat is a finicky eater." Unless the child is familiar with "finicky," there is little hope that she will understand the meaning. Vocabulary learning represents the conceptual core of language; in fact, early vocabulary is a strong predictor of children's reading skills and academic success (Dickinson, Golinkoff, & Hirsh-Pasek, 2010; National Institute for Literacy, 2009). Shared book reading is an effective method for teaching vocabulary (Biemiller & Boote, 2006; Penno, Wilkinson, & Moore, 2002), and research suggests that adding play provides extra benefit (Han, Moore, Vukelich, & Buell, 2010; Roskos & Burnstein, 2011). This article assesses an evidence-based intervention for teaching 4-year-olds vocabulary through a game plus shared book reading.

Why Focus on Vocabulary?

Many studies have examined children's receptive and expressive vocabulary, language comprehension, and phonological processing to demonstrate the predictive role of language for reading (Dickinson et al., 2010; NICHD ECCRN, 2005). However, the quantity, quality, and diversity of language heard may be different for children from various socioeconomic and cultural backgrounds (Hoff, 2006; Rowe, 2012). Unfortunately, research has consistently found that children with higher initial levels of vocabulary knowledge experience more vocabulary growth than their peers with less initial knowledge, termed *the Matthew effect* (Stanovich, 1986). Children from lower income backgrounds often begin formal schooling knowing significantly fewer words than children from higher income backgrounds (Hart & Risley, 1995), and this gap often continues to grow unchecked (Farkas & Beron, 2004).

Increasing Vocabulary Through Shared Book Reading and Guided Play

Shared book reading studies have explored two main techniques for increasing children's vocabularies: explicit instruction of word definitions and adult scaffolding in a participatory learning environment (Coyne, Zipoli, & Ruby, 2006). During explicit instruction of word definitions, adults tell children the meaning of a word. Adult scaffolding includes posing open-ended questions about the story in

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conjunction with child participation and helping children find answers.

To generate additional vocabulary gains, studies have combined shared book reading with guided play (Han et al., 2010; Roskos & Burnstein, 2011). Guided play recognizes that children best acquire knowledge by exploring their environment through interactions with adults holding implicit learning goals (Weisberg, Hirsh-Pasek, & Golinkoff, 2013). Guided play might be particularly effective for young children, who lack well-developed "proactive control"—or neural mechanisms that help the brain anticipate upcoming events based on contextual clues (Weisberg, Hirsh-Pasek, Golinkoff, & McCandliss, 2014). That is, neuroscientists now distinguish between two kinds of cognitive control: proactive control in which the brain anticipates stimuli and reactive control in which the brain responds to stimuli. Guided play might help children construct a *mise en place*, or a disposition to anticipate certain things from an environment (Weisberg et al., 2014)—such as their participation. Adult scaffolding within guided play might provide crucial external support for children's newly developing proactive control mechanisms as children respond to a positive *mise en place* (Weisberg et al., 2014). Guided play also exemplifies the "enhanced-discovery" approach (Alfieri, Brooks, Aldrich, & Tenenbaum, 2011) that has been effective for increasing children's learning through active, engaged, meaningful, and socially interactive elements (Hirsh-Pasek et al., 2015).

Increasing Vocabulary Knowledge Through Games

Guided play can also entail an adult constructing a game that requires active child participation. By infusing games with educational content, their playful, active, and engaging elements increase children's motivation to learn (Garris, Ahlers, & Driskell, 2002). Games may be successful learning tools since they foster an environment that activates children's intrinsic motivation. Games include the motivating element of *challenge* if they are difficult enough to prevent boredom but give players some *control* over learning outcomes (Malone & Lepper, 1987). Games can also encourage both sensory (auditory/visual) and cognitive (productive feedback and surprise elements) *curiosity* and incorporate elements of make-believe or *fantasy* (Malone & Lepper, 1987). To explain the connections between gameplay and learning, the term *intrinsic integration* (Kafai, 1996) describes the incorporation of educational content within game structure. Intrinsically integrated games that deliver learning material promote *flow*—a state of complete absorption in an activity—which relates to learning (Csikszentmihalyi & Csikszentmihalyi, 1988).

In particular, word games increase vocabulary learning by exposing children to new words and providing a playful context in which they can process words deeply and actively (Richek, 2005). Previously studied word games (Berne & Blachowicz, 2008; Wells & Narkon, 2011) were successfully implemented with school-aged children. This study focuses on younger children to increase vocabulary early.

Present Study

This study steps beyond previous research by combining shared book reading with gameplay to increase children's vocabularies. In the *intervention condition*, children engaged in shared book reading and reviewed taught words in an author-modified version of the *Snakes & Ladders* board game. Children in the *comparison condition* also engaged in book reading and reviewed definitions of taught words but played a version of the game without vocabulary words. This allowed us to separate the effects of a word game versus the same game without words, while still providing equivalent amounts of vocabulary review. We hypothesized that all children would know more taught words at posttest than at pretest, but that children who played the vocabulary game would show significantly greater gains than the comparison group. However, we expected that children with higher initial vocabulary knowledge would continue to demonstrate greater knowledge of taught words than children with lower initial vocabulary knowledge due to the Matthew effect and short intervention duration.

METHOD

Participants

Forty-eight 4-year-old participants ($M_{age} = 52.61$ months, $SD_{age} = 3.68$ months) whose primary language was English were recruited from nine preschool classrooms affiliated with a university in the Mid-Atlantic region of the United States. Families gave blanket consent for their children to participate in research projects. Four children did not complete the second session, making the final sample size 44 children. Socioeconomic information was available for 32 children: 22 reported maternal education ranging from associate's to master's degrees and 10 reported receiving state-subsidized childcare. Twenty three were boys and 21 were girls. Five were identified as African American (11.3%), two as Hispanic (4.5%), 26 as Caucasian (59.1%), five as Asian (11.3%), three as Pacific Islanders (6.8%), and three as biracial (6.8%), by school report. Children were randomly assigned to an intervention ($n = 22$) or comparison ($n = 22$) condition. Then, children were randomly paired to form dyads that remained the same for both sessions. They were randomly assigned to read *Farmer Duck*, intervention ($n = 13$); comparison ($n = 10$), or *The Knight and the Dragon*, intervention ($n = 9$); comparison ($n = 12$).

Procedure

Sessions

Experimenters met with children for two 30-min sessions between two and seven days apart based on child availability. The intervention was delivered to dyads, except when one child was unable to participate in the second session, which occurred four times. In Session 1, tester(s) first administered the pretest receptive and expressive vocabulary measures. Next, an experimenter read the storybook to the dyad using the script developed for each book. The script defined the vocabulary words as they appeared in the story. Finally, the dyad either played the intervention version of the vocabulary game or reviewed the vocabulary and played the comparison version of the game without the vocabulary items overprinted on the game board.

Session 2 was identical to Session 1 except that at the conclusion of the session, tester(s) administered the posttest vocabulary assessments.

Book Reading and Vocabulary Words

Each pair of children heard one of the two books, *The Knight and the Dragon* (dePaola, 1998) or *Farmer Duck* (Waddell, 1996), using an enriched book reading method consisting of a different script at each reading (Hadley, Dickinson, Hirsh-Pasek, Golinkoff, & Nesbitt, 2016). The books and all words were selected as a part of a larger (Read-Play-Learn) project (see Hadley et al., 2016, for more detail). The books were comparable in terms of the pictorial representations of taught words, length, and complexity of text. Ten taught words per book, representing a mix of verbs, nouns, prepositions, adverbs, and adjectives, were selected using the following procedures. First, Tier 2—or words of high utility that often occur in adult conversations and literature (Beck, McKeown, & Kucan, 2002)—were identified within each book. Additional taught words were inserted into the texts since both books did not feature 10 Tier 2 words. In adapting the texts, we ensured that the two books were similar in numbers of words per page, total number of pages, and pictorial representations of taught words. By making these changes to the books' text, we did not significantly alter the original storylines. Instead, we added additional detail. Taught words were selected based on the ability to provide child-friendly definitions, semantic and phonological qualities, frequency of use (Biemiller, 2010; Chall & Dale, 1995), difficulty, and the words' unfamiliarity, based on prior data from the Read-Play-Learn project (see Table 1 for taught word definitions).

Comparison Condition After-Reading Word Review

After reading the story, the experimenter said, "Now I want us to go back and remember a little of what happened in the story." The experimenter then reviewed the words by revisiting them in context of the story and included questions about the uses of the words or requests for gestures. For example, to review *below*, children heard, "Here is the knight practicing for the fight. The princess is high above him in the castle. The knight is *below* her [point to ground in picture]. Can you put your hand *below* your foot?" The words were generally said two times in each review statement or question. In some cases, children had to be prompted for answers; in these cases, they heard the word again during the prompts. Such prompting occurred similarly during game play for the intervention group.

Thus, this activity required children to answer some word-based questions, both verbally and using gesture, which were similar to the questions within the game. However, the after-reading word review was designed to contrast with the game so that children were presented with similar content, but without the focus on challenge, fantasy, curiosity, and control (Malone & Lepper, 1987) that was present within the game structure.

Intervention Condition Game

After each book reading, intervention group children played the vocabulary game using their own individual game boards (see Figure 1) and game pieces. The experimenter explained how to play the game and provided support while the children played. As spaces on the game board were either blue or yellow unnumbered squares, children took turns spinning a spinner that could land on either a yellow or a blue quadrant. Children then moved their pieces to the next square of that color. If the space contained a word, the experimenter asked the child the corresponding question from a list of vocabulary questions.

As the game progressed, questions moved from primarily low demand (i.e., recalling story elements) to high demand (i.e., making inferences and predictions based on the story) (Blewitt, Rump, Shealy, & Cook, 2009). Words that received low-demand questions during the first session received higher demand questions in the second session and vice versa (see Table 2). If the child gave an inappropriate answer or no response, the experimenter said, "Let's remember how we used _____ in our story," and gave an example. The words were generally said two times in each question or review statement.

If children landed on a space without a word, they were asked to spin again until they landed on a space with a word. If the child answered the question correctly, the player was praised for answering, and the next player took a turn. If the child answered incorrectly, the experimenter guided the child to the correct answer and then praised the child.

To add an element of fantasy, the board also contained two ladders and two snakes. If children landed at the bottom of a ladder, they had to answer correctly to move up the

Table 1
Taught Words and Parts of Speech by Book With the Book Reading Definitions Given

Taught word	*Part of speech*	*Definition*
		Farmer Duck ($n = 10$ words)
Dawn	Noun	Time of day when the sun is coming up (The animals met at **dawn**.)
Weeds	Noun	Plants that grow where they are not wanted (The duck picked **weeds**.)
Rung	Noun	Each step of a ladder (The duck stood on the **rung** to pick apples.)
Lane	Noun	A little road (The farmer ran down the **lane**.)
Returning	Verb	To come back (The farmer was never **returning** to the farm.)
Fled	Verb	To run away very quickly (The farmer **fled** when the animals chased him.)
Fetching	Verb	To get something and bring it back (The duck was **fetching** the cow from the field.)
Over	Preposition	Going up and across something (The farmer ran **over** the hill.)
Wearily	Adverb	In a very tired way (The duck was doing his work **wearily**.)
Weighty	Adjective	Very heavy (The duck carried a **weighty** basket full of eggs.)
		The Knight and the Dragon ($n = 10$ words)
Enemies	Noun	People who do not get along and fight (The knight and dragon used to be **enemies**, but now they are friends.)
Nostrils	Noun	Little holes in a nose (The dragon blew fire from his **nostrils**.)
Scales	Noun	Little, hard, green plates on a dragon's body (The dragon's **scales** protected him in a fight.)
Talons	Noun	Animal or bird claws (The dragon's **talons** scared the knight.)
Rummaging	Verb	To move things around to look for something (The dragon was **rummaging** for a book about knight fighting.)
Charging	Verb	To run at something very fast (The knight and dragon were **charging** at each other.)
Galloping	Verb	To run very fast (The knight's horse was **galloping** during the fight.)
Below	Preposition	At a lower level (The knight and dragon were fighting **below** the princess's tower.)
Intelligent	Adjective	Smart (The princess was very **intelligent**.)
Fierce	Adjective	Scary (The dragon made **fierce** faces to scare the knight.)

ladder. Whenever children landed on the top of a snake, the experimenter told them that in order to avoid the snake, they needed to answer the question correctly. If a player landed on a word that the other player had landed on, the experimenter asked a different question about that word. When the first player reached "Finish," the player who had not yet reached "Finish" had to complete the "Bonus Round." This meant that the player had to answer questions about the words neither child had landed on during the course of the game. After correctly answering the questions about those words, that player also won.

Comparison Condition Game

These children played a version of the game without overprinted words on the game board. The children took turns spinning the spinner and played until they both reached "Finish." This version of the game took less time to play than the version of the game in the intervention condition. However, the addition of the after-reading word review made the total time for the book reading and gameplay equal across conditions.

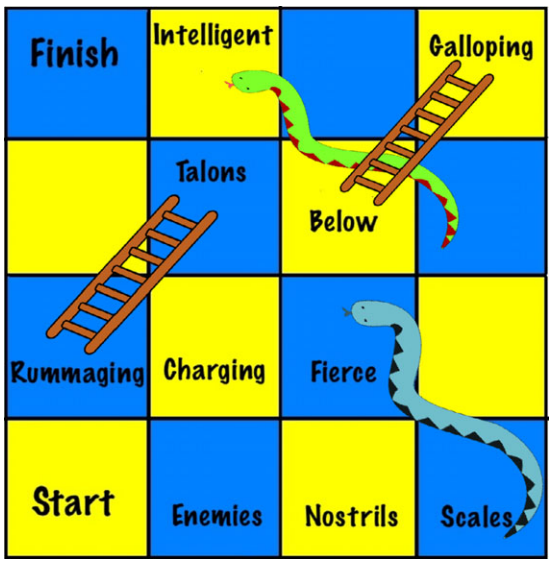

Fig. 1. Sample game board in the intervention condition; the comparison condition contained the words "Start" and "Finish" but the rest of the words were not present. Players moved from "Start" to the right and then moved up at the end of the row and up and to the left.

Measures

Receptive Vocabulary

An author-generated assessment was used to measure children's pretest and posttest receptive vocabulary knowledge. Along with four practice words to familiarize the task, the assessment tested three types of words: 10 taught words, 7 control words that were not heard in the story but were of the

Table 2
Sample Intervention Condition Game Questions

Question type	*Book*	
	The Knight and the Dragon	*Farmer Duck*
Low demand	In our story, the dragon made *fierce* faces to see how scary he could be. Can you show me how he made a *fierce* face?	The animals chased the farmer down the *lane* and away from the farm. Can you point to the *lane* in the picture from our book?
High demand	In our story, the dragon made *fierce* faces to see how scary he could be. Why might you make a *fierce* face?	The animals chased the farmer down the *lane* and away from the farm. Where do you think the farmer went at the end of the *lane*?

same difficulty as the taught words, and 5 filler words children likely knew. In addition to the correct target, the picture choices included a conceptual foil and a thematic foil (see Table 3). By not using images from the books, the comprehension test also assessed extension. Testers asked children to "Show me (the word)." Children were given one point for selecting the target picture.

Expressive Vocabulary

The *New Word Definition Test* (NWDT; Blewitt et al., 2009) assessed children's pre- and posttest expressive vocabulary knowledge. Children were asked to define the words verbally or using gesture. Participants were introduced to a puppet who "doesn't know very many words." The puppet asked children to define 18 words (10 taught, 4 control, and 3 filler) along with 2 practice words, a smaller number of control and filler words relative to the receptive test to compensate for the length and difficulty of the expressive task. For each word, children were asked "What is (a) (noun)?" or "What does (verb) mean?" and then, "Can you show me or tell me anything more about (noun/verb)?"

A coding scheme, adapted from Blewitt et al. (2009) (Hadley et al., 2016) was used to categorize children's responses based on semantic and contextual content (see Table 4). Children were given 1 point for each information unit, except for Basic Context (0.5 points). Children's scores for a single word ranged from 0–2. Two raters assigned point values based on the coding criteria, and inter-rater reliability calculated on 25% of the tests was 98%.

Fidelity of Implementation

Sessions were either observed by an author or recorded for later analysis. Sessions were checked against the text from the book-reading scripts, the after-reading word review, and the intervention game questions. The check sheet required marking off whether the experimenter followed the script and resulted in a total number of checks per session. Based on recordings of 50% of sessions, an average fidelity score was calculated for all three experimenters who delivered the instruction. Fidelity for individual sessions ranged between 90.4% and 100%. Across experimenters, average fidelity of implementation was 98% (range: 96.5%–100%).

Data Analyses

An experimental pretest/posttest design was used with the dependent variables of (1) receptive vocabulary and (2) expressive vocabulary. Analyses of taught, control, and filler words were conducted.

One-way analyses of covariance (ANCOVA) were run to test mean gains between pretest and posttest. For each dependent variable, a child's pretest score served as the covariate to minimize the confounding factor of children's previous knowledge and reduce unexplained variance, increasing the ability of the analyses to detect effects (Field, 2009). Raw scores were used for all analyses as all children answered all the questions posed. In addition to *p*-values, effect sizes are reported using partial eta square coefficients (η_p^2). For partial eta square coefficients, values equal to or above .01 are considered small, values equal to or above .06 are considered moderate, and values equal to or above .14 are considered large (Murphy & Myors, 2004). An analysis of gain scores between pretest and posttest was also conducted to determine the gains made by children in the intervention and comparison groups who scored differentially at pretest.

RESULTS

Table 5 provides mean raw scores and standard deviations for all measures by group, word type, and time. Gender and socioeconomic status (SES) were not significant predictors of any outcome and were not included in the final analyses.

Analyses of Covariance

Receptive Vocabulary

On taught words featured in the receptive test, a two-factor ANCOVA comparing Condition (intervention or comparison) and Book (*Farmer Duck* or *The Knight and the Dragon*)

Table 3
Sample Receptive Vocabulary Test Items by Word Type and Foils

Sample Taught Words		
Target Image	**Thematic Foil**	**Conceptual Foil**
Intelligent	Books	Athletic
Wearily	Working	Doing chores
Rung	Bunk Beds	Stairs
Sample Filler Word		
Target Image	**Thematic Foil**	**Conceptual Foil**
Dog	Bone	Cat
Sample Exposure Word		
Target Image	**Thematic Foil**	**Conceptual Foil**
Weeping	Angry	Laughing
Sample Control Word		
Target Image	**Thematic Foil**	**Conceptual Foil**
Pliers	Wire	Hammer

while covarying for pretest scores, revealed a significant main effect of Condition; $F(4, 39) = 20.80$, $p < .001$, $\eta_p^2 = .35$, with no main effect for Book; $F(4, 39) = 3.03$, $p = .10$, and no interactions. The children in the intervention condition outperformed their peers in the comparison condition. No significant differences were present between Condition or Book on the control and filler words.

Expressive Vocabulary

On taught words featured in the expressive test, a two-factor ANCOVA comparing Condition and Book while covarying for pretest scores revealed a significant main effect for Condition; $F(4, 39) = 4.22$, $p < .05$, $\eta_p^2 = .10$; with no main effect for Book; $F(4, 39) = .21$, $p = .07$, and no interactions. At posttest, the children in the intervention condition outperformed the children in the comparison condition. No significant differences emerged between Condition or Book on the control and filler words.

Coding Categories

For each taught word at both pretest and posttest, there were no significant condition differences regarding the frequency of children's responses aligning with any specific coding category. Of the nine coding categories, the most commonly used were Basic Context and Meaningful Context. The use of these categories demonstrates that children in both

Table 4
Coding Categories for the New Word Definition Test-Modified (NWDT-M; Hadley et al., 2016)

Information unit	*Description*	*Example*
Nouns only		
Superordinate/Subordinate	Naming a larger category of which this is a member. Such as: a "kind of _____" or "type of _____." Naming a member of a category (when the target word is the category).	**Weeds** are *a kind of* plant.
Function	Any process, purpose, or use. Any movement or action. Answers question: what do you do with it?	People walk on it (**lane**).
Perceptual feature	Properties of nouns; how it looks, smells, tastes, feels, or sounds.	They are hard (**scales**).
Part/Whole	Describes a distinct part of target word OR describes the whole that the target word is a part of.	They are in your nose (**nostrils**).
All form classes		
Synonym	Any word or short phrase that is equivalent to the word being explained. Provides decontextualized information about the word.	Get the ball (**fetching**).
Antonym	A word that is the opposite of the word being explained, plus "not" or other negating word.	**Enemies** are not your friends.
Gesture/Act out	A gesture, action, or facial expression that shows knowledge of the word meaning.	Child acts out **charging** by banging fists together.
Basic context	Uses minimal context/typical association. Shows little to no understanding of word meaning.	Sun (**dawn**).
Meaningful context	A longer phrase that uses detailed, meaningful context to explain target word.	When you're riding a horse in a **battle**.

Note: All coding categories were worth 1 point except for Basic Context which was worth 0.5 points.

conditions gave some definitions that reflected either a minimal understanding of the word or a more detailed understanding in the context of the story, such as giving the answer "Sun" for the word *dawn* or "You pick *weeds* so vegetables grow."

Taught Word Gain Scores

An analysis was also conducted to investigate the Matthew effect (Stanovich, 1986). Gain scores on the receptive test, calculated by subtracting pretest taught word scores from posttest scores, were used to determine vocabulary growth. Using a median split, initial Low Scorers, intervention ($n = 11$), comparison ($n = 8$), were identified as children scoring 0–3 out of 10 points at pretest, while initial High Scorers, intervention ($n = 11$), comparison ($n = 14$), scored between 4–6 points. For the intervention group, an analysis of variance (ANOVA) examining Book × Scorer Status demonstrated a main effect of Scorer Status, $F(3, 18) = 7.56$, $p < .05$, $\eta_p^2 = .29$. The main effect of Scorer Status for receptive knowledge indicates that intervention children who were Low Scorers grew *more* in their taught word knowledge (5.3 points) than High Scorers (2.4 points) (see Figure 2). Item analyses indicated that there were no items on which all High Scorers performed poorly

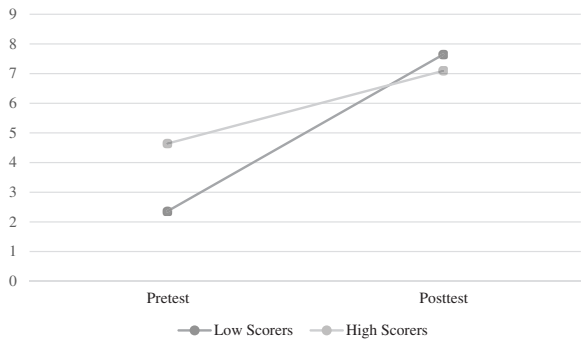

Fig. 2. Intervention group scores on taught words from pretest to posttest on the receptive test for low scorers and high scorers.

(>80% incorrect), indicating that their lack of comparable growth was likely not due to a ceiling effect. An ANOVA for the comparison group's receptive test scores did not demonstrate a main effect of Scorer Status, $F(3, 18) = 3.54$, $p = .08$. Thus, the comparison group Low Scorers did not close the gap to the same degree as in the intervention group.

On the expressive test, the range of initial pretest scores was much smaller. Using a median split, children who scored 0–1.5 points at pretest were designated as Low

Table 5
Means and Standard Deviations by Condition, Type of Word, and Time (Raw Scores)

		Pretest		*Posttest*	
	N	*M*	*SD*	*M*	*SD*
Receptive test	*22*				
Word type					
Taught	*10*				
Intervention		3.50	1.46	7.36	1.94
Comparison		4.00	1.41	5.23	1.51
Control	*7*				
Intervention		3.50	1.22	4.54	2.46
Comparison		3.27	1.20	3.36	1.20
Filler	*5*				
Intervention		4.72	0.45	4.81	0.39
Comparison		4.68	0.71	4.81	0.39
Expressive test	*18*				
Word type					
Taught	*10*				
Intervention		1.72	1.02	4.47	3.07
Comparison		1.86	1.77	3.02	2.21
Control[a]	*4*				
Intervention		0.77	0.83	0.47	0.70
Comparison		0.70	1.28	0.45	0.78
Filler[a]	*3*				
Intervention		3.18	1.65	2.97	1.72
Comparison		2.70	1.65	2.77	1.44

Note. N = total number of items, M = Mean, SD = Standard deviation. Control words were of the same difficulty as taught words, while filler words were selected as words likely known by the children.
[a]The numbers of control and filler words were reduced on the expressive test relative to the receptive test due to the length and difficulty of the test.

Scorers, intervention ($n = 10$), comparison ($n = 12$), and children scoring 2.0–5.5 were designated as High Scorers, intervention ($n = 12$), comparison ($n = 10$). An ANOVA examining Book × Scorer Status found no main effect of Scorer Status and no interaction effects.

DISCUSSION

The goal of this study was to increase children's knowledge of vocabulary words using a novel combination of shared book reading and guided play in the form of a vocabulary game. In the *intervention condition*, dyads played a game in which they answered questions about taught words. Conversely, in the *comparison condition*, dyads played the same game with no vocabulary words. Comparison children instead reviewed all taught words after book reading to equate the number of exposures received by the intervention group. All children were pretested and posttested on measures of receptive and expressive vocabulary. Because all children received the book-reading sessions featuring word definitions and additional vocabulary review, differences between conditions in children's word knowledge are attributed to playing the vocabulary game. These results were achieved with a comparison group that also heard the stories, were taught word definitions, and played a wordless version of the game instead of a business-as-usual control. The fact that the vocabulary game trumped this comparison condition suggests the game was a motivator for children beyond getting to spend time with an adult and playing a game without vocabulary words.

The present findings are consistent with research that has demonstrated the effects of both shared book reading (e.g., Biemiller & Boote, 2006; Penno et al., 2002) and guided play (Han et al., 2010; Roskos & Burnstein, 2011) for increasing children's vocabularies. Yet, our findings show the specific effects of a vocabulary game.

Guided Play and Vocabulary Development

Our intervention was successful in increasing children's receptive and expressive word knowledge: for taught words; the intervention group performed significantly better on both measures than the comparison group. Thus, combining a vocabulary game with shared book reading promoted greater word learning. With regard to the smaller effects on expressive vocabulary, receptive understanding often precedes expressive knowledge in young children and represents the leading edge of linguistic ability (Benedict, 1979; Hirsh-Pasek & Golinkoff, 1996). Thus, it follows that children demonstrated stronger gains on receptive vocabulary after our short intervention period.

The construct of *mise en place* (Weisberg et al., 2014) might begin to explain why playful activities like our game are effective. By encouraging the development of a positive stance toward learning, guided play may promote task persistence and support proactive control processes.

Additionally, games help foster intrinsic motivation and a positive attitude toward learning through the inclusion of ingredients such as challenge, control, fantasy, and curiosity (Malone & Lepper, 1987). Our game was difficult enough that it kept children engaged, while giving them some control over the outcome by allowing them to generate their own answers. The game fostered sensory curiosity by being colorful and visually appealing and supported cognitive curiosity by incorporating challenging questions that took advantage of children's word knowledge gap (Malone & Lepper, 1987). It also included some fantastical elements by incorporating snakes. Previous work has also shown the benefits of fantastical elements for teaching vocabulary (Weisberg et al., 2015). In contrast, the after-reading word review experienced by the comparison group exposed children to content similar to that which the experimental group reviewed during gameplay. However, the experimental game encouraged greater child agency than the

comparison condition after-reading word review, which was more experimenter-directed.

"Meek Effect"

Perhaps the most intriguing finding is that the lowest-scoring children in the intervention condition at pretest on the receptive measure experienced the greatest gains in taught word knowledge. We dub this the *Meek effect*, as a biblical reference to the idea that the meek shall inherit the earth. This finding contradicted our original hypothesis and suggests that children with less initial vocabulary knowledge might derive the greatest benefit from the adult scaffolding featured within the game, perhaps because these children need the most external support for their proactive control mechanisms (Weisberg et al., 2014). Additional research is needed to determine exactly how this relation operates. In the comparison condition, low-scoring children also grew in their word knowledge, but not enough to close the gap between Low and High Scorers.

On the expressive test, there were no significant differences between Low and High Scorers since posttest knowledge was still low for all children. However, the intervention group grew more than comparison group children, suggesting that our game did promote word learning above and beyond the comparison condition activities.

It should be noted that our sample included limited information about children's SES, so the question remains as to whether this intervention would work in the same way for lower income children. Research indicates that there are SES disparities in children's neurocognitive functions, particularly in the areas of language and executive function (Hackman & Farah, 2009). In one study, Walsh and Blewitt (2006) found that vocabulary-eliciting and nonvocabulary-eliciting questions produced the same effects on vocabulary growth for middle income children, but their finding was not upheld in a sample of low income children. Instead, nonvocabulary-eliciting questions led to greater receptive vocabulary knowledge than vocabulary-eliciting questions (Walsh & Rose, 2013). This finding suggests that our intervention may be differentially effective based on children's SES backgrounds. In addition, the length of intervention was quite short—only two 30-min sessions. If the span of the intervention were lengthened, we might have found greater vocabulary gains. Finally, since no delayed testing was conducted, it is unknown if gains persisted.

Future research should also examine the cognitive and neurocognitive benefits of vocabulary games. Research with older children suggests that playing both nondigital and digital games improves cognitive outcomes, including fluid reasoning and processing speed (Mackey, Hill, Stone, & Bunge, 2011). However, studies specifically targeting vocabulary games have not assessed any cognitive or neurocognitive outcomes. Despite these limitations, our findings suggest that the vocabulary game provided a setting more conducive to fostering word learning than the after-reading word review and nonvocabulary game.

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