Easy as ABC? Investigating Storybook Exposure, Invented Spelling and Vocabulary as Predictors of Learning to Read

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Abstract

It is known that vocabulary connects to reading and can be learned from storybook exposure, yet the question remains: will children learn to read words they are exposed to through storybooks better than words not in those books? Further, would additional teaching for vocabulary depth and/or invented spelling be beneficial? These are the primary goals of the present study. Fifty-nine kindergarten students were recruited from a local elementary school to participate in a pretest, intervention, and posttest experimental design. They were exposed to 10 nonwords in a storybook, then completed word learning and learn-to-read tasks. Invented spelling was a between-participant variable, semantic enrichment within-participant. Participants correctly identified the nonwords presented in the storybook, showing vocabulary learning via storybook exposure. Extra semantic enrichment improved word learning on tasks measuring semantic depth (i.e., comparison and definition tasks). The participants were then administered a learn-to-read task, and the results showed increased learning across trials; a benefit of word exposure (control words significantly lower); an interaction between spelling and semantic enrichment- indicating a significant advantage provided by extra semantic teaching in the group that did not also spell the words. In sum, this study demonstrates that vocabulary links to learning to read on a word-specific basis, and both spelling practice and semantic enrichment further contribute to learning to read- although their beneficial effects do not appear to be additive at this early age.

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Dedication

I would like to dedicate this thesis to my younger sister, Emma. Your talent is inspiring, and you drive me to be the best version of myself that I can be every day. I am so grateful that I get to be your older sister.

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Easy as ABC? Investigating Storybook Exposure, Invented Spelling and Vocabulary as Predictors of Learning to Read

Learning to read can often be challenging but is nevertheless an extremely rewarding process. In essence, the acquisition of reading occurs when children experiment with word comprehension, and they become increasingly adept at connecting the sounds heard to the resulting letters (Read, 1971). Relatedly, invented spelling can be defined as children's spontaneous or self-directed attempts to represent words in print (Read, 1971). So, if a child spells dog like DG, or prince like PRNS, this is not to be of concern; they are simply going through the process of invented spelling, learning how words and word patterns work. On another hand, vocabulary is often referred to as the set of words for which meanings are known (Nation, 2008). Both vocabulary and invented spelling are associated with learning to read.

There is also accumulating research on the relationship between storybook exposure and reading. Thus far, it has been found that if novel words are embedded in story books, children will learn them and add them to their vocabulary. However, it remains unknown if this helps them learn to comprehensively read those same words. The present study evaluates how, when combined with storybook exposure, invented spelling and vocabulary may affect early reading.

Invented Spelling

As children explore the intricacies of print, they undergo the process of invented spelling; a key construct of the present study, thus making it crucial to delve into the details of the process itself. This can be done using Gentry's (1982) five phases of developmental spelling. The first is the precommunicative stage, where the child exhibits some knowledge of the alphabet via production of letter forms to represent a message. However, they do not demonstrate any knowledge of letter-sound correspondence, which may explain why their spelling attempts are random strings of letters they are capable of producing in written form. Spellers at this initial stage may or may not include number symbols in their spelling or understand the principle of left-to-right directionality. Lastly, they frequently mix uppercase with lowercase lettering, favouring uppercase more often. The second stage is referred to as the semiphonetic stage. It consists of the child's first approximations to proper alphabetic orthography- in other words, the correct written makeup of a word. The conditions of the second stage are as follows: there is an increasing comprehension that letters have sounds that are used to represent the sounds they hear in words. Spellers can partially map out phonetic representation for words, meaning they often abbreviate an entire word, narrowing it down to two or three letters. In addition, the speller begins to grasp the left-to-right sequential arrangement (Gentry, 1982). The phonetic stage is next, and although the speller's letter choices still do not always conform to conventional spelling of a word, the choices made are perceptually and systematically correct. For the first time the child can provide a complete mapping of letter-sound correspondence; all of the surface sound features of the words being spelled are present, typically with one letter produced for each sound in the word. An important aspect of this stage is that children develop certain spellings for key details of phonetic form, such as tense vowels, syllabic sonorants, *-ed* endings, etc. Yet, letters are assigned solely by their sound with no consideration of typical letter sequences or orthography. Finally, word segmentations are usually evident in this stage as well (Gentry, 1982). The fourth stage is the transitional stage, where spellers typically remain for a long period of time. This is where the child begins to assimilate the conventional alternative for representing sounds, moving from a reliance on phonology (sound) for representing words to a reliance on visual representation and an understanding of the structure of words. They also adhere to conventions of the language, such that vowels are in every syllable (i.e., eagle would be spelled as EGUL instead of EGL in this stage). The fifth and final stage of invented spelling is the correct stage. The speller understands the English orthographic system and its accompanying rules, as well as how to deal with prefixes and suffixes, alternative or irregular spellings, and silent consonants. An extensive number of learned words are accumulated, and the child's generalizations about spelling and knowledge of exceptions are usually correct.

Given that invented spelling typically emerges before children are established readers, it is possible that early spelling attempts promote the development and integration of the necessary skills to progress in learning to read (Gentry & Gillet, 1993). An intervention study by Ouellette and Sénéchal (2008) assessed this relationship between invented spelling and learning to read. It aimed to determine whether invented spelling allowed children to develop an analytic stance to language that exceeded phonological awareness stimulation and promoted the storage of orthographic information within lexical representations, beyond simply learning letter sounds and names. In other words, invented spelling is not a process of recall and memorizing whether certain strings of letters go together, but a natural, developmental progression in which spelling attempts become increasingly accurate in their sound and how they look on paper. In saying this, the goal of the study was to evaluate invented spelling as an intervention for children learning to read. To do so, Ouellette & Sénéchal evaluated the benefits of training kindergarten students to be better invented spellers through a pretest, post-test, comparison group design that spanned over the course of four weeks. In total, 69 children (39 female, 30 male) participated with a mean age of five years and seven months. Participants were divided equally into the three intervention groups (one invented spelling training group, two control) and all groups were taught 13 letter-sound associations necessary to form the training target words as well as the pre- and post-test words. One of the control groups received an alternate phonological awareness training, while the second was asked to draw pictures for the target words. The invented spelling group was trained to increase the sophistication of their naturally occurring invented spellings through teacher feedback. Following the intervention, all participants spelled 10 words to their best ability. The attempts were scored on a seven-point scale (0 = random string of letters, 1 = phonetically related letter used to mark a salient part of the word, 2 = the correct initial grapheme, 3 = representing more than one phoneme with phonetically related or conventional letters, 4 = all phonemes represented with phonetically related or conventional letters, 5 = all consonant phonemes represented with conventional letters and vowel presence marked, and 6 = proper conventional spelling). Results concluded that the invented-spelling group outperformed the other groups. They demonstrated more advanced invented spellings than did the other groups, and both the invented-spelling and the phonological awareness groups demonstrated superior phonological awareness. Furthermore, the invented-spelling group learned to read more words than the children in other groups. This directly demonstrates a causal role of invented spelling in learning to read.

Another study done by Sénéchal et al. (2012) also focused on whether guided invented spelling would facilitate entry into reading. Although Ouellette and Sénéchal's (2008) findings were important in establishing a causal link between invented spelling and early reading, their participants consisted of a homogenous sample of kindergarteners with age-appropriate development. The subsequent study was particularly interested in potential benefits of systematic training in invented spelling for children who were considered more at-risk in terms of reading difficulties due to low phoneme awareness. An eight-week intervention was conducted in which 60 kindergarten children were pre-tested on various measures of literacy and language abilities and then randomly assigned to one of three conditional groups (invented spelling, phoneme awareness and storybook reading). Phoneme awareness training was a necessary comparison condition to demonstrate that any invented spelling advantage was not entirely due to developing phoneme awareness. Following a similar intervention method to Ouellette & Sénéchal (2008), results found that children in the invented spelling condition learned to spell words more accurately than the children in the two other conditions. They were also able to spell novel words in a more phonologically complex manner, thus showing that invented spelling instruction increased the sophistication of children's spelling attempts a significant amount compared to other children. In addition, participants trained in invented spelling and in phoneme awareness had better phoneme awareness scores than those in the control condition. These findings show that invented spelling can be beneficial to kindergarten children at risk of reading difficulties because of poor phoneme awareness, which adds to the support of other research dictating that invented spelling facilitates learning to read.

Similarly, when investigating whether guiding invented spelling using a Vygotskian approach to feedback would enable kindergarten children's entry into literacy more so than phonological awareness instruction, results remained consistent (Ouellette et al., 2013). That is, children trained in invented spelling outperformed the phonological awareness ones on all trials of the learn-to-read task given to them and maintained this advantage until the beginning of Grade 1. Moreover, these children's conventional spellings in Grade 1 were slightly advanced relative to those of the students from the phonological awareness condition. This suggests that with proper feedback, invented spelling does not disrupt the learning of proper conventional spellings. In fact, it expedites this learning, even for children receiving a literacy rich school experience and already learning to read.

Ouellette & Sénéchal (2017) also evaluated whether the sophistication of children's invented spellings in kindergarten was predictive of subsequent reading and spelling in Grade 1, while considering the influence of well-known precursors. This time however, a longitudinal, correlational analysis was used. Two hundred and eighteen children with no known speech-language or learning disability participated. They were assessed for letter–sound knowledge, phonological awareness, receptive vocabulary, reading, and invented spelling in early kindergarten. Children were then assessed for a second time midway through the first grade in regard to the outcome measures of reading and conventional spelling. Results showed that invented spelling was a unique predictor of growth in early reading skills and even surpassed the role of children's alphabet knowledge and phonological awareness. The longitudinal causal role of invented spelling in literacy acquisition evaluated here is thus in agreement with recent research that has demonstrated spelling practice transfers to reading improvement in general (Ouellette & Sénéchal, 2008). More specifically, there is a confirmed, direct path from kindergarten invented spelling to Grade 1 conventional spelling. This is an extremely impactful finding as it demonstrates that invented spelling attempts do not direct children on a rigid path where they will not learn to properly spell (Ouellette & Sénéchal, 2017).

Vocabulary

Along with the impact of invented spelling, the role of oral language and reading intertwine. In considering specific areas within oral language, vocabulary has been identified as especially crucial. The triangle model from Siedenberg & McClelland (1989) stripped the role of vocabulary in reading acquisition down to its bare bones. It stated that there are three elements required to be successful in visual-word processing: phonology, orthography and semantics. Phonology is the way speech sounds are structured, orthography is the way they are spelled, and semantics is the actual meaning of this combined structure and spelling. These elements are inextricably linked in reading acquisition; as a child reads any individual word, they are actively integrating all aspects (Siedenberg & McClelland, 1989). Nation (2008) further argued the importance of this rich network of semantic and episodic knowledge of words when learning to read. She argued that phonological awareness is most important to early stages of reading when children are learning to phonologically decode words. Phonological awareness is the ability to manipulate the sound structures of speech (Mann & Foy, 2003). Considering that learning to read requires connecting phonemes and spelling patterns, those with well-structured phonological awareness are at an advantage (Nation, 2008). The self-teaching hypothesis also supports this stance. It states that both sound knowledge and rudimentary decoding skills provide children with a means to convert print into spoken word (Share, 1995). A central aspect of the hypothesis is that phonological decoding offers a crucial foundation in regard to reading development. The self-teaching hypothesis is typically tested by asking children in grades one through three to read made-up words within texts and, following various decoding attempts and repetitions, they are asked to select the correct spelling of this novel word, read the item, and/or spell it. Essentially, the self-teaching hypothesis supports the notion that children start with decoding words and with repetition those words become better stored in memory. Therefore, when the words are subsequently encountered, they are read more fluently and spelled more accurately.

In saying this, successful reading is reliant on the accuracy of these integrations of phonological, orthographic, and semantic representations. This can be explained using Perfetti's Lexical Quality Hypothesis (2007). It proposed, in essence, that the process begins with the presence of a word in the oral lexicon (a lexicon being the complete set of words not only known but understood by an individual), followed by partial decoding attempts of it, then the activation of the lexical item, and finally the successful reading of the word (Perfetti, 2007). Over time these skills strengthen, and the more often a word is read correctly, the stronger the connections become. As the number of words in the oral lexicon increases, the system becomes more efficient in organization and retrieval (Ouellette & Beers, 2010). As a result, overall reading becomes increasingly fluent, and this efficacy of the oral lexicon is extremely advantageous in learning to read. Thus, vocabulary is tied to both word recognition and reading comprehension, making it objectively important in literacy acquisition (Flack et al., 2018). Furthermore, semantics have been shown to play an important role in early word recognition, leading to literacy acquisition. Nation (2008) discussed this relationship between semantic factors and learning to read words, noting specifically that oral vocabulary has provided a reasonable proxy for the skills that contributed to the semantic pathway. Imageability (a semantic variable) has been known to influence word recognition in typically developing children and in children with developmental dyslexia, and the rate at which written abbreviations for words could be learned by young children at the earliest stages of reading development depended upon the word's imageability. Therefore, an understanding of semantic meanings of words impact how they are learned, which transitions naturally to overall literacy acquisition. These relationships may be even more specific, with semantic knowledge playing an active role in the word-reading process itself, which is a concept the present study investigates. The triangle model from Siedenberg & McClelland (1989) described above makes the prediction that the relationship between semantic factors and word reading is at an item-level; that is, a person’s knowledge of the meaning of a particular word should predict their ability to read that item, with this relationship being moderated by spelling consistency (Nation, 2008). Thus, for inconsistent words (those which are not commonly used, such as *yacht*), whether or not the word is familiar in a child's oral vocabulary should predict how well that child is able to read and in turn comprehend that item.

Ricketts et al. (2016) also explored this area of reading by focusing on whether semantic knowledge influenced word reading in six- and seven-year-old children. They used standardized tests to assess the potential relationship, which included measurements of lexical-semantic knowledge (expressive vocabulary) as well as broader semantic knowledge (Ricketts et al., 2016). Results indicated that semantic knowledge is positively associated with variation in word reading performance, regardless of spelling consistency and regularity. Essentially, understanding more words has been shown to positively correlate with reading ability, and their findings provide robust evidence that semantic knowledge and sentence context independently support word reading (Ricketts et al., 2016). This interplay of print skills and oral language can be further encapsulated within the *simple view of reading* (SVR) presented by Gough & Tunmer (1986). It proposed that two independent factors can completely explain reading comprehension: listening or language comprehension and decoding ability. However, definitions for these terms are ambiguous and have been difficult to conceptualize. Moreover, recent research such as the previous studies mentioned have emphasized the importance of oral vocabulary in both word reading and reading comprehension, leading some to suggest that the SVR does not fully account for the role of vocabulary in reading. Ricketts et al. (2016) also investigated the dimensions of vocabulary depth and breadth. Vocabulary breadth can be defined as the number of words known, and vocabulary depth is the extent or richness of the word knowledge. Differentiating between vocabulary breadth and depth in literacy research has been shown to better explain the nature of the connections between oral vocabulary and reading comprehension, with measures of vocabulary breadth being highly predictive of performance on reading tests (Ouellette & Beers, 2010).

A study by Ouellette & Beers (2010) aimed to clarify the relations between phonological awareness, decoding, listening comprehension, facets of oral vocabulary and word comprehension using two groups of children with varied reading abilities (grade 1 and grade 6). To do so, they used standardized tests that included measures of vocabulary breadth, depth, and listening comprehension in beginner readers and children with more advanced reading levels (Ouellette & Beers, 2010). The results showed that oral vocabulary predicted reading comprehension in grade six students, even with all variables considered. Furthermore, oral vocabulary breadth predicted word recognition in both grades one and six. However, vocabulary depth contributed to irregular word recognition in grade one, whereas vocabulary breadth proved to be the more significant predictor in grade six. This suggests that vocabulary depth was likely a stronger predictor for younger children, that is, they may have been more prone to discrepancies between the number of words known and the extent of their semantic representations. In sum, this study showed the importance of oral vocabulary, not only in terms of reading comprehension but also for other reading skills such as word recognition and decoding, as well as furthering the notion that oral vocabulary and print reading skills are complex and connected (Ouellette & Beers, 2010).

Storybook Research

Storybook exposure has been shown to be a consistent pathway to learning vocabulary. The study from Sénéchal et al. (2012) discussed earlier also touched on vocabulary using a storybook condition group. Children in this group participated in shared reading sessions which were aimed at promoting vocabulary and story knowledge using dialogic reading techniques. At the beginning of each session, children received their alphabet training and exposure to target words. The experimenter showed a picture of a target item, labelled each picture four times and children were required to repeat the word out loud in unison once (Sénéchal et al., 2012). Results of this area showed that if you embed novel words in story books children will learn them in their vocabulary. However, it remains unknown if that helps them learn to read those same words, which is precisely what the present study explores.

A combination of two studies done by Dickinson et al. (2019) investigated factors that fostered both breadth and depth of word learning during storybook reading in preschool children. To test this, they developed a scalable method of teaching words in group reading sessions by varying the types of information children heard about the words, while holding the amount of exposure to the target words constant. They also examined breadth and depth of learning the instructed words compared to words that were only heard as storybooks were read. The second of the studies used four separate reading sessions, where children heard 10 target words once each time. Eight explanations of each word were given, once during the readings and once afterwards as part of a vocabulary and story plot review (explanations consisted of the following: drawing attention to a picture in the story that helped illustrate the word's meaning, defining the word in age-appropriate language, physical representation of the word, and an example of the word provided outside of the story's context). To measure the children's depth of knowledge for the words, they were given tasks pretest and posttest that required them to express their knowledge of the meanings of the words (ex. "What is a ____?"). Results of the study demonstrated that children could form initial representations of words when they heard them within the context of a storybook and increase their knowledge of these words with more elaborated teaching. Overall, the findings from Dickinson et al. (2019) add to the importance of vocabulary depth in language acquisition, as they revealed exactly what the children knew about the vocabulary they learned. Moreover, they also placed a spotlight on exposure as a means to learn new words and underscored that book reading can be systematically used and evaluated to foster broad vocabulary knowledge through this exposure. How this in turn impacts learning to read, however, has yet to be directly examined.

Present Study

Past research has shown important roles of both invented spelling and vocabulary in learning to read. However, the research that has been done within this area is still fairly limited, especially when integrating the role of invented spelling alongside oral vocabulary to investigate early reading. Given the research that has been discussed, it is known that vocabulary connects to reading and can be learned from storybook exposure, so the question becomes: will children learn to read the words they are exposed to through storybooks better than words not in those books? Further, would elaborated teaching for vocabulary depth be beneficial? These are the primary goals of the present study. In addition, the study aims to determine if invented spelling will add a benefit to learning to read, as has been shown in past research when vocabulary stimulation is also present.

Method

Participants

For the current study, 59 kindergarten students from four different classrooms were recruited from a local elementary school to participate. Parental consent forms were completed for all participants. Over the length of the study, complete data was obtained for the students, excluding any outliers if deemed necessary (>2.5 *SD* above the mean). Demographics such as biological sex, age, spoken language(s), and parental education levels of the participants were also obtained.

Pretest

Assessment began with three standardized tests, completed individually by each participant.

Comprehensive Test of Phonological Awareness (CTOPP). Two subsets of the CTOPP from Wagner et al. (1999) were administered to assess phonological awareness. In the Elision subtest, the administrator read a word aloud and asked the participant to repeat it. The child was asked to say the word again, while leaving out a specific sound (i.e., saying “cup” without the sound /k/). In total there were 20 items tested and testing ended following three consecutive errors. Test-retest reliability for this subset was r = .88. For the Sound Matching subset, participants were shown pictures and asked to identify the ones that had the same initial or final sound. Again, 20 items were tested, but testing ended following four errors over seven items. This subtest had strong internal reliability (α = .83).

Peabody Picture Vocabulary Test (PPVT-4 A). The PPVT-4 (A) from Dunn & Dunn (2007) was implemented to measure participant’s receptive vocabulary. They were shown four pictures and asked to point to the picture that fully matched the words spoken by the examiner. This testing followed test specific basal and ceiling rules such that testing ended after eight errors were made within a set of 12. The reported internal consistency reliability for the PPVT-4 (A) was also excellent (α = .91).

Woodcock Reading Mastery Task (WRMT). Two subtests of the WRMT (Woodcock, 1998) were administered to measure reading ability. The Letter Identification subset asked participants to identify alphabet characters in various fonts and testing ended following six consecutive errors. In the Word Identification subset, participants were asked to read aloud regular and irregular words in isolation from lists of increasing difficulty. The listed words had to be decoded and pronounced in a manner consistent with articulation guidelines in order to be deemed correct. This subtest has high internal consistency, α=.91.

Intervention Procedure

Students were exposed to a total of 15 nonwords. The nonwords were organized into three equivalent lists of five words each, with similar letter length and vowel patterns across lists. Lists one and two were inserted throughout a book titled *Howling Dog*, originally written by Tracey Campbell Pearson in 1991, with an alternative script by Dr. Gene Ouellette in 2019. List three was used for posttest (no-treatment comparison), as seen in Table 1. Within the storybook, the two-word lists were counterbalanced across the main condition (semantic elaboration/no elaboration) and teacher (two teachers administered the session to small groups). Half of the students observed by each teacher also completed additional invented spelling-based practice with the words from the storybook, thus making invented spelling a between participant variable.

Table 1

Organization of Nonword Lists

Howling Dog 1	Howling Dog 2	Comparison
RELL	DUSS	HESS
FID	SOT	BAZ
VEAK	ZEET	LOAT
LURT	VERN	PRAIF
UT	IP	OP

Students took part in the shared storybook intervention described above over the course of three consecutive days, in groups of four or five students. Sessions lasted approximately 25 minutes and took place in a classroom during normal school hours. Lastly, the sessions were led by one of two retired teachers hired for the study.

Day One. On the first day, the administrator read the storybook and told students that the book contained some “special” words. Following the initial reading, the administrator talked about the 10 nonwords presented and showed the children where in the book they occurred. Then, the administrator read each nonword and had the students repeat the words out loud. Administrators asked the students a phonological question about each word’s pronunciation (ex. “Did I say PRISP or CRISP?”). For the five target words in the condition with additional semantic elaboration, participants completed extra semantic activities. This included the administrator providing context of each target word (ex. “Here in the story it said…”) then using those nonwords in a brand-new sentence. Participants then answered a forced choice category/similarity question (ex. “Is a DUSS a piece of furniture or a piece of an airplane?”). The number of times participants heard and said each word was equal across conditions.

Days Two and Three. On the second and third day of the intervention, children listened to the storybook again and were instructed to raise their hands when they heard one of the "special" words during the reading. As the 10 nonwords were encountered, the teacher asked questions about the pronunciation, per the day prior. For the five target words within the semantic condition, the same semantic enrichment tasks were completed as the first day, however this occurred as each word was encountered in the storybook reading. Students in the spelling condition also practiced spelling the target nonwords on days two and three. After the storybook reading, teachers handed out whiteboards and said "Today we will try and spell the new words. It isn't a test. Just do your best". The students then spelled each word in a dictation task. They were shown the correct words and discussed the spelling using the start, middle and end of them (ex. "The first sound is ___ so we use the letter ___") and copied the correct overall spelling. The scripts teachers used for the book intervention were modified for the students in the spelling condition to have the number of auditory exposures of each word to remain constant across conditions (i.e., so the students in the spell condition didn't hear the words more).

Posttest

On the day immediately following the third intervention session, students completed individual posttesting sessions, lasting 20 to 30 minutes. The purpose of this was to assess word learning (breadth and depth), determine whether additional semantic depth influenced word learning, and directly evaluate performance on a learn-to-read task for the newly taught items.

Word Learning. The posttest tasks assessed participants' word learning (depth and breadth) as well as ability to read the nonwords. Index cards of the printed nonwords were shown in random order and students were asked to read the word. If read correctly, the administrator responded with "That's correct, it says ___." If incorrect, the administrator emphasized the correct pronunciation and then repeated it normally. The student was then asked to identify whether the word was seen in the storybook (recognition) and to answer a forced choice comparison question, such as "Is a SOT something to drink from or something to cook on?" They were then asked to define the word. All answers were coded as either correct or incorrect except for the definition task, which was scored out of two, based on the amount of detail provided.

Learn-to-read Task. This tests the participant's performance in learning to read these new words over repeated trials. Here, the administrator held each card up again and asked students to read the word. Since the participants were kindergarteners (between ages of five and six), they were expected to have a low reading level. Thus, it was important to assess both a single trial reading as well as their performance on a learn-to-read task. If read correctly, the administrator replied, "That's correct, it says ___." If the participant read it incorrectly, the administrator elongated the correct pronunciation and repeated it normally. In total this task was repeated four times and would be recorded as correct or incorrect for each reading attempt.

Receptive Vocabulary. A receptive and expressive vocabulary test for the 10 nonwords from the storybook was completed to further assess vocabulary learning. In the receptive vocabulary task, students were shown a set of three pictures from the book and asked to point to the one that matched the nonword spoken by the administrator.

This was repeated for all 10 nonwords, using 10 different picture sets with responses recorded as either correct or incorrect. In the expressive vocabulary activity, participants were asked to name a specific item in a picture set. This was repeated for all 10 nonwords, and again responses were recorded as either correct or not.

Results

Over the course of the study, complete data was obtained for 54 of the kindergarten students (i.e., those present on all intervention and test dates). Following data collection, the data was prepared for analysis. One student was deemed to be an outlier on the pretested literacy areas (>2.5 *SD* above mean) and was at ceiling on all post-test measures and was therefore excluded from analyses. The final sample reported here was 53 students across four classrooms (33 male, 20 female) with a mean age of 66.79 months (*SD* = 3.45, *r* = 60-73). English was primarily spoken in all homes, with 13 homes reporting a second language spoken. Parental education ranged from less than high school (*n* = 1) to post-secondary education (*n* = 25).

The correlation coefficients and descriptive statistics from the pretest items are presented in Table 2. The PPVT-4 (A) was not significantly correlated with the CTOPP Sound Matching or the CTOPP Elision tests. All other items were significantly intercorrelated with moderate to very strong relations, specifically among phonological awareness, word comprehension and spelling.

Table 2

Intercorrelations and Descriptive Statistics Among Pretest Variables (N = 53)

	1	2	3	4	5	6
1. CTOPP Sound Match	-	-	-	-	-	-
2. CTOPP Elision	.502***	-	-	-	-	-
3. WRMT Letter ID	.448***	.450***	-	-	-	-
4. WRMT Word ID	.429***	.450***	.559***	-	-	-
5. PPVT-4 (A)	.117	.244	.393**	.294*	-	-
6. Spelling	.649***	.534***	.645***	.561***	.272*	-
Mean	6.90	3.92	25.00	2.50	110.79	11.67
SD	4.13	2.30	8.73	2.32	15.13	10.27

** = p < .0, ** = p < .0, *** = p < .001*

Word Learning. An initial test investigated if participants could correctly identify which nonwords were shown in the storybook. One-sample t tests were used to determine whether participants correctly replied to the question “Was ___ in our book?” at a capacity greater than what would be expected by chance (i.e., if they were just guessing). Results showed that when presented with extra semantic elaboration, student’s average score for recognition of the storybook nonwords (*M* = 4.55, *SD* = 0.67) was significantly higher than chance, $t(52) = 22.35$, $p < .001$. For the ones presented without extra semantic enrichment (*M* = 4.32, *SD* = 0.75), performance was also significantly above chance, $t(52) = 17.59$, $p < .001$, as was identification of the control nonwords as not being in the book (*M* = 4.51, *SD* = 0.89), $t(52) = 16.43$, $p < .001$.

To investigate whether word learning was benefitted by extra semantic teaching and/or spelling practice, they were compared between conditions. The student's mean scores and standard deviations are presented in Table 3.

Table 3

Means and Standard Deviations for Word Learning Tasks (N = 53)

	Semantics/ No Spelling	Semantics/ Spelling	No Semantics/ No Spelling	No Semantics/ Spelling
Recognition	4.48 (0.65)	4.61 (0.69)	4.12 (0.78)	4.50 (0.69)
Comparison	4.60 (0.76)	4.54 (0.74)	4.48 (1.01)	4.29 (0.86)
Definitions	4.04 (1.95)	3.68 (1.57)	3.52 (1.53)	3.07 (1.41)
Expressive V.	1.36 (1.03)	2.24 (1.45)	1.18 (1.06)	1.92 (1.29)
Receptive V.	4.25 (1.00)	4.48 (0.96)	4.07 (1.09)	4.36 (1.19)

To compare participants' results across conditions on whether they could correctly identify if nonwords were encountered in the storybook, a repeated measures test was done for performance on the recognition question. There was a significant main effect for extra semantics teaching, $F(1, 51) = 3.31$, $p = .038$, $\eta 2 = .061$, which reflects a medium effect size. There was also a significant main effect for extra spelling practice, $F(1, 51) = 3.06$, $p = .043$, $\eta 2 = .057$, reflecting a medium effect size.

To determine whether additional semantic teaching and/or spelling practice impacted participants' depth of word learning, individual repeated measures tests were done on the other administered vocabulary tasks as well: comparison, definition, expressive naming, and receptive picture ID. For the comparison question, there was a main effect of condition, showing a significant benefit of semantic enrichment, $F(1, 51) = 3.085$, $p = .085$, $\eta 2 = .057$, reflecting a medium effect size. There was no significant effect of spelling practice, $F(1, 51) = 0.388$, $p = .536$.

For the definition task, there was a main effect of condition, showing a benefit of semantic enrichment $F(1, 51) = 7.196$, $p = .010$, $\eta 2 = .124$, indicating a medium-large effect size. There was no significant effect of spelling practice, $F(1, 51) = 1.064$, $p = .307$.

The expressive vocabulary/picture naming task showed no significant effect for semantic enrichment, $F(1, 51) = 1.870$, $p = .177$, but did show a significant effect of spelling practice, $F(1, 51) = 8.531$, p = .005, $\eta 2 = .143$, reflecting a large effect size. The receptive vocabulary/picture ID task showed no main effect for semantic enrichment, $F(1, 51) = 0.677$, $p = .415$, or a main effect for spelling practice, $F(1, 51) = 1.280$, $p = .263$.

Learn-to-Read Task. Performances across four reading trials on the learn-to-read task are shown, with semantic enrichment as a within-participant variable (control words not in storybook, words in storybook without additional semantic elaboration, words in storybook with extra semantic teaching) and spelling practice as a between-participant variable (those who did additional spelling practice and those who did not). See Figure 1 for the within-participant conditions without additional spelling practice, and Figure 2 for the within-participant conditions with additional spelling practice. Repeated measures analyses were performed to test whether storybook exposure improved learning to read these same nonwords. The test of sphericity was significant (*p*

$< .001$). There was a significant main effect for trial, $F(3, 49) = 20.712$, $p < .001$, $\eta^2 = .559$, indicating an extremely large effect size. There was also a significant effect of word condition, $F(2, 50) = 37.267$, $p < .001$, $\eta^2 = .599$, reflecting a very large effect size. Pairwise post-hoc tests revealed significant improvement across all four trials (all *p*'s < .001), with no significant differences between exposed words with and without extra semantic elaboration ($p = .750$); performance for the control words (not in the storybook) was significantly lower than exposed words ($p < .001$).

There was no significant main effect of spelling practice, $F(1, 51) = 0.004$, $p = .949$, however there was a significant interaction between spelling and word condition, $F(2, 50) = 4.820$, $p = .012$, $\eta^2 = .162$, reflecting a large effect size. To isolate the significant interaction, the repeated measures was done separately for students who practiced extra spelling and for those who did not. This showed a significant advantage provided by extra semantic teaching in the group that did not have additional spelling practice ($p = .003$, large effect size of .308).

Figure 1

Mean Number of Words Read on Trials of Learn-to-Read Task: No Spelling Practice

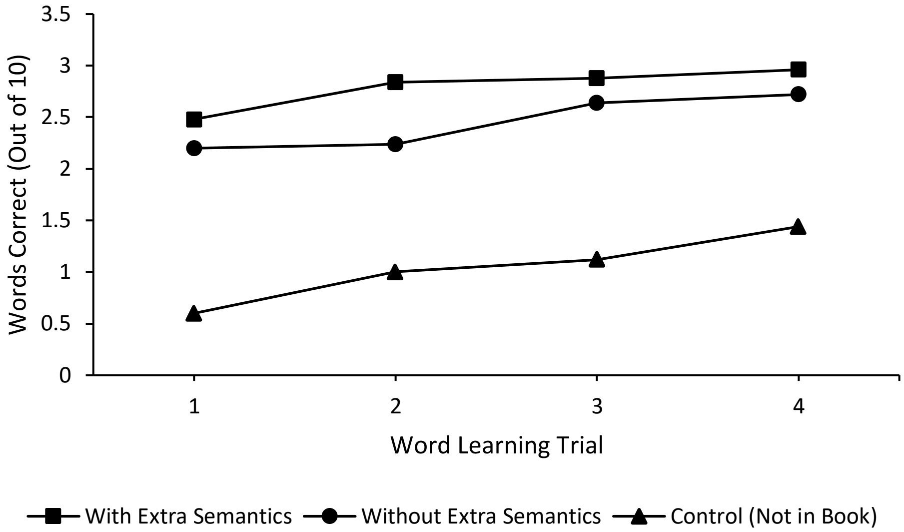
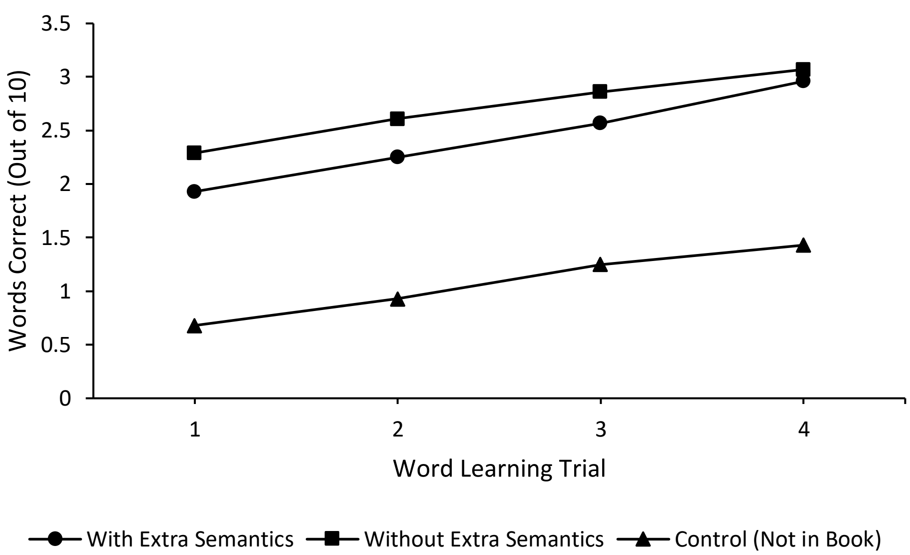


Figure 2

Mean Number of Words Read on Trials of Learn-to-Read Task: With Spelling Practice



Discussion

The present findings emphasize the positive impact of storybook exposure and semantic elaboration on breadth and depth of vocabulary learning and early reading skills. Participants could correctly identify which nonwords were presented in the storybook regardless of the condition, there was improvement across all reading trials, as well as a significant advantage provided by extra semantic teaching in the group that did not also spell the words.

Word Learning. It was first hypothesized that children would learn the nonwords embedded in the storybook. This was supported, as one sample t-tests show that participants were able to identify which nonwords were from the storybook. The present results remain consistent with past research discussed, such as the findings from Flack et al. (2018) which show that a dialogic exposure approach influenced the number of words learned (dialogic meaning providing definitions and asking questions throughout the book reading). Essentially, over time, children develop a more refined understanding of words in their vocabulary the more often they are exposed to the words. Moreover, Sénéchal (1997) found that children's expressive and receptive vocabulary improved with repeated exposure to storybooks, and children who heard the story more frequently could understand and produce the novel words better than children in the control group who only heard the story once. The present study did so with the *Howling Dog* storybook as the means of exposure, and the presence of the nonwords embedded in this book helped participants learn them in their vocabulary.

The second area of the present study explored whether extra semantic enrichment and/or spelling practice would impact participants' overall word learning. Support of this hypothesis varied across the tasks (recognition, comparison, definition, expressive and receptive vocabulary) used to determine breadth and depth of word knowledge. For the recognition (breadth) task, both additional semantic teaching and spelling practice provided a significant boost in performance. For the comparison question, extra semantic teaching yielded a significant increase in depth of knowledge. Performance on the definition task was also boosted by semantic enrichment. Contrarily, the expressive vocabulary/picture naming task did not show any significant effect of semantic enrichment. However, spelling practice did boost performance on this task. Lastly, the receptive vocabulary/picture ID task showed no main effect of semantic enrichment or spelling practice, likely due to being close to ceiling/maximum performance.

Overall, these results from the word learning tasks align with much previously discussed research on the connection between spelling, semantics, and vocabulary. The active exploration of print-sound connections in spelling exercises helps word learning, as evidenced in measures that touch on vocabulary breadth (Ouellette & Sénéchal, 2017). Tasks in the current study relative to vocabulary breadth consist of expressive naming and recognition, and both of these areas were the ones demonstrating significant effects of spelling practice. As noted above, receptive picture ID scores of the present study were near ceiling, which may explain why no effects of spelling practice was found for performance on this particular task.

In the present study, tasks that focus more on vocabulary depth were benefitted from extra semantic elaboration: the comparison and definition tasks indicated that semantic teaching did have significant effects on word learning. Dickinson et al. (2019) measured children’s depth of knowledge for words through pretest and posttest tasks that required them to express their knowledge of the meanings of the words. They drew similar conclusions, that children formed initial representations of words when they heard them within the context of a storybook and increased their knowledge and depth of these words with more elaborated teaching. Present findings of vocabulary depth are also supported by Ouellette (2006) regarding the use of semantic enriching activities. A sample of grade four students were evaluated on various measures such as receptive and expressive single-word vocabulary to assess vocabulary breadth, and semantic information to assess depth of vocabulary knowledge. It found that depth of vocabulary knowledge contributed to visual word recognition through its association with expressive vocabulary and directly predicted reading comprehension beyond the measures of vocabulary breadth. Essentially, word learning was improved by vocabulary depth- the greater the exposure to new words, the deeper the knowledge of that word (Ouellette, 2006).

Learn-to-Read Task. The present study also explored if vocabulary exposure via the storybook paradigm would be helpful in learning to read those same words. Further, the present experimental design allowed for the exploration of whether semantic elaboration and/or spelling practice would provide additional benefits when it came to learning to read exposed words. Results were clear: storybook exposure was linked to learning to read the embedded nonwords. There was significant improvement in reading across all four trials, with superior reading for exposed words over the control words (not in the storybook). There were no significant main effects of semantic enrichment or of spelling practice, but there was a significant spelling by word condition interaction. To isolate the basis for this significant interaction, the repeated measures was again repeated separately for students who practiced spelling and for those who did not. This revealed that there was indeed a significant advantage provided by extra semantic teaching but only in the group that did not also spell the words (similarly, there was an advantage in reading among the spelling group, however only for words that did not receive semantic enrichment).

As previously covered, breadth is defined as the number of items in an individual's lexicon, regardless of whether it is a rich understanding of the word. Depth is a continuation and refers to how well an individual can define and understand a word on this deeper level. Results from the study by Ouellette (2006) examined this and revealed that vocabulary breadth is a predictor of decoding ability and of more rapid visual word recognition. The present study supports this impression, as vocabulary breadth gained through storybook exposure helped in the learn-to-read task- participants were better at learning to read the nonwords that were now present in their lexicons. Similarly, Share's self-teaching hypothesis of reading development suggests that having a specific word in one's oral lexicon is advantageous (Share, 1995). It explains that a child's ability to learn to read words is dependent upon their ability to phonologically decode new letter strings. With repetition, this decoding leads to the formation of lexical representations that are accessed for more rapid, fluent reading. Basically, reading a word correctly reinforces the ability to read that word, as seen in the present study with significant increases over the reading trials. Moreover, there is importance of oral vocabulary- not only in terms of reading comprehension but to other reading skills such as word recognition and decoding, as well as furthering the notion that oral vocabulary and print reading skills are complex and connected (Ouellette & Beers, 2010).

Nation (2008) argued that it is important to view the visual word recognition system within the context of a broader language system, one that incorporates a rich network of semantic and episodic knowledge. Given that an understanding of the semantic meanings of words impacts how they are learned, and the natural transition from that to overall literacy acquisition, the current findings show that semantic knowledge plays an active role in the word-reading process itself. There was a significant advantage provided by extra semantic teaching in the group that did not also spell the words, so these notions align well. Moreover, Ricketts et al. (2016) shows a close relationship between semantic knowledge and both regular and exception word reading. This finding also goes with present results, and further demonstrates that depth of knowledge gained through semantic elaboration teaching increases the strength of internal representations- which in turn, helps with learning to read on a word specific basis.

Interestingly, despite results from Ouellette & Sénéchal (2017) showing that invented spelling was a unique predictor of growth in early reading skills and even surpassed the role of children's alphabet knowledge and phonological awareness, there was no significant main effect of spelling practice on learning to read in the present study. Yet, the interaction in the repeated measures shows that spelling does indeed help in learning to read, but this advantage was not seen for words with extra semantic teaching. Likewise, semantic teaching helps learning to read- but this was not seen in the spelling group. Thus, it seems that both semantics and spelling do actually help in learning to read, but their benefits were not additive; making this the first study to show such results. The probable explanation is that there is a limit to how much we can boost learning to read at this age and in a short-term intervention like this. Learning to read can only be helped so much- and it was helped equivalently by semantic teaching and spelling practice (but having both did not give double the boost).

Limitations and Next Steps

There is likely only so much growth and learning that can take place during this age group of kindergarten students, particularly in a short-term intervention such as the present study. It was established that without spelling practice, the extra semantic teaching does help learning to read. For the spelling group, however, they have already been helped by the spelling practice. Therefore, less room is left for further improvement past this, especially in a short intervention study with such young students. Basically, the advantages of semantic elaboration and spelling are not additive- there is a limit to how much learning will occur at this age, at least in a three-day long intervention. In future research on this topic, other grades, ages, and lengths of intervention can be studied. It is important to note that using a longitudinal approach when studying both semantic enrichment and spelling practice may well reveal greater benefits of both vocabulary teaching and spelling practice over time, as seen in earlier research discussed by Ouellette and Sénéchal (2017). They reported a significant influence of invented spelling in kindergarten on measures of reading and conventional spelling in grade one. These results show the benefit of a longer time period of study as it allowed for the identification of a direct path from kindergarten invented spelling to grade one conventional spelling and reading. The same may well hold true for semantic depth, especially considering the results of Ricketts et al. (2016).

Summary and Conclusion

In summary, the present study was performed to examine effects of storybook exposure, semantic teaching, and spelling practice on vocabulary learning and subsequent learning to read exposed words. The results highlight the impact of storybook exposure, semantic elaboration, and spelling practice both on oral vocabulary learning and on early reading skills. Our vocabulary learning from storybook exposure was effective and semantic elaboration improved depth of knowledge. Further, spelling practice improved breadth of word learning, and they both provided an advantage when it came to learning to read the words that were in the storybook- although there was a limit as to how much improvement may be possible at this age in a short-term intervention. Together these results suggest that vocabulary and spelling can both help learning to read on a word-specific basis- the first study to do so using a storybook exposure paradigm.

In conclusion, the results of this study carry educational implications and offer guidance for educators in terms of teaching young children to read. Reading is a fundamental aspect of all areas of education and being able to do so confidently at a young age fosters resiliency in the classroom as children grow up. Overall, the findings from the present study offer potential strategies for educators, such as reading storybooks aloud with a focus on semantic elaboration to help students reach their utmost literacy potential.

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Appendix

Word List 1
RELL
FID
VEAK
LURT
UT

Word List 2
DUSS
SOT
ZEET
VERN
IP

Word List 3
HESS
BAZ
LOAT
PRAIF
OP